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ST. IVES NORTH PUBLIC SCHOOL

ARBORICULTURAL IMPACT ASSESSMENT MAIN WORKS

PREPARED FOR:

JDH ARCHITECTS

PREPARED BY:

DAVID PRIETO
Dip. Hort, Arboriculture
B. Agriculture Engineering
M Landscape Architecture
TRAQ, QTRA
IACA

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Executive Summary

This report was commissioned by JDH Architects to accompany their Development Application, within the Ku Ring Gai Council area at 87 Memorial Avenue, St Ives. The aim of this report is to provide an assessment of the impacts of the proposed works (construction of a three levels building, toilet and demolition of demountable buildings) on eighty one trees in accordance with *AS4970 – 2009 Protection of trees on development sites* ('the standard').

This report collates and presents information collected by David Prieto on the 10/04/18 & 19/07/18. The data collected is located at **7. Tree Survey Table** (page 23) also see **8. Tree Survey Table Notes** (page 30) for notes relating to tree survey table.

Generally the site's vegetation was observed to have a majority native tree canopy, with an exotic shrub midstorey and an exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 35).

The proposed development main works will involve the construction of a three level building on Memorial Avenue, construction of new toilet block, resurface of the pavement on pedestrian access path on Memorial Avenue and replacement of the existing paving to the east of the proposed new three storey building and removal of trees. This will be followed by removal of all demountable buildings, with associated gardens, paving and retaining wall. This will involve regrading site levels in some areas through excavation, cutting and filling of the soil on site.

The matrix below gives a brief overview summary of tree significance and level of encroachment from the proposed development of numbered trees.

	ENCROACHMENT WITHIN TPZ Numbering of trees as shown on Tree Location Plan				
TREE LANDSCAPE SIGNIFICANCE		**No Impact**	**Minor Encroachment by removal of demountables** (<10% of TPZ)	**Major Encroachment** (>10% of TPZ)	**Within Development Footprint**
	High	53, 58 & 59	-	25, 28, 61 & 71	-
	Medium	6, 20, 21, 23, 24, 26, 27, 31, 35, 36, 37, 42, 43, 45, 46, 49(M-H), 52, 54, 55, 56, 57, 62, 67, 72, 73, 74, 75, 76, 77, 78 & 79	1, 2, 9, 16, 18, 19 & 60	-	29
	Low	3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 17, 22, 30, 32, 33, 34, 38, 39, 40, 41, 44, 47, 48, 50, 51, 63, 64, 68, 69, 70 & 80	18a, 65 & 66	-	-
	Total Number of trees	**66**	**10**	**4**	**1**

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No. 29, if the development is approved as there will be an unavoidable major encroachment into the tree protection zone.
- The retention of Tree No.'s 20, 21, 22, 26, 27, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64, 67, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78 & 79. The construction will not impact these trees.
- The retention of Tree No.'s 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 23 & 24 and other vegetation. The construction will not provide an impact on the trees. However tree protection measures should be installed to protect as much as possible of the TPZ. These panels should be removed once the construction

works have been completed and/or the demountable buildings have been removed from the site respectively.

- The retention of Trees No.'s 1, 2, 9, 16 & 19. The construction may provide minor encroachments into the TPZ and crown encroachment.
  - The existing pavement should be maintained during construction and then replaced if necessary.
  - Fencing should be installed before construction works and removed after works have been completed and demountable buildings removed from site.
  - Possible pruning to be determined by the project arborist.
- The retention of Trees No.'s 18, 18a, 60, 62, 65, 66. The proposed works for demolition of demountable buildings may provide minor encroachments into the TPZ.
  - If existing, the pavement should be maintained during construction and then replaced if necessary.
  - Fencing should be installed before removal of demountable buildings.
  - Maintain existing underground services.
  - Heavy machinery should not be used within the TPZ of the trees.
  - The existing levels within the TPZ should be maintained.
  - Mulch the area within the TPZ after building removal has been completed.
- The retention of Tree No. 25. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Fencing should be installed and maintained until construction works have been completed.
  - Pruning to be specify by the project arborist.
  - Services to be installed as far as possible from the tree.
- The retention of Tree No. 28. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Excavation works should be limited for the ground level.
  - Construction and Landscape plans should show detailed existing and proposed levels. Construction drawings including plans and sections at 3m intervals to be prepared in liaison with the project arborist as described in **4 Discussion**.
  - All services requiring excavation should be installed outside of the TPZ. Layouts to be prepared in liaison with the project arborist as described in **4 Discussion**.
  - Fencing should be installed before construction works and removed following completion.
  - Existing pavement is to be maintained wherever possible and replaced after main construction works have been completed.
  - Crown pruning to be specified by the project arborist.
  - Garden beds to be mulched and levels to be maintained as existing.
  - The tree is to be assessed at the conclusion of construction by the project arborist and a tree care plan be provided to provide optimum conditions for the growth of the tree into the future.
- The retention of Tree No. 61. The proposed works for demolition of existing demountable buildings may provide minor encroachments into the TPZ.
  - If existing, the pavement or artificial turf should be maintained during removal of existing demountable buildings.
  - Demountable footings to be removed under arborist supervision.
  - Fencing should be installed before removal of demountable buildings.
  - Maintain existing underground services.
  - Heavy machinery should not be used within the TPZ of the tree.

  - The existing levels within the TPZ should be maintained.
  - Mulch the area within the TPZ after building removal has been completed.
- The retention of Tree No. 71. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Fencing should be installed before construction works and removed once the demountable buildings have been removed.
  - Building E and demountable footings to be removed by hand under arborist supervision.
  - The TPZ area be mulched and levels s to be maintained as existing. No excavation below trunk base levels within the TPZ apart for the new proposed building.
  - All services requiring excavation should be installed as far as possible from the trunk.
- Crown reduction pruning works on Trees No.'s 47 & 80 and an unassessed *Eucalyptus piperita* located in the northwest corner of the property are required to remove deadwood which is most likely to fail.
- Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically the final cut of roots should result in a clean cut, using appropriate tools. Severing roots by earthmoving equipment is unacceptable.
- Pruning of branches should comply with Australian Standard No *4373 -2007 - Pruning of Amenity Trees*. Branch reduction should be made to internal lateral branches or stems which are at least 1/3rd of the diameter of the branch being cut – or – removed at the branch collar, consistent with AS *4373 -2007; Sections 6.4 a) & b) and 7.3.* Deadwooding should be carried out concurrently.
- It is anticipated that due to construction activities, tree protection fences will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37) and

  Tree Protection Plan 2: Removal of Demountables(page 39).
- Further defects such as cambial damage, decay or hollows may be present which are not visible from the ground. Whilst work is being carried out by climbing arborists (AQF Level 3) aerial inspection of stems, branches and their attachments should be made when work is being carried out. If minor additional works are needed to remove or correct defects it should be done at that time. If significant defects are found requiring heavy pruning or whole tree removal, photos should be taken and an AQF Level 5 Arborist be consulted prior to work being done.
- No landscape plans or service plans have been supplied. Constructed landscape elements such as retaining walls, paving and other features; and open trenches for services requiring excavation should be located outside the TPZ of all retained trees.
- This arboricultural assessment should be reviewed upon the preparation of stormwater, landscape or revised architectural plans.
- Hand excavation under Project Arborist supervision is required for all works located within the TPZ of all retained trees.
- A minimum AQF Level 5 Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page21).
- For additional tree protection notes see **12 Tree Protection Notes and Details** (page 41) and **14 General Tree Protection Notes** (page47).

Table of Contents

1. Introduction

This report was commissioned by JDH Architects to accompany their Development Application, within the Ku Ring Gai Council area at 87 Memorial Avenue, St Ives. The aim of this report is to provide an assessment of the impacts of the proposed works (construction of a three levels building, toilet and demolition of demountable buildings) on eighty one trees in accordance with *AS4970 – 2009 Protection of trees on development sites* ('the standard').

This report collates and presents information collected by David Prieto on the 10/04/18 & 19/07/18. The data collected is located at **7. Tree Survey Table** (page 23) also see **8. Tree Survey Table Notes** (page 30) for notes relating to tree survey table.

2. Methodology

2.1. Limitations

Care has been taken to obtain all information from reliable sources. All data has been verified as far as possible. However David Prieto - Consulting Arborist can neither guarantee nor be responsible for the accuracy of information provided by others. Unless stated otherwise:

- Information contained in this report covers only the tree/s examined and reflects the health and structure of the tree at the time of inspection. The documented, observations, results, recommendations and conclusions given may vary after the site visit due to environmental conditions. Liability will not be accepted for damage to person or property as a result of natural processes, unforeseeable actions or occurrences.
- Observations recorded for trees located within adjacent properties have been made without entering that property. Deciduous trees inspected during winter and all trees obscured by other vegetation are not able to be properly assessed. As a result measurements for these trees are estimated. Similarly these trees were not subject to a complete visual inspection and defects or abnormalities may be present but not recorded.
- The inspection was limited to visual examination from the base of the subject tree without dissection, excavation, probing or coring (unless specifically noted otherwise).
- There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject tree may not arise in the future.

2.2. Site Inspection

A visual inspection of the tree/s was performed from ground level, data collected includes:

- Genus, Species, Common Name;
- Height, Width, DBH (Diameter at Breast Height), DRB (Diameter above Root Buttress);
- Age, Health & Vigour;
- Significance, Amenity and Ecological Value;
- Form and Structural Condition;
- Visible Defects or Evidence of Wounding.

2.3. Measurement

- Tree locations are supplied by client on the survey plan or triangulated using a measuring tape.
- Diameter at breast height (DBH) and Diameter above Root Buttress (DRB) are measured using a diameter tape.
- Height is measured using a clinometer or Nikon *Forestry Pro*.
- Canopy width is estimated using a measured stride paced out on site.
- Structural Root Zone (SRZ) and Tree Protection Zone (TPZ) radii are calculated (in accordance with *AS 4970-2009*).
- Development impact/setback is measured from the nearest face of the trunk to the face of the structure in Auto CAD using the perpendicular distance function.

2.4. Recording Data

Data collected is collated in the tree survey table located at **7. Tree Survey Table** (page 23). The tree survey table contains abbreviations for terms describing the tree's characteristics; explanatory notes pertaining to these are located at **8. Tree Survey Table Notes** (page 30).

The physical data for tree locations, crown width and DRB is schematically described in **9. Tree Location Plan** (page 35).

2.5. Reference Documents

The report was written in coordination with:

- Survey Plan prepared by RPS Australia East Pty Ltd Revision B, dated 24/01/18.
- Architectural Plan Set Prepared by JDH Revision B, dated 19/09/18.
- Roof Plan Prepared by JDH Schematic design S.1, dated 21/09/18.
- Bushfire Assessment Report by Building Code & Bushfire Hazard Solutions Pty Ltd, dated 08/08/18
- The Australian Standard for the Protection of Trees on Development Sites (AS 4970 – 2009).

2.6. Council Tree Preservation Order

The Ku-ring-gai Council Tree Preservation controls define a tree as "A perennial plant with at least one self supporting woody, fibrous stem, whether native or exotic, which is 5 metres or more in height or has a trunk diameter of 150mm or more measured at ground level."

The Tree Preservation Order applies to "the whole of the local government area of Ku-ring-gai with the exception of those lands dedicated as National Park."

Exemptions from this Tree Preservation Order apply to dead trees and branches, a list of exempt species is provided within the TPO and "trees within 3.0m of an approved, existing residential building" measured from the centre of the trunk at ground level to the external wall of the building in question are also exempt from protection.

2.7. Determining a tree's significance

The landscape significance of a tree is an essential criterion to establish the importance that a particular tree may have on a site. When determining a tree's significance within the landscape context, the following questions are asked of each tree. Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥4) of the answers will be yes; For a Medium-High rating 3.5 of the answers will be yes; for a Medium rating half (=3) of the answers will be yes; for a Low-Medium rating 2.5 of the answers will be yes; and for the Low rating the minority of answers will be yes (≤2).

1. Is the tree a locally native remnant; an endangered species; a part of an endangered ecological community; or does the tree provide critical habitat for an endangered species?

2. Is the tree of botanical interest; Is it included in a significant tree register or listed as a heritage item under the Federal State or Local Regulations?

3. Is the tree visually prominent in the locality?

4. Is the tree well structured?

5. Is the tree in good health and/or does it display signs of good vigour?

6. Is the tree typically formed for the species?

7. Is the tree currently located in a position that will accommodate future growth?

3. Observations

3.1. Site Description

The site is a school located at 67 Memorial Avenue, St Ives North. It contains a number of buildings and demountable classrooms, driveways, paved areas, paths, turf areas, sport fields and gardens. There was no evidence of recent earthworks on the site or adjoining sites. The site has a general north-easterly aspect.

3.2. Soil Landscape Map

The soils in this area are from the Lucas Heights soil landscape group [3]. They are characterised by moderately deep 50-150 cm hard setting yellow podzolic soils and yellow soloths, with yellow earths on the outer edges.

Generally the landscape is characterised by gently undulating crests and ridges on plateau surfaces of the Mittagong formation with alternating bands of shale and fine-grained sandstones. There is local relief to 30 m with slope gradients of <10%, and rock outcrops are absent [3].

These soils are limited by low soil fertility, low available water capacity and stony soil. The critical soil characteristics of this soil type for trees growing on this site include low fertility, and low water capacity [3].

3.3. Native Vegetation Map

Sandstone Ridgetop Woodland ecological community[13, 14] is dominated by *Corymbia gummifera* and *Eucalyptus sclerophylla* with *Banksia serrata* frequently present at lower abundance. A variety of other tree species occur more sporadically, including *E. punctata, E. oblonga*, *E. piperita, Angophora bakerii* and *Angophora costata*.

A diverse array of shrub species is always present, although depending on the time of the last fire a shrub stratum may not be fully developed. Shrub species frequently recorded include *Banksia spinulosa* var. *spinulosa, Isopogon anemonifolius, Leptospermum trinervium, Phyllanthus hirtellus, Dillwynia retorta* and *Eriostemon australasius* subsp. *australasius*. [13, 14]

The ground stratum is similarly diverse and features species such as *Lomandra obliqua*, *Entolasia stricta*, *Cyathochaeta diandra*, *Dampiera stricta* and *Stipa pubescens*. [13, 14]

There appears to be species representative of this vegetation community located on this site.

3.4. Summary of site inspection data

Generally the site's vegetation was observed to have a majority native tree canopy, with an exotic shrub midstorey and an exotic turf groundcover layer. The existing surveyed trees are shown at **9. Tree Location Plan** (page 35).

3.5. Summary of Proposed Development

The proposed development main works will involve the construction of a three level building on Memorial Avenue, construction of new toilet block, resurface of the pavement on pedestrian access path on Memorial Avenue and replacement of the existing paving to the east of the proposed new three storey building and removal of trees. This will be followed by removal of all demountable buildings, with associated gardens, paving and retaining wall. This will involve regrading site levels in some areas through excavation, cutting and filling of the soil on site.

3.6. Tree significance and encroachment matrix

The matrix below gives a brief overview summary of tree significance and level of encroachment from the proposed development of numbered trees.

	ENCROACHMENT WITHIN TPZ Numbering of trees as shown on Tree Location Plan				
TREE LANDSCAPE SIGNIFICANCE		**No Impact**	**Minor Encroachment by removal of demountables** (<10% of TPZ)	**Major Encroachment** (>10% of TPZ)	**Within Development Footprint**
	High	53, 58 & 59	-	25, 28, 61 & 71	-
	Medium	6, 20, 21, 23, 24, 26, 27, 31, 35, 36, 37, 42, 43, 45, 46, 49(M-H), 52, 54, 55, 56, 57, 62, 67, 72, 73, 74, 75, 76, 77, 78 & 79	1, 2, 9, 16, 18, 19 & 60	-	29
	Low	3, 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 17, 22, 30, 32, 33, 34, 38, 39, 40, 41, 44, 47, 48, 50, 51, 63, 64, 68, 69, 70 & 80	18a, 65 & 66	-	-
	Total Number of trees	**66**	**10**	**4**	**1**

4. Discussion

4.1. Trees with a Minor TPZ Encroachment

The proposed construction encroaches within the TPZ by 10% or less.

- Trees 1, 2, 9 & 16 are located adjacent to the existing driveway and Tree 19 is located to the proposed demountable buildings with crowns which extend over the existing driveway. The driveway is proposed to be used as the main access for construction personnel, vehicles and equipment. These trees and other vegetation are considered to be of medium significance and are suitable for retention. The proposed construction and removal works may

provide minor encroachment into the TPZ and possible crown encroachment.

The proposed works for construction of a three storey building and removal of demountable buildings will increase the traffic activity within this area to the southwest of the school grounds. These trees should be adequately protected before construction works commence to avoid soil compaction and damage to the trunk or branches.

No plans for services or other construction works requiring excavation have been provided. If excavation works are required to be carried out within the TPZ of these trees, the project arborist should be contacted to determine the location and extension of the works and impact to the trees.

These possible encroachments are considered to be a low impact if properly managed and sustainable by the trees. These trees are proposed to be retained.

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 *Protection of trees on development sites*. Specifically;

- The existing pavement should be maintained during construction works to reduce compaction on the soil and then removed and replaced if necessary.
- Tree Protection Fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37) and **0**
- **Tree Protection Plan 2: Removal of** Demountables(page 39). These panels should be kept in place until the demolition works have been completed.
- If pruning for clearance for heavy vehicles access is required, trees should be inspected by the project arborist to verify that no more than 10% of the crown requires removal following commencement of above ground building works.

- Trees 18, 18a, 60, 62, 65, 66 are located adjacent to demountable buildings to be removed. These trees and other vegetation are considered to be of low and medium significance respectively and are suitable for retention. The proposed works for removal of demountable buildings may provide minor encroachments into the TPZ.

  These possible encroachments are considered to be a low impact and sustainable by the trees. These trees are proposed to be retained.

  Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically;

  - If existing, the existing pavement should be maintained during removal of demountable buildings to reduce soil compaction and then removed and replaced if necessary.
  - Consideration should be given to maintained underground services and pillars within the TPZ of the trees. However if they are to be

removed, it should be done by hand and minimising the level of soil disruption.

- Track machinery only should be used for removal works within the TPZ. However the use of heavy machinery should be avoided altogether within the TPZ of the trees minimising the level of compaction of the soil.
- Fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **0**
- **Tree Protection Plan 2: Removal of** Demountables(page 39). These panels should be kept in place until the demolition works have been completed.
- The existing levels within the TPZ of the trees should be kept.
- Consideration should be given to mulch the TPZ of the trees to a depth of 75mm with an approved organic mulch.

4.2. Trees with a Major TPZ Encroachment

The proposed construction encroaches within the TPZ by more than 10% or is within the SRZ.

- Tree 25 is located 1.06m, 8.38m & 6.46m from proposed existing path, ground level façade and roof respectively, providing a combined 22.6% within the TPZ (5.7% cut & 16.9% light impact) and crown encroachment. This early mature tree is considered to be of high significance, it is in good health and good structure, is located at the front garden and should be retained and protected.

  Ground level footprint provides 5.2% cut encroachment within the TPZ, being mostly located within the footprint of the existing building. When considering in isolation, this is a low impact and sustainable by the tree provided the existing features have likely deflected roots from this area.

  Refurbishment works for pedestrian access provide an additional 16.9% light encroachment within the TPZ and within the SRZ. When considered in isolation, this is a low impact and sustainable by the tree provided the proposed pedestrian footpath is over the existing subbase and no excavation will be carried out wider or deeper than the existing pavement profile.

  This tree has a high crown with most of the crown over the road and Memorial Avenue frontage. It is anticipated that minor pruning (pruning of large diameter growth or in excess of 10% of the crown) will be required to give clearance to scaffolding for construction, APZ clearance and the building itself. This is considered a low and sustainable impact as the tree crown will continue to grow above the height of the roof, extending partially over it.

  These encroachments provide a major and sustainable level of impact by the tree. This tree is proposed to be retained. Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically;

  - Fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **10. Tree**

Protection Plan 1: Construction(page 35). These panels should be kept until the construction works have been completed.

- The location and extension of crown pruning works should be determined by the project arborist following commencement of above ground building works.
- If minor pruning of roots within the TPZ is required, final cut of roots should result in a clean cut, using appropriate tools. Severing roots by earthmoving equipment is unacceptable as this results in tearing damage to roots, putting the tree at greater risk of root decay and/or structural instability.

- Tree 28 will be likely impacted by different proposed elements:

1. The tree is located 12m from proposed three storey building ground level, providing a 7.2% cut encroachment within the TPZ. When considered in isolation, this is a low impact and sustainable by the tree as it is located within the layout of the existing building. It is likely that roots have been largely deflected by the existing continuous footings.

2. The tree is located 7.3m, 7.6m, 10.6m & 12m from proposed pillars and foundations, providing an additional 3.4% cut encroachment within the paved surface area of the TPZ. The exact pattern of root growth is unknown below the existing yard pavement but is likely to be less divided than that in open ground. When considered in isolation, this is a low impact and sustainable by the tree as these are isolate encroachments amounting to a small area.

3. The tree is located 7.35m & 8.84m from proposed facades and under-croft areas to the west and north of the tree respectively, providing a 20.5% encroachment within the TPZ. These areas are located over existing paved surfaces. When considered in isolation, this is a potentially moderate to high level of impact if excavation below the existing outdoor pavement profile occurs over the majority of this area, particularly in areas nearer the tree. However details of existing and proposed surface levels and profiles are not known so this cannot be fully assessed.

   Construction drawings must include levels and floor paving profile depths which do not require excavation deeper than existing profiles in order for this to be sustainable by the tree. This should be determined with a number of Construction plans sections showing existing levels and profile depths, and proposed FFLs and paving profile depths to achieve no or nominal excavation below the base of existing paving within the TPZ. Further information re existing levels within the TPZ may be required to determine type and level of impact.

4. The tree is located 5.62m from a paved transition area surrounding the undercroft floor to be regraded, providing an additional 6% encroachment within the TPZ. When considering in isolation this is a low impact and sustainable by the tree provided no excavation below the existing pavement is anticipated. However, details of existing and proposed surface levels and profiles are not known so this cannot be fully assessed. Final levels must be indicated on Construction and Landscape plans as indicated above under 3.

5. The tree is located 4.24m from proposed roof, providing crown encroachment. It is anticipated that less than 10% of the crown will require pruning to allow construction works and installation of scaffolding.

6. The tree is located within a garden bed. This and the other garden bed are to be retained as existing.

This tree is considered to be of high significance, it provides great amenity value to the site and should be retained and protected. The encroachment by the proposed building and pavement cumulatively amounts to 37.2%. These elements are located within the existing building and paved yards. We anticipate that roots are not likely to be found within the existing building footprint by deflection of the physical barrier (existing building footings) and root growth is diminished to the west of the tree (paved yard) and dry, covered soil conditions).

Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically;

- Construction and Landscape plans should show detailed existing and proposed levels for all structures within the TPZ. A number of sections should be provided to show excavation works are limited for the ground level and pillars. All other elements should be installed above existing pavement sub-base levels.
- Hydraulic and other plans should show all services to be installed as far as possible from the tree, requiring no additional excavation within the TPZ of the tree. Final location of services should be decided in liaison with the Project Arborist.
- Fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37). These panels should be kept in place until the construction works have been completed.
- The existing paved area within the TPZ must be retained as much as possible during all construction works to reduce compaction and root damage within the TPZ. It should then be removed carefully and replaced at the end of main works under the project arborist's supervision.
- Construction plans and sections showing existing levels and profile depths at 3m intervals, and proposed FFLs and paving profile depths to achieve no (or nominal excavation at the periphery of the TPZ) below the base of existing paving within the TPZ should be prepared. This should be resolved sufficiently to avoid the need for root mapping.
- Consideration should be given to select a porous pavement (unitary porous pavers, porous asphalt or other) over porous sub-base.
- As the existing paving has been in place for some time, it would appear unnecessary to compact the soil prior to the new surface being installed. The construction plans should be reviewed by a minimum AQF Level 5 Arborist and the impact assessed.
- The location and extent of crown pruning works should be determined by the project arborist following commencement of above ground building works.
- No other elements requiring fill or cut are to be installed within the TPZ. The current levels and soil permeability are to be maintained or

increased within the garden beds and soil compaction avoided to facilitate the ongoing viability of the tree. Final landscape design within the TPZ of the tree should be finalised in liaison with the project arborist. A layer of mulch less than 75mm is recommended to maximise the gas and water exchange. This is the single most efficient practice to enhance the biological health, structure, texture and nutrient availability of soil to promote root growth and establishment. The mulch should be only applied to the surface of the soil as the Nitrogen used to assist decomposition temporarily depletes Nitrogen available to the tree.

- Final cut of roots should result in a clean cut, using appropriate tools. Severing roots by earthmoving equipment is unacceptable as this results in tearing damage to roots, putting the tree at greater risk of root decay and/or structural instability.
- The tree should be assessed at conclusion of construction by the project arborist and a tree care plan be provided to provide optimum conditions for the growth of the tree into the future. Other soil amendments and treatments may be recommended in this plan.

- Tree 61 is located 2.22m & 2.96m from existing demountable buildings proposed to be removed. This tree is considered to be of medium to high significance and should be retained and protected. The proposed demolitions works may provide minor encroachment into the TPZ of the tree.

  This possible encroachment is considered to be a low impact and sustainable by the tree if managed well. This tree is proposed to be retained.

  Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically;

  - Any existing pavement within the TPZ should be maintained during removal of demountable buildings to reduce compaction on the soil and then removed and replaced if necessary.
  - Consideration should be given to maintain underground services and pier footings within the TPZ of the tree to minimize root disturbance. However if they are to be removed, it should be done by hand under arborist supervision.
  - Track machinery only should be used for removal works within the TPZ. However the use of heavy machinery should be avoided altogether within the TPZ of the trees minimising the level of compaction of the soil.
  - Fencing is to be installed in liaison with the project arborist to protect as much as practicable of the TPZ as possible as indicated on **0**
  - **Tree Protection Plan 2: Removal of Demountables** (page 39). These panels should be kept in place until the demolition works are completed.
  - Where soil is exposed, consideration should be given to mulch the TPZ of the tree to a depth of 75mm with an approved organic mulch.

- Tree 71 will be likely impacted by different elements:

  1. It is located 7.25m from proposed three storey building northeast paved under-covered area and pillars providing a 10.1% cut encroachment within the TPZ. When considering in isolation, this is a low impact and sustainable

by the tree provided it is mostly located within the footprint of the former building. It is likely that roots have been largely deflected by the existing building continuous footings. It is anticipated no crown pruning will be required.

2. It is located adjacent to an existing demountable building to be demolished after construction works of the main building have been completed. This is considered to be a low impact to the tree if carried out appropriately to minimise compaction and avoid impact to the tree.

A greater area within the TPZ will not be covered once the demolition works have been completed. The health of the tree will largely benefit if no structures are proposed on the landscape plans and the area surface is treated following tree management best practices.

This tree is considered to be of high significance, it provides high amenity value to the site and should be retained and protected. The encroachment and demolition provide a low to moderate level of impact and sustainable by the tree if construction works are carried out in a manner that minimise the impact to the tree.

- Fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37) and

  Tree Protection Plan 2: Removal of Demountables(page 39). These panels should be kept in place until the construction works have been completed.
- The current levels within the TPZ are to be maintained outside of the proposed building footprint and no other structure requiring fill or cut should be located within the TPZ of the tree.
- In order to increase gaseous exchange and water infiltration, landscape plans should show no structures are proposed within the TPZ. A layer of less than 75mm is recommended to maximise the gas and water exchange. This is the single most efficient practice to enhance the biological health, structure, texture and nutrient availability of soil to promote root growth and establishment. The mulch should be only applied to the surface of the soil as the Nitrogen used to assist decomposition temporarily depletes Nitrogen available to the tree.
- Stormwater lines and other services should be strapped to the side of the building concrete slab, installed as far as possible from the trunk requiring minimal excavation within the TPZ or the tree.
- Final cut of roots should result in a clean cut, using appropriate tools. Severing roots by earthmoving equipment is unacceptable as this results in tearing damage to roots, putting the tree at greater risk of root decay and/or structural instability.

4.3. Trees within the development footprint

- Tree 29 is located within the proposed three levels building. This tree is considered to be of medium significance and is suitable for retention. However, extensive modification of anticipated earthworks would be required to retain this tree. It cannot be retained if the future development is approved in its current form.

4.4. Other Tree Comments

- Trees 20, 21, 22, 26, 27, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64, 67, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78 & 79 are located in positions that will allow their retention without impact from proposed developments.

- Trees 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 23 & 24 and other vegetation are located in positions that will allow their retention without impact from proposed developments. However, fencing is to be installed in liaison with the project arborist to protected as much as practicable of the TPZ as possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37) and **Tree Protection Plan 2: Removal of Demountables**(page 39). These panels should be kept onsite until the construction works have been completed.

- Trees No.'s 47 & 80 and an unassessed Eucalyptus piperita are located at the bottom of the embankment to the northest of the property. They are dead or in advanced decay and present a large volume of dead branches likely to fail. Pruning works should be carried out to minimise the risk.

5. Recommendations

In consideration of the data collected recommendations are provided for the removal or retention of trees including specific tree protection measures required to reduce the anticipated impacts from the proposed construction on those trees proposed to be retained. This report specifically recommends:

- The removal of Tree No. 29, if the development is approved as there will be an unavoidable major encroachment into the tree protection zone.
- The retention of Tree No.'s 20, 21, 22, 26, 27, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 63, 64, 67, 68, 69, 70, 72, 73, 74, 75, 76, 77, 78 & 79. The construction will not impact these trees.
- The retention of Tree No.'s 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 23 & 24 and other vegetation. The construction will not provide an impact on the trees. However tree protection measures should be installed to protect as much as possible of the TPZ. These panels should be removed once the construction works have been completed and/or the demountable buildings have been removed from the site respectively.
- The retention of Trees No.'s 1, 2, 9, 16 & 19. The construction may provide minor encroachments into the TPZ and crown encroachment.
    - The existing pavement should be maintained during construction and then replaced if necessary.
    - Fencing should be installed before construction works and removed after works have been completed and demountable buildings removed from site.
    - Possible pruning to be determined by the project arborist.
- The retention of Trees No.'s 18, 18a, 60, 62, 65, 66. The proposed works for demolition of demountable buildings may provide minor encroachments into the TPZ.
    - If existing, the pavement should be maintained during construction and then replaced if necessary.
    - Fencing should be installed before removal of demountable buildings.

- Maintain existing underground services.
- Heavy machinery should not be used within the TPZ of the trees.
- The existing levels within the TPZ should be maintained.
- Mulch the area within the TPZ after building removal has been completed.

- The retention of Tree No. 25. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Fencing should be installed and maintained until construction works have been completed.
  - Pruning to be specify by the project arborist.
  - Services to be installed as far as possible from the tree.
- The retention of Tree No. 28. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Excavation works should be limited for the ground level.
  - Construction and Landscape plans should show detailed existing and proposed levels. Construction drawings including plans and sections at 3m intervals to be prepared in liaison with the project arborist as described in **4 Discussion**.
  - All services requiring excavation should be installed outside of the TPZ. Layouts to be prepared in liaison with the project arborist as described in **4 Discussion**.
  - Fencing should be installed before construction works and removed following completion.
  - Existing pavement is to be maintained wherever possible and replaced after main construction works have been completed.
  - Crown pruning to be specified by the project arborist.
  - Garden beds to be mulched and levels to be maintained as existing.
  - The tree is to be assessed at the conclusion of construction by the project arborist and a tree care plan be provided to provide optimum conditions for the growth of the tree into the future.
- The retention of Tree No. 61. The proposed works for demolition of existing demountable buildings may provide minor encroachments into the TPZ.
  - If existing, the pavement or artificial turf should be maintained during removal of existing demountable buildings.
  - Demountable footings to be removed under arborist supervision.
  - Fencing should be installed before removal of demountable buildings.
  - Maintain existing underground services.
  - Heavy machinery should not be used within the TPZ of the tree.
  - The existing levels within the TPZ should be maintained.
  - Mulch the area within the TPZ after building removal has been completed.
- The retention of Tree No. 71. This is a high significant tree and the proposed works will provide a major and sustainable impact. The following should be implemented to minimise the impact;
  - Fencing should be installed before construction works and removed once the demountable buildings have been removed.
  - Building E and demountable footings to be removed by hand under arborist supervision.
  - The TPZ area be mulched and levels s to be maintained as existing. No excavation below trunk base levels within the TPZ apart for the new proposed building.
  - All services requiring excavation should be installed as far as possible from the trunk.

- Crown reduction pruning works on Trees No.'s 47 & 80 and an unassessed *Eucalyptus piperita* located in the northwest corner of the property are required to remove deadwood which is most likely to fail.
- Tree sensitive construction measures must be implemented if works are to proceed within the TPZ as prescribed by the Australian Standard AS4970-2009 Protection of trees on development sites. Specifically the final cut of roots should result in a clean cut, using appropriate tools. Severing roots by earthmoving equipment is unacceptable.
- Pruning of branches should comply with Australian Standard No *4373 -2007 - Pruning of Amenity Trees*. Branch reduction should be made to internal lateral branches or stems which are at least 1/3rd of the diameter of the branch being cut – or – removed at the branch collar, consistent with AS *4373 -2007; Sections 6.4 a) & b) and 7.3.* Deadwooding should be carried out concurrently.
- It is anticipated that due to construction activities, tree protection fences will not be able to be installed around the entire TPZ. It should be installed to protect as much as practically possible as indicated on **10 Tree Protection Plan 1: Construction** (page 37) and

  Tree Protection Plan 2: Removal of Demountables(page 39).
- Further defects such as cambial damage, decay or hollows may be present which are not visible from the ground. Whilst work is being carried out by climbing arborists (AQF Level 3) aerial inspection of stems, branches and their attachments should be made when work is being carried out. If minor additional works are needed to remove or correct defects it should be done at that time. If significant defects are found requiring heavy pruning or whole tree removal, photos should be taken and an AQF Level 5 Arborist be consulted prior to work being done.
- No landscape plans or service plans have been supplied. Constructed landscape elements such as retaining walls, paving and other features; and open trenches for services requiring excavation should be located outside the TPZ of all retained trees.
- This arboricultural assessment should be reviewed upon the preparation of stormwater, landscape or revised architectural plans.
- Hand excavation under Project Arborist supervision is required for all works located within the TPZ of all retained trees.
- A minimum AQF Level 5 Project Arborist shall be engaged to certify the tree protection works in accordance with the hold points provided at **6.3. Hold Points** (page21).
- For additional tree protection notes see **12 Tree Protection Notes and Details** (page 41) and **14 General Tree Protection Notes** (page47).

6. Tree Management

6.1. Tree Management Objectives

The general tree management objectives include:

- Appointment of a Project Arborist who has a minimum Level 5 AQF Arboriculture qualification and experience in managing trees on construction sites.
- Installation of additional root, trunk and branch protection as required to protect retained trees where minor encroachments within the TPZ are anticipated.
- The installation of a Tree Protection Fence to enclose and protect the TPZ.
- Monitoring, inspection and certification of tree protection as per the below hold points.

6.2. Management Objective Priorities

The prioritisation of the above objectives is integral for the successful management of site trees:

1. Protection of the TPZ of retained trees;
2. Protection of the trunk and branches of retained trees;
3. Reduction of stress related to construction impacts;
4. The ongoing viability of retained trees after practical completion.

6.3. Hold Points, Inspection and Certification

To ensure this plan is implemented hold points (**HP**) have been specified in the schedule of works (below). Once each stage is reached the work will be inspected and certified by the Project Arborist and the next stage may commence.

Alterations to this schedule may be required due to necessity however this shall be through consultation with the Project Arborist only.

6.4. Schedule of Works and Responsibilities

Hold Point	Task	Responsibility	Certification	Timing of Inspection
1	Install TPF as per T02 (and additional root, trunk and/or branch protection)	Principal Contractor	Project Arborist	Prior to construction.
2	Undertake Root Mapping for Tree 28 if required after Landscape and Construction Plans have been completed,	Principal Contractor	Project Arborist	Prior to completion of foundation design

3	Complete foundation and resurface design so to avoid woody roots greater than 40mm	Principal Contractor	Project Arborist	Prior to construction certificate application
4	Supervise all excavation works proposed within the TPZ	Principal Contractor	Project Arborist	As required prior to the works proceeding adjacent to tree
5	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Quarterly during construction period
6	Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Following the removal of tree protection measures
7	Install TPF as per T03 (and additional root, trunk and/or branch protection)	Principal Contractor	Project Arborist	At conclusion of construction works, prior to removal of demountables.
8	Final Inspection of trees by Project Arborist	Principal Contractor	Project Arborist	Prior to issue of occupation certificate.

7. Tree Survey Table

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact | Minor encroachment | Major encroachment | Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
1	*Triadica*	*sebifera*	Chinese Tallow	9	4	340	180			385	490	2453	4620	M	G	Av	M	M	L	CD	97-01	Ret	Possible impact during proposed works	On council verge. Crown slightly skewed to west. Exposed roots approximately 300mm Ø 1m to east and some girdling roots. Improbable failure of tree or tree part	No	-
2	*Citharexylum*	*spinosum*	Fiddlewood tree	12	7	450	400			603	640	2744	7236	M	G	Av	M	M	L	CD	02-05	Ret	Possible impact during proposed works	Multi-trunked at 0.8m. 200 & 150mm Ø wounds at 0.8 & 1m to east from former pruning for access clearance with associated epicormic growth. Improbable failure of tree or tree part	No	-
3	*Callistemon*	*viminalis*	Weeping Bottlebrush	6.5	2.5	160	210	140		299	670	2797	3588	M	G	Av	L	L	M	CD, M	06	Ret	No impact	Multi-trunked at base with recent pruning wounds to east 70 & 100mm Ø at 0.3 and 80mm Ø at 3m to south. Improbable failure of tree or tree part	No	-
4	*Callistemon*	*viminalis*	Weeping Bottlebrush	6	1.5	100				100	240	1817	2000	SM	Av	F	L	L	M	CD	07	Ret	No impact	Recent pruning wounds at base 120mm Ø to south at bas. 10% deadwood up to 20mm Ø. Improbable failure of tree or tree part	No	-
5	*Callistemon*	*viminalis*	Weeping Bottlebrush	6	2	80	180			197	230	1785	2364	SM	Av	F	L	L	M	CD, M, Su	09	Ret	No impact	Multi-trunked at base. 150mm Ø recently removed stem at base. Trunk leaning and crown completely skewed to north. Improbable failure of tree or tree part	No	-
6	*Callistemon*	*viminalis*	Weeping Bottlebrush	8.5	6	170	170	170	170	340	930	3210	4080	M	G	G	M	L-M	M	D, M	10-11	Ret	No impact	Crown slightly skewed to north over neighbouring property. 50mm Ø wounds from recent pruning for crown lifting at 2.2 & 3m	No	-
7	*Callistemon*	*viminalis*	Weeping Bottlebrush	6	2	120	130			177	450	2366	2124	M	Av	Av	L	L-M	M	CD, M	12	Ret	No impact	Crown skewed to west	No	-
8	*Banksia*	*serrata*	Old-man Banksia	5.5	2	170				170	260	1879	2040	M	G	Av	L	L	M	CD, Su	14	Ret	No impact	Crown skewed to west. 50mm Ø recent pruning wounds at 1.2m & 2m to east	No	-
9	*Jacaranda*	*mimosifolia*	Jacaranda	9.5	6	300	300			425	405	2264	5100	M	G	Av	M	M	L	D, M	13	Ret	Possible impact during proposed works	Crown above most of driveway width. Multi-trunked at 0.5. 6m clearance over driveway	No	-
10	*Banksia*	*serrata*	Old-man Banksia	5.5	2	170	120			209	320	2051	2508	M	G	Av	L	L	M	CD, M	16	Ret	No impact	Sparse crown empty in the middle due to recent pruning works	No	-
11	*Callistemon*	*viminalis*	Weeping Bottlebrush	7.5	3	150	150	150	150	300	400	2252	3600	M	Av	Av	L	L-M	M	D, M	19	Ret	No impact	Somewhat sparse crown. Exposed hardwood from former pruning wounds on stem to the east	No	-
12	*Syzygium*	*smithii*	Lilly Pilly	8	2	190				190	310	2024	2280	M	Av	Av	L	L	M	CD	23	Ret	No impact	Forest form. 10% deadwood, sparse crown	No	-
13	*Syzygium*	*smithii*	Lilly Pilly	9	4	290	155			329	350	2129	3948	M	Av	Av	L	M	M	D, M	26	Ret	No impact	Somewhat sparse crown. 100mm Ø recent pruning wounds at 1m to south to remove stem	No	-

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact | Minor encroachment | Major encroachment | Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
14	*Melaleuca*	*styphelioides*	Prickly-leaved Paperbark	7	4	220	220	160	160	385	530	2535	4620	M	G	Av	L	M	M	CD	27	Ret	No impact	Multi-trunked at 0.3m from base	No	-
15	*Banksia*	*serrata*	Old-man Banksia	5.5	2	170				170	260	1879	2040	M	G	Av	L	L	M	CD, Su	14	Ret	No impact	Crown skewed to west. 50mm Ø recent pruning wounds at 1.2m & 2m to east	No	-
16	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	13	6	900				900	900	3166	10800	M	G	Av	M	M	M	CD	33	Ret	Possible impact during proposed works	Sparse crown. Former pruning wound 200mm Ø at 3 & 4m from base almost entirely occluded	No	-
17	*Callistemon*	*viminalis*	Weeping Bottlebrush	6	2	80	180			197	230	1785	2364	SM	Av	F	L	L	M	CD, M, Su	09	Ret	No impact	Multi-trunked at base. 150mm Ø recently removed stem at base. Trunk leaning and crown completely skewed to north	No	-
18	*Eucalyptus*	*pilularis*	Blackbutt	12	3.5	250				250	330	2077	3000	SM	G	G	M	L-M	H	D	72	Ret	Possible impact during proposed works	First order branches at 4m over tennis court	No	-
18a	*Casuarina*	*cunninghamiana*	River Sheoak	13.5	6	290				290	360	2155	3480	M	G	G	L	L	M	D	170	Ret	Possible impact during proposed works	First order branches at 4m	No	-
19	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	12	8	870				870	990	3295	10440	M	G	Av	M	M	M	D	61	Ret	Possible impact during proposed works	On council verge. Exposed roots for 2m south & west	No	-
20	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	12	8	450	450	200	400	778	910	3181	9336	M	G	Av	M	M	M	D	62	Ret	No impact	On council verge. Exposed roots for 2m	No	-
21	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	12	8	400	400	400		693	1050	3378	8316	M	G	Av	M	M	M	D, M	63	Ret	No impact	On council verge. 2.5m from trunk exposed upper root plate	No	-
22	*Hymenosporum*	*flavum*	Native Frangipani	9.5	3	200				200	260	1879	2400	M	F	F	L	L	M	CD, P	54	Ret	No impact	Very sparse crown. 30% deadwood up to 50mm Ø	No	-
23	*Cupressus*	*torulosa*	Himalayan cypress	8	7	630				630	630	2726	7560	M	Av	Av-F	M	M	L	CD, M	66	Ret	No impact	Crown skewed to east & west. Multi-trunked at base. Somewhat sparse and raised crown to south	No	Monitoring
24	*Eucalyptus*	*saligna*	Sydney Blue Gum	16	6	490				490	700	2849	5880	SM	G	G	M	M	H	D	73	Ret	No impact	-	No	Monitoring
25	*Eucalyptus*	*saligna*	Sydney Blue Gum	18	19	1100				1100	1210	3585	13200	M	G	G	H	H	H	D	74	Ret	Located 1.06m, 8.38m & 6.46m from proposed existing path, ground level façade and roof respectively, providing a major impact (5.7% cut & 16.9 light impact) within the TPZ and crown encroachment	Buttresed. Several occluded wound from formal pruning on lower crown	No	Monitoring

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact | Minor encroachment | Major encroachment | Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
26	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	6	430				430	520	2515	5160	M	F-Av	Av	M	M	M	CD, Su	68	Ret	No impact	Sparse crown	No	-
27	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	6	430				430	521	2517	5160	M	F-Av	Av	M	M	M	CD, Su	70	Ret	No impact	Sparse crown	No	-
28	*Eucalyptus*	*tereticornis*	Forest Red Gum	21	12	1500				1500	1530	3957	15000	M	G	G	H	H	H	D	190	Ret	Located 5.64m, 8m & 9m from transition area, pillar and ground level of proposed building respectively, providing a combined major (37.2%) combined encroachment within the TPZ and crown encroachment	Multi-trunked at 1m from ground	No	Monitoring
29	*Eucalyptus*	*pilularis*	Blackbutt	15	7	690				690	810	3029	8280	M	Av	Av	M	M	H	D	195	Rem	Within the proposed development footprint	7m long 130mm Ø dead branch 6m to south	Yes	Remove the tree
30	*Syzygium*	*australe*	Bush Cherry	4.5	3.5	100	100	120		186	370	2180	2232	M	G	G	L	M	M	D	91	Ret	No impact	-	No	-
31	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	6	430				430	520	2515	5160	M	F-Av	Av	M	M	M	CD, Su	80	Ret	No impact	Sparse crown	No	-
32	*Casuarina*	*cunninghamiana*	River Sheoak	10	4	520				520	570	2613	6240	M	G	Av	L	L-M	M	CD	89	Ret	No impact	Multi-trunked at 1m. Somewhat sparse crown	No	-
33	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	8	6	640				640	660	2779	7680	M	Av	Av	L	L-M	M	CD	81	Ret	No impact	Exposed roots 2m around the trunk	No	-
34	*Liquidambar*	*styraciflua*	Sweet Gum	11	6	280	280	190		440	580	2633	5280	M	Av	Av	L	L-M	L	CD, M	92	Ret	No impact	Exposed root flare	No	-
35	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	8	6	630	280			690	790	2997	8280	M	Av-F	Av-F	M	L-M	M	D	82	Ret	No impact	Sparse crown. Exposed roots for 2m around trunk	No	-
36	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	6	600				600	700	2849	7200	M	Av-F	Av-F	M	M	M	D	83	Ret	No impact	Sparse crown. Exposed roots for 2m around trunk	No	-
37	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	6	600				600	700	2849	7200	M	Av-F	Av-F	M	M	M	D	84	Ret	No impact	Sparse crown. Exposed roots for 2m around trunk	No	-
38	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	7	6	400				400	430	2322	4800	M	Av-F	Av-F	L	M	M	D	85	Ret	No impact	Sparse crown. Exposed roots for 2m around trunk	No	-

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact | Minor encroachment | Major encroachment | Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
39	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	7.5	7	780				780	870	3121	9360	M	Av	Av	L	M	M	M	85	Ret	No impact	Exposed roots 2m to north & south. Somewhat sparse crown	No	-
40	*Liquidambar*	*styraciflua*	Sweet Gum	9	5	600				600	600	2670	7200	M	G	F	L	L	L	CD	134	Ret	No impact	On Council verge. Heavily modified crown for lateral services. Several pruning wounds at 1m (5x150mm Ø) & 4m (5x120mm Ø) and several lopped branches on the upper crown	No	-
41	*Liquidambar*	*styraciflua*	Sweet Gum	12	4	280	300			411	540	2555	4932	M	Av	F	L	L	L	CD	96	Ret	No impact	Exposed modified 300mm base of trunk to north & east. 230mm Ø	No	-
42	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	12	7	600				600	690	2832	7200	M	Av	Av	M	L-M	M	CD	99	Ret	No impact	Somewhat sparse crown	No	-
43	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	10	7	580				580	670	2797	6960	M	G	G	M	L-M	M	CD	100	Ret	No impact	-	No	-
44	*Fraxinus*	*angustifolia*	Narrow Leaf Ash	10	7	360	270	100		461	630	2726	5532	M	Av	Av	L	L-M	L	CD, Su	106	Ret	No impact	Sparse crown	Remove 3 dead branches of 40mm to east	Remove dead branches
45	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	10	7	580				580	670	2797	6960	M	Av	Av	M	L-M	M	CD	111	Ret	No impact	Somewhat sparse crown	No	-
46	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	10	7	580				580	670	2797	6960	M	Av	Av	M	L-M	M	CD	117	Ret	No impact	Exposed hardwood at lower trunk to east with associated possible internal decay from former failure stem	No	Monitoring
47	*Populus*	*nigra*	Black Poplar	10	3	310				310	370	2180	3720	M	F	F	L	L	L	CD, Su	119	Ret	No impact	Possible internal decay at base to south. 50mm Ø pruning wound at base to north. 40% deadwood up to 100mm Ø	Yes	Remove dead branches
48	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	10	4	420				420	460	2388	5040	M	Av	Av	L	M	M	CD	124	Ret	No impact	Forest form	No	-
49	*Eucalyptus*	*saligna*	Sydney Blue Gum	16	9	710				710	940	3224	8520	M	G	G	M-H	H	H	D	127	Ret	No impact		No	Monitoring
50	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	8	4	420				420	460	2388	5040	M	Av	Av	L	M	M	CD	130	Ret	No impact	Forest form	No	-
51	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	8	4	420				420	460	2388	5040	M	Av	Av	L	M	M	CD	130	Ret	No impact	Forest form. Crown skewed to north	No	-
52	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	10	4	860				860	860	3106	10320	M	G	G	M	M	M	CD	129	Ret	No impact	-	No	-
53	*Eucalyptus*	*saligna*	Sydney Blue Gum	19	12	1080				1080	1300	3695	12960	M	G	G	H	H	H	D	138	Ret	No impact	2 open cavities and exposed hardwood at 10m to north. Possible fauna hollows	No	Monitoring

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact | Minor encroachment | Major encroachment | Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
54	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	11	4	730				730	740	2916	8760	M	G	G	M	L-M	M	D	140	Ret	No impact	-	No	-
55	*Melaleuca*	*quinquenervia*	Broad-leaved Paperbark	9	5	200	190	130		305	440	2344	3660	M	G	G	M	M	M	CD	140	Ret	No impact	First order branches at 1m. Crown skewed to north	No	-
56	*Syncarpia*	*glomulifera*	Turpentine	9	5	450				450	560	2594	5400	M	G	G	M	M	H	CD	140	Ret	No impact	First order branches at 2m	No	-
57	*Eucalyptus*	*saligna*	Sydney Blue Gum	13	4	420				420	460	2388	5040	SM	G	Av	M	L-M	H	CD	141	Ret	No impact	-	No	Monitoring
58	*Eucalyptus*	*saligna*	Sydney Blue Gum	21	19	950				950	1000	3309	11400	M	G	G	H	H	H	CD	142	Ret	No impact	Combined crown with tree 59	No	Monitoring
59	*Eucalyptus*	*saligna*	Sydney Blue Gum	21	19	930				930	900	3166	11160	M	G	G	H	H	H	CD	142	Ret	No impact	Combined crown with tree 58	No	Monitoring
60	*Casuarina*	*cunninghamiana*	River Sheoak	10.5	6	700				700	700	2849	8400	M	G	F	M	L-M	M	CD	147	Ret	Possible impact during proposed works	Crown skewed to south. Former crown lifting to north for 6m for clearance. Several 200mm Ø pruning wounds at 1.5m	No	-
61	*Eucalyptus*	*saligna*	Sydney Blue Gum	18	12	1150				1150	1180	3548	13800	M	G	G	H	M-H	H	D	152	Ret	Possible impact during proposed works	Several former occluded wounds to west	No	Monitoring
62	*Eucalyptus*	*acmenoides*	White Mahogany	15	9	900				900	930	3210	10800	M	G	G	M	M	H	D	156	Ret	No impact	-	No	-
63	*Callistemon*	*viminalis*	Weeping Bottlebrush	5.5	8	130	100	120		204	320	2051	2448	M	Av	F	L	L	M	CD, B	158	Ret	No impact	Modified crown. Fo	No	-
64	*Araucaria*	*heterophylla*	Norfolk Island pine	6	3	260				260	250	1849	3120	SM	F	Av	L	L	M	CD	160	Ret	No impact	Some decay	No	-
65	*Robinia*	*pseudoacacia 'Frisi*	Golden Robinia	5.5	3	130	110			171	180	1611	2052	SM	G	Av-G	L	M	L	CD	179	Ret	Possible impact during proposed works	Not on survey. Approximate location	No	-
66	*Robinia*	*pseudoacacia 'Frisi*	Golden Robinia	5.5	3	130	110			171	180	1611	2052	SM	G	Av-G	L	L-M	L	CD	179	Ret	Possible impact during proposed works	Not on survey. Approximate location	No	-
67	*Casuarina*	*cunninghamiana*	River Sheoak	13	5.5	440				440	550	2575	5280	M	G	Av	M	L-M	M	D	184	Ret	No impact	Crown skewed & trunk leaning to east	No	-

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ST IVES NORTH PUBLIC SCHOOL TREE SURVEY DATA

DATE OF SURVEY: 10/04/18 & 19/07/18

No impact	Minor encroachment	Major encroachment	Within development footprint

NO#	Genus	Species	Common Name	Height	Spread	Trunk Dia	Trunk Dia 2	Trunk Dia 3	Trunk Dia 4	DBH	DRB	SRZ	TPZ	Age	Health	Crown	Signifi-cance	Am	Eco	Form	Photo	Rem-Ret	DA - Development Setback and Encroachment	Comments, Description & Defects	DA - Works required	Recom-mendations
68	*Banksia*	*serrata*	Old-man Banksia	7	3	210				210	230	1785	2520	M	G	Av	L	L	M	CD, Su	188	Ret	No impact	Crown skewed to west	No	-
69	*Banksia*	*serrata*	Old-man Banksia	5	5	190				190	210	1718	2280	M	G	Av	L	L	M	CD, Su	187	Ret	No impact	Crown completely skewed to southwest	No	-
70	*Banksia*	*serrata*	Old-man Banksia	7	2.5	150				150	190	1647	2000	M	G	Av	L	L	M	CD, Su	188	Ret	No impact	1m stub 50mm Ø branch to west at 1.2m	Branch to be pruned at base to main trunk	Remove branch
71	*Eucalyptus*	*saligna*	Sydney Blue Gum	15	10	1050				1050	1130	3484	12600	M	G	G	H	H	H	D	180		Located 7.25m from proposed building and adjacent to proposed three levels building and demountable building to be removed, providing a major (22.4%) combined encroachment within the TPZ en encroachment within the SRZ		No	Monitoring
72	*Angophora*	*costata*	Smooth-barked Apple	12	5	300				300	310	2024	3600	M	G	F	M	M	M	CD	6397	Ret	No impact	Not on survey	No	Monitoring
73	*Angophora*	*costata*	Smooth-barked Apple	12	7	400				400	430	2322	4800	M	Av	Av	M	M	M	CD	6397	Ret	No impact	Not on survey	No	Monitoring
74	*Acacia*	*melanoxylon*	Blackwood	12	7	100	400			413	600	2670	4956	M	G	Av	M	L	M	CD, M	6399	Ret	No impact	Not on survey. Cluster of trees	No	-
75	*Acacia*	*implexa*	Hickory	12	6	230				230	300	1996	2760	SM	G	F	M	L	M	CD, Su	6400	Ret	No impact	Not on survey. Cluster of trees	No	-
76	*Acacia*	*implexa*	Hickory	12	6	300				300	400	2252	3600	M	G	F	M	L	M	CD, Su	6402	Ret	No impact	Not on survey. Cluster of trees	No	-
77	*Acacia*	*implexa*	Hickory	12	7	300				300	400	2252	3600	M	G	F	M	L	M	CD, Su	6402	Ret	No impact	Not on survey. Cluster of trees	No	-
78	*Acacia*	*implexa*	Hickory	12	8	500				500	650	2762	6000	M	G	G	M	M	M	CD	6404	Ret	No impact	Not on survey. Cluster of trees	No	-
79	*Angophora*	*costata*	Smooth-barked Apple	12	5	300	300			425	550	2575	5100	M	G	F	M	L	M	D, M	6405	Ret	No impact	Not on survey. Multi-trunked at base	No	Monitoring
80	*Eucalyptus*	*piperita*	Sydney Peppermint	15	10	1000				1000	1200	3573	12000	M	P	P	L	L	M	D	6409	Ret	No impact	Not on survey. Dead or on advanced decay	Yes	Remove dead branches

8. Tree Survey Table Notes

8.1. Genus, Species and Common Name

The botanical and common name of each tree is identified and recorded. Occasionally the exact species name is unknown; *sp.* is recorded to indicate this.

8.2. Height, Spread, Trunk Dia, DBH and DRB

- The tree's height and spread is recorded in metres.
- The tree **DBH** is recorded in millimetres. DBH is an abbreviation of Diameter (of the trunk) measured at Breast Height (or 1.2m from the base of the trunk). If more than one trunk is present the DBH is calculated in accordance with AS4970-2009 Protection of Trees on Development Sites.
- If the tree has multiple trunks multiple trunks each trunk DBH (**Trunk Dia**) will be recorded individually.
- The tree **DRB** is recorded in millimetres. DRB is an abbreviation of Diameter (of the trunk) measured above the Root Buttress. It is required to calculate the SRZ in accordance with AS4970-2009 Protection of Trees on Development Sites when there is major encroachment within the TPZ, ie. greater than 10% is encroached upon or if there is an encroachment within the SRZ.

8.3. Age

The age class of each tree is estimated as either:

- **J** – Juvenile, a young sapling, easily replaced from nursery stock.
- **SM** - Semi Mature, a tree that has not grown to mature size.
- **M** - Mature, a tree that has reached mature size and will slowly increase in size over time.
- **OM** - Over Mature, a tree that has been mature for a long period and is beginning to display signs of decline, e.g. large dead branches.
- **S** - Senescent, an over mature tree that is now in decline.

8.4. Health and Vigour

The trees health and vigour is recorded as a measurement of:

- **G** - Good the tree does not appear stressed with no excessive dieback, insect infestation, decay, dead wood or epicormic shoots.
- **Avg** - Average Health the tree appears stressed and have some crown dieback, and/or a few epicormic shoots, and/or some dead wood in the crown and some new growth at branch tips. These trees may benefit from remediation of the growing environment to reduce stress and return it to good health.
- **F** - Fair the tree may have areas of crown dieback, and/or epicormic shoots, and/or areas of decay, and/or reduced new growth at branch tips. These trees have been stressed for a short period of time, remediation of the growing environment may improve the trees health.
- **P** - Poor the tree may have large areas of crown dieback, and/or many epicormic shoots, and/or reduced new growth at branch tips. These trees

have been stressed for a long time, remediation of the growing environment would not return the tree to good health.

- **D** – Dead the tree is dead

8.5. Crown Condition

The crown condition of each tree is assessed and recorded as either:

- **G** - Good Condition: the tree appears to have no visible indication of inherent structural defects.
- **Avg** - Average Condition: the tree has minor structural defects which may be corrected with remedial works or pruning, allowing the tree to return to Good Condition.
- **F** - Fair Condition: the tree has visible structural defects such as (but not limited to) dead branches, and/or an unbalanced crown, and/or leaning trunk and/or areas of decay. These trees do not demonstrate the typical form of their species, or have been damaged or have begun to deteriorate. Remedial works or pruning may return the tree to Average Condition.
- **P** - Poor Condition: the tree has significant structural defects such as (but not limited to) very large dead branches, and/or extremely unbalanced crown, and/or subsiding trunk and/or large areas of decay. These trees do not demonstrate the typical form of their species, or have been severely damaged or have deteriorated significantly. Remedial pruning would not return the tree to Fair Condition.

8.6. Significance

Measured as High, Medium or Low, see **0. The Ku-ring-gai Council Tree** Preservation controls define a tree as "A perennial plant with at least one self supporting woody, fibrous stem, whether native or exotic, which is 5 metres or more in height or has a trunk diameter of 150mm or more measured at ground level."

The Tree Preservation Order applies to "the whole of the local government area of Ku-ring-gai with the exception of those lands dedicated as National Park."

Exemptions from this Tree Preservation Order apply to dead trees and branches, a list of exempt species is provided within the TPO and "trees within 3.0m of an approved, existing residential building" measured from the centre of the trunk at ground level to the external wall of the building in question are also exempt from protection.

Determining a tree's significance (page 8). Significance may be expressed in increments of High, Medium or Low. For a High rating the majority (≥4) of the answers will be yes; For a Medium-High rating 3.5 of the answers will be yes; for a Medium rating half (=3) of the answers will be yes; for a Low-Medium rating 2.5 of the answers will be yes; and for the Low rating the minority of answers will be yes (≤2).

8.7. Amenity Value

Amenity value is a subjective measurement based on the tree's contribution to the landscape, it may be based on the tree's visual form, however it also includes non visual attributes such as provision of shade for a seat, screening of poor views or for privacy, or if it has historical significance. The amenity value is recorded as:

- **H** - High, the trees form is an excellent example of its species and it makes a great specimen and/or it has other attributes such screening, or is historical

significance. These trees are visually prominent and valuable to the community or public domain.

- **M** - Medium, the tree may have an altered form and/or it has attributes that provides amenity to local residents only.
- **L** – Low, the tree is not a good specimen and it does not provide substantial benefit to local residents or the community.

8.8. Ecological Value

Ecological value is a measurement of the trees contribution to the environment. It is determined by the trees area of origin, its potential to provide habitat to native fauna and its potential to become an environmental pest. The ecological value is recorded as:

- **H** - High, the tree is locally native or remnant and/or it has habitat value for native fauna.
- **M** - Medium the tree is native but not locally native.
- **L** - Low, the tree is not native and/or it may be a listed nuisance or weed species.
- **Ha** – Habitat, is the tree valued by fauna for food (ie. foliage fruit or sap) or shelter (ie. nesting, roosting, dray or hollow).

8.9. Form

The form, structure or shape of each tree is assessed and recorded as either one or a combination of several of the below terms; (**U**) Upright, (**B**) Broad, (**C**) Conical, (**Sh**) Shrub, (**CS**) Crown Shy (also referenced is the adjacent dominant tree canopy ie. **T4**), (**V**) Vase, (**D**) Dome, (**P**) Palm, (**S**) Spreading, (**L**) Leaning or (**BM**) Basal Multi Trunked.

Crown form may also be assessed in accordance with the relationship with the neighbouring tree and recorded as either: **S** - Suppressed, the crown is located beneath another larger crown and is leaning away (Crown Shy); **CD** - Codominant, the crown is adjacent to another crown of similar size, their crown areas may appear joined; **D** - Dominant, the crown is above other lower crowns; **E** - Emergent, the crown emerges from a lower canopy formed by other dominant or codominant crowns.

8.10. Indicative Canopy area

This is indicated in square metres and rounded to the closest whole square metre. Each figure is calculated from average crown spread measured on site of individual trees and assumes a circular shape. Crown overlapping of adjacent trees is not taken into account.

8.11. Defects

The presence of one or a combination of several defects is recorded (**W**) Wound, (**D**) Decay, (**F**) Fungus, (**B**) Bulge, (**FB**) Fibre Buckling, (**C**) Cracks, (**S**) Split, (**H**) Hollow, (**DB**) Die Back, (**E**) Epicormic shoots, (**DW**) Dead Wood, (**I**) Inclusion, (**CA**) Cavities, (**PF**) Previous Failure, (**R**) Root Damage, (**P**) Pruning wound, (**PD**) Pests and diseases, (**ST**) Storm Damage.

8.12. SRZ (Structural Root Zone)

The SRZ is a radial area extending outwards from the centre of the trunk. This area contains the majority of the structural woody roots. This area is responsible primarily for stability. Root damage or root loss within this zone greatly increases the opportunity for decay fungi to ingress into the heartwood, causing internal decay in addition to destabilising the tree's structural integrity. The SRZ is calculated as follows (This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites):

$$\textbf{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

8.13. TPZ (Tree Protection Zone)

The TPZ is a circular area with a radius measured by multiplying the DBH by twelve (12), or a circular area the size of the tree's drip line whichever is greater. This area contains the majority of the essential structural and feeder roots responsible for stability, gaseous exchange and water and nutrient uptake. Excavation, back filling, compaction or other disturbance should not occur in this area.

The TPZ is used to identify the minimum area required for the safe retention of a given tree. This calculation is derived from the Australian Standard 4970 – 2009 Protection of Trees on Development Sites. An incursion to 10% within the TPZ is potentially acceptable if no other option is available. A major encroachment (in excess of 10%) is required to be clearly justified by the project Arborist and compensated for elsewhere. Justification methodology may vary depending on site or the individual tree's health, vigour and ability to withstand disturbance and may require root investigation.

8.14. Development Setback / Impact

The successful retention of trees on construction sites is dependent on the adequate allocation and management of the space above, below and around trees to be retained.

The trunk and canopy of trees to be retained must be protected to ensure the trunk and branches are not damaged during construction. The removal of bark and / or branches allows the potential ingress of micro organisms which may cause decay. Similarly the removal of bark restricts the tree's ability to distribute water, mineral ions and glucose.

It is essential to prevent the disturbance of the soil beneath the drip line of each tree, because this is the area where oxygen, water and mineral ions are absorbed by tree roots. Oxygen, water and mineral ions are essential for healthy plant growth. If soil becomes compacted, the ability of roots to function correctly is greatly reduced. Similarly the removal or damage of roots will reduce the ability of roots to function correctly. Woody roots provide stability for the tree and they also transport nutrients to the leaves.

The potential implications of removing or damaging roots are threefold:

1. The risk of whole tree failure is increased, as tree roots anchor and stabilise the tree. Woody roots are developed to assist in the support of the tree in prevailing wind, with these roots removed wind throw may occur, which would result in the mass failure of the tree.

2. The ability of the tree to absorb and transfer the essential nutrients, oxygen and water from the soil to the leaves is greatly affected. This will place the tree under stress and reduce the tree's ability to photosynthesise, and in turn cause the tree to use up stored energy reserves. These energy reserves are used to fight infection and insect attack, for new growth, maintenance of existing tissues and also for healing wounds. Once energy reserves become depleted a tree is much more susceptible to drought, disease and pest attack.
3. Open wounds are sites by which decay-causing pathogens can enter the tree. The severance or damage of woody roots creates sites where pathogens may gain ingress. Whilst the effect of decay may not be immediately apparent, the long term health and structure of the tree will be compromised.

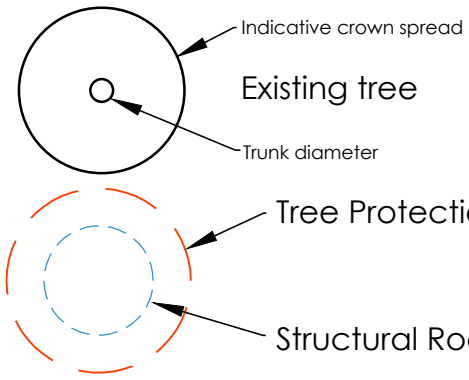
8.15. Comments

Comments generally relate to the suitability for retention. The comments allow for a brief notation of other factors relevant to the assessment of the tree.

9. Tree Location Plan

LEGEND

+101.45	Existing levels
+ RL 101.55	Proposed levels
+ TOW 101.55	Proposed Top Of Wall levels
—·—·—	Boundary
-------	To be removed / demolished
----------	Building under
———	Building
-------	Building over



Cut - encroachment into Tree Protection Zone

Encroachment into Tree Protection Zone

Light encroachment into Tree Protection Zone

REVISION	DESCRIPTION	DRAWN	CHECK	DATE
A	SUBMITTED TO CLIENT FOR COMMENT ON CONCEPT PLAN	DP	AM	18-04-18
D	SUBMITTED TO CLIENT FOR DA	DP	AS	03-10-18
E	SUBMITTED TO CLIENT FOR DA - trees 74-79 & 80	DP	AS	21-12-18

arboreport™
Vegetation Management Consultants
PO Box 8136, Baulkham Hills, NSW 2153
Ph: (02) 9680 7713 Fax: (02) 9680 7705
Email: info@arboreport.com.au
Web: www.arboreport.com.au
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7. All work to be performed by a suitably qualified tradesperson
8. For application purposes only - NOT FOR CONSTRUCTION

PROJECT: **ST. IVES NORTH PUBLIC SCHOOL**

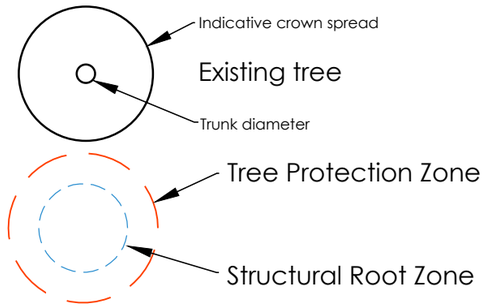
CLIENT: **JDH ARCHITECTS**

STAGE	DA : MAIN WORKS		
DRAWING	TREE LOCATION PLAN		
SCALE	N.T.S. @ A3	ISSUE DA	SHEET T - 01
DRAWN	DP	CHECK AM	DATE 21-12-18
			REVISION E

10. Tree Protection Plan 1: Construction

LEGEND

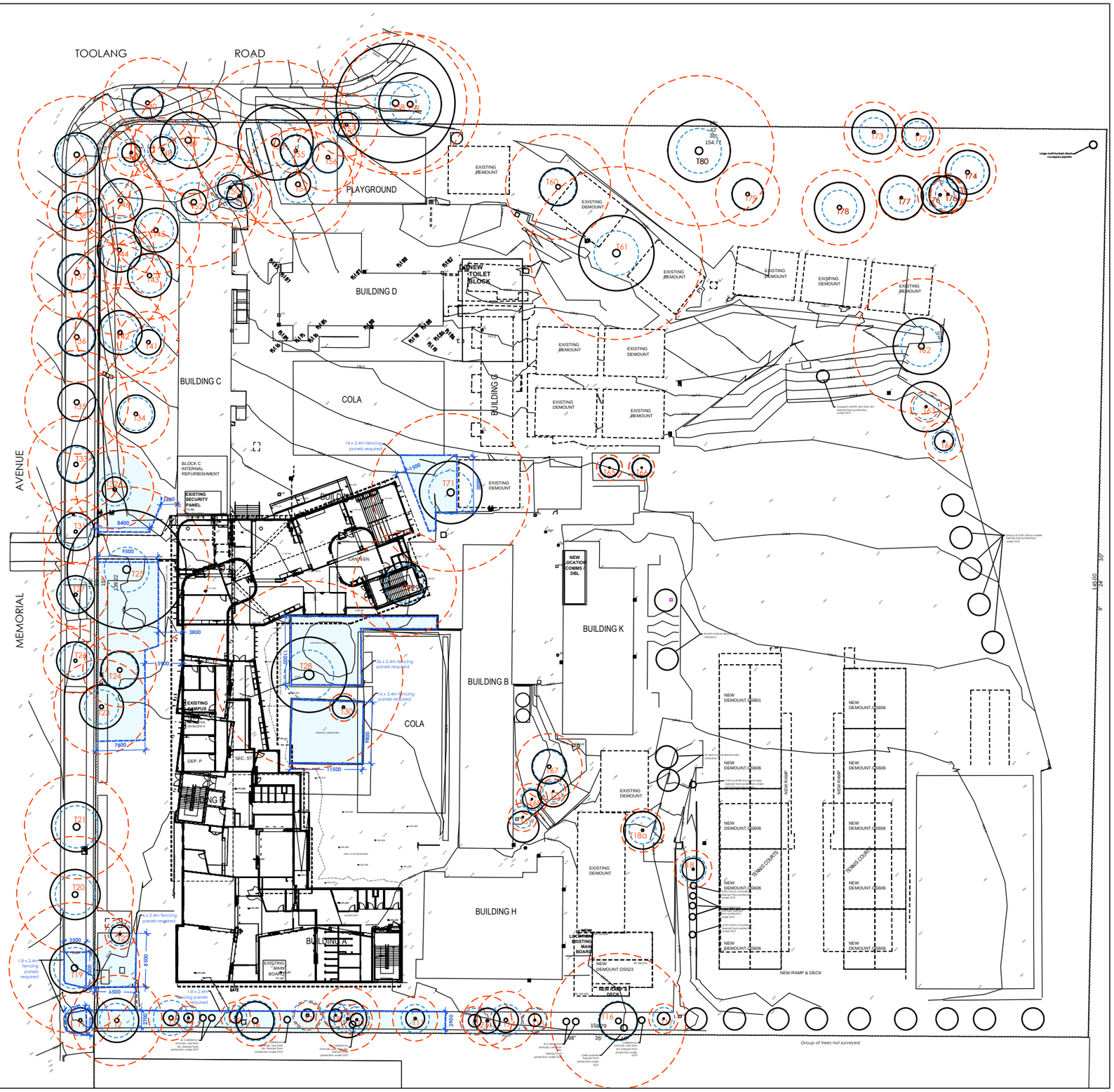
+101.45	Existing levels
+ RL 101.55	Proposed levels
+ TOW 101.55	Proposed Top Of Wall levels
—·—·—	Boundary
-------	To be removed / demolished
-·-·-·-·-	Building under
———	Building
-------	Building over



Location of Tree Protection Fencing

A COPY OF THIS TREE PROTECTION PLAN TO BE KEPT ON SITE AT ALL TIMES

ALL EXCAVATION WITHIN TPZs TO BE DONE UNDER SUPERVISION OF THE PROJECT ARBORIST



REVISION	DESCRIPTION	DRAWN	CHECK	DATE
A	SUBMITTED TO CLIENT FOR COMMENT ON CONCEPT PLAN	DP	AM	18-04-18
D	SUBMITTED TO CLIENT FOR DA	DP	AM	03-10-18
E	SUBMITTED TO CLIENT FOR DA	DP	AM	21-12-18

arboreport™
Vegetation Management Consultants
PO Box 8136, Baulkham Hills, NSW 2153
Ph: (02) 9680 7713 Fax: (02) 9680 7705
Email: info@arboreport.com.au
Web: www.arboreport.com.au
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PROJECT
ST. IVES NORTH PUBLIC SCHOOL

CLIENT
JDH ARCHITECTS

STAGE: DA : MAIN WORKS

DRAWING: TREE PROTECTION PLAN DURING CONSTRUCTION OF MAIN BUILDINGS AND CONSTRUCTION WORKS

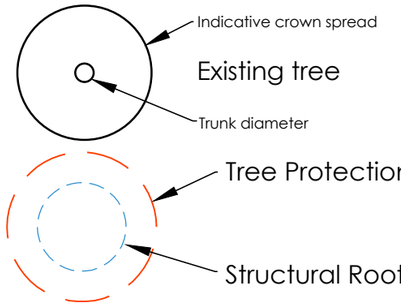
SCALE	ISSUE	SHEET
N.T.S. @ A3	DA	T - 02

DRAWN	CHECK	DATE	REVISION
DP	AM	21-12-18	E

11. Tree Protection Plan 2: Removal of Demountables

LEGEND

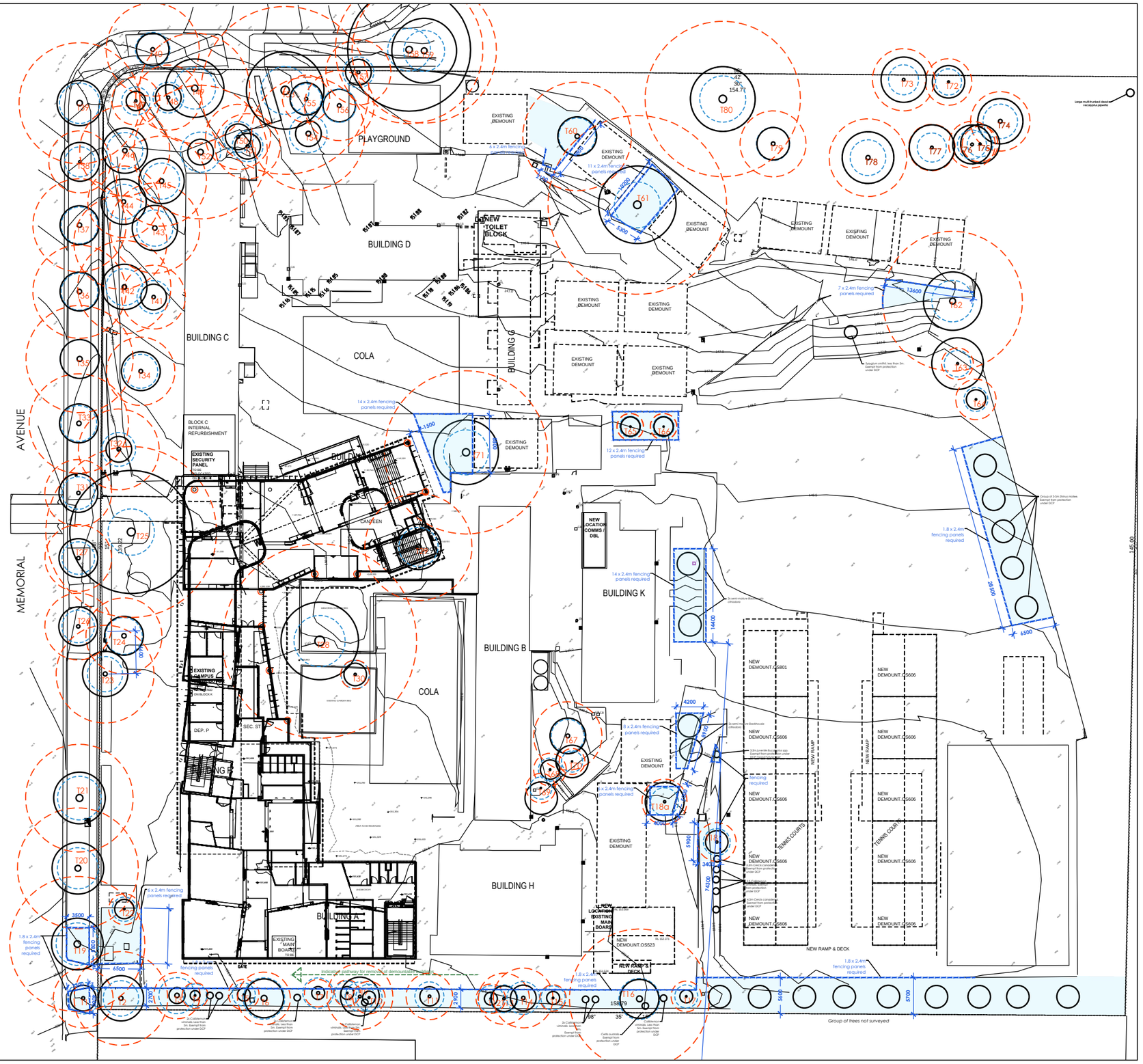
+101.45	Existing levels
+ RL 101.55	Proposed levels
+ TOW 101.55	Proposed Top Of Wall levels
—·—·—	Boundary
- - - - - - -	To be removed / demolished
—·—·—·—	Building under
———	Building
- - - - - - -	Building over



Location of Tree Protection Fencing

A COPY OF THIS TREE PROTECTION PLAN TO BE KEPT ON SITE AT ALL TIMES

ALL EXCAVATION WITHIN TPZs TO BE DONE UNDER SUPERVISION OF THE PROJECT ARBORIST



REVISION	DESCRIPTION	DRAWN	CHECK	DATE
A	SUBMITTED TO CLIENT FOR COMMENT ON CONCEPT PLAN	DP	AM	18-04-18
D	SUBMITTED TO CLIENT FOR DA	DP	AM	03-10-18
E	SUBMITTED TO CLIENT FOR DA	DP	AM	21-12-18

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PO Box 8136, Baulkham Hills, NSW 2153
Ph: (02) 9680 7713 Fax: (02) 9680 7705
Email: info@arboreport.com.au
Web: www.arboreport.com.au
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1. Do not scale from drawings
2. Verify all measurements on site
3. Notify ecodesign of any inconsistencies
4. Copyright © arboreport. All rights reserved
5. Drawing remains the property of arboreport
6. All work to comply with relevant Australian Standards or Building Code of Australia
7. All work to be performed by a suitably qualified tradesperson
8. For application purposes only - NOT FOR CONSTRUCTION

PROJECT: **ST. IVES NORTH PUBLIC SCHOOL**

CLIENT: **JDH ARCHITECTS**

STAGE: DA : MAIN WORKS

DRAWING: TREE PROTECTION PLAN DURING REMOVAL OF DEMOUNTABLE BUILDINGS

SCALE	ISSUE	SHEET
N.T.S. @ A3	DA	T - 03

DRAWN	CHECK	DATE	REVISION
DP	AM	21-12-18	E

12. Tree Protection Notes and Details

FURTHER INFORMATION AS PER AS 4970-2009

PRE-CONSTRUCTION

Tree Protection Barriers

1. Tree Protection Fencing forming Exclusion Zones must consist of galvanised pipe at 2.4m spacing and connected by securely attached chain mesh fencing to a minimum height of 1.8m in height prior to work commencing. No access to the fenced off area should be given unless approved by the Project Arborist. All tree protection barriers must be kept in place until the conclusion of construction.
2. Signage to be affixed to every third panel indicating the area is a Tree Protection Zone and a list of the prohibited activities within the area.
3. Moving of fencing/barriers to allow approved works carried out within the Exclusion Zone must be returned to its initial location directly at the conclusion of works. If the works are carried out for over 1 day, barriers are to be replaced at the conclusion of each day.
4. Exclusion Zones should be kept free of weeds by appropriate physical or approved herbicide control.
5. Existing paving at the front of the dwelling to be kept during construction works.
6. Trunk and Branch Protection shall consist of wrapped padding material underneath boards strapped (not nailed or screwed) around the trunk or branch to a minimum height of 2m to prevent mechanical damage to bark.
7. Ground protection must be installed prior to the commencement of works to prevent damage to roots during construction works. Rumble boards,14-25mm steel plates or similar are to be installed on top of a layer of 75mm layer of mulch above impervious geofabric, woven weedmat or similar to prevent soil contamination and compaction from building activities. This must be kept in place until the conclusion of construction, and then removed by hand.

Tree removal and pruning -

1. Heavy machinery is to be avoided within the TPZ of retained trees. Where machinery is required in this area, only machinery with tracksshall enter.
2. Any approved pruning required to allow for works should be done at this stage by a minimum AQF Level 3 arborist in a manner consistent with AS 4373.
3. The project arborist is to supervise tree removal, transplanting and pruning and certify the works on completion.

CONSTRUCTION STAGE

Construction Works -

1. All earthworks and pruning works within TPZ (see AS4970) to be supervised, directed and recorded by the project arborist.
2. The project arborist shall inspect the trees and protection measures on a quarterly basis unless otherwise stated.

Landscape Works -

1. The landscape plan to be checked for compliance with this tree protection plan.
2. The project arborist to approve the staged removal of protection measures required to allow for landscape works.
3. All works within TPZs, including retaining walls, irrigation and lighting installation, topdressing, planting and paving are to be supervised, directed and recorded by the project arborist. The project arborist should specify any remedial works above and below ground. Monitoring is to be recorded for inclusion in certification at practical completion.

POST-CONSTRUCTION

1. Retained trees to be inspected by the project arborist at the conclusion of works.

Arborist Inspections and certifications are required as follows:

- **Inspection & Certification of correct installation of fencing and ground protection as per T02 - Tree Protection Plan during construction works**
- **Direct supervision of ANY excavation works within the Tree Protection Zone of all retained trees.**
- **Inspection & Certification of correct installation of fencing and ground protection as per T03 - Tree Protection Plan during removal of demountables**
- **Certification any changes to tree protection requirements.**
- **Quarterly intervals during construction.**
- **Following the removal of tree protection measures**
- **Prior to issue of occupation certificate**

For further details, see Arboricultural Impact Assessment, Section 6.4

A COPY OF THIS TREE PROTECTION PLAN TO BE KEPT ON SITE AT ALL TIMES

ALL EXCAVATION WITHIN TPZs TO BE DONE UNDER SUPERVISION OF THE PROJECT ARBORIST

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PO Box 8136, Baulkham Hills, NSW 2153
Ph: (02) 9680 7713 Fax: (02) 9680 7705
Email: info@arboreport.com.au
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PROJECT: **ST. IVES NORTH PUBLIC SCHOOL**

CLIENT: **JDH ARCHITECTS**

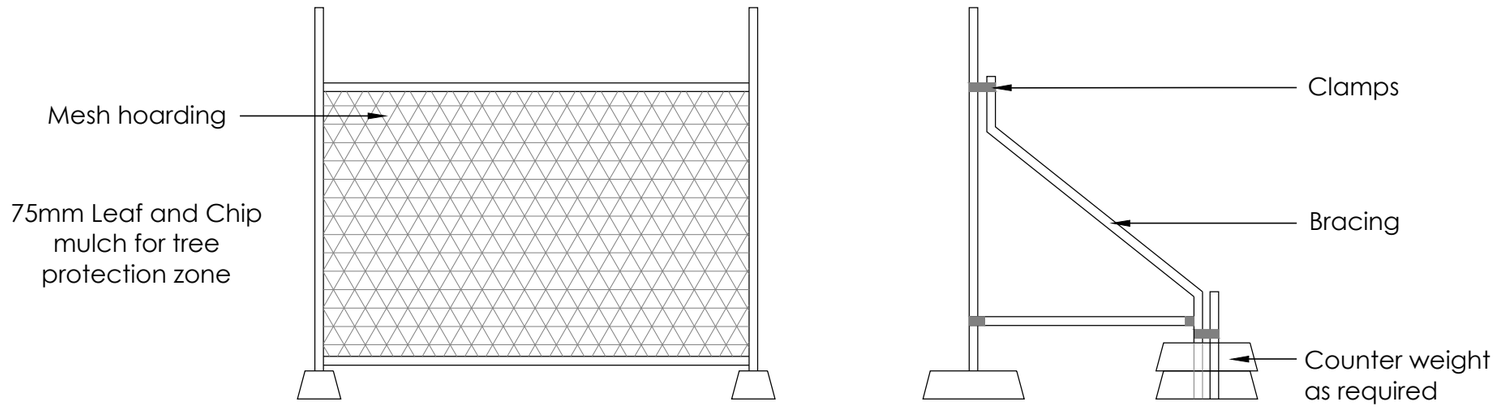
STAGE: DA - MAIN WORKS

DRAWING: TREE PROTECTION PLAN - NOTES

SCALE	ISSUE	SHEET
N.T.S. @ A3	DA	T - 04

DRAWN	CHECK	DATE	REVISION
DP	AM	21-12-18	E

TPZ sign to be printed on A3 and displayed at 1 x sign every 2-3 panels or as indicated on Tree Fencing Plan



Continuous temporary fencing equal to Temporary Fence Hire Mesh Panel System.
NOT TO SCALE

1 / NTS **Tree protection fence**
Typical Elevations

- Note: Protection Fencing must consist of steel wire mesh fence at a minimum 1.8m height, with appropriate signage indicating the area is a Tree Protection Zone. No access to the fenced off area should be given unless approved by the Project Arborist.
- Note: It is anticipated that limited works will occur within the TPZ and outside of the tree protection barrier fencing.
- Note: Hand excavation is required for all works located within the TPZ of all retained trees to enable a clean cut of the roots.

  These works shall be supervised by the Project Arborist. Roots greater than 30mm in diameter should be cut cleanly by a minimum AQF Level 3 arborist.

List of activities prohibited within TPZ include but not limited to:

- Mechanical excavation (such as trenching or excavation for silt fencing)
- Cultivation
- Storage
- Chemical preparation
- Parking
- Refuelling
- Waste dumping
- Equipment cleaning
- Fill replacement
- Lighting of fires
- Soil level changes
- Installation of signs or utilities
- Any physical damage to the tree

Source: AS 4970-2009 Australian Standard

NO ACCESS

TREE PROTECTION ZONE

List of activities prohibited within TPF include but not limited to:

- **Mechanical excavation (such as trenching or excavation for silt fencing)**
- **Cultivation**
- **Storage**
- **Chemical preparation**
- **Parking**
- **Refuelling**
- **Waste dumping**
- **Equipment cleaning**
- **Fill replacement**
- **Lighting of fires**
- **Soil level changes**
- **Installation of signs or utilities**
- **Any physical damage to the tree**

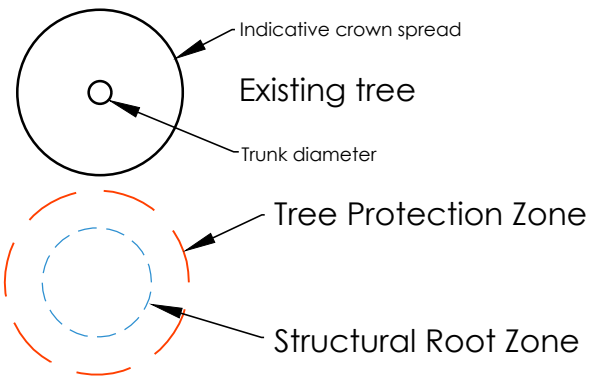
Source: AS 4970-2009 Australian Standard

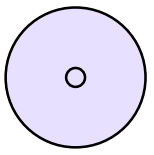
PROJECT ARBORIST
CONTACT 9680 7713

13. Tree Removal Plan

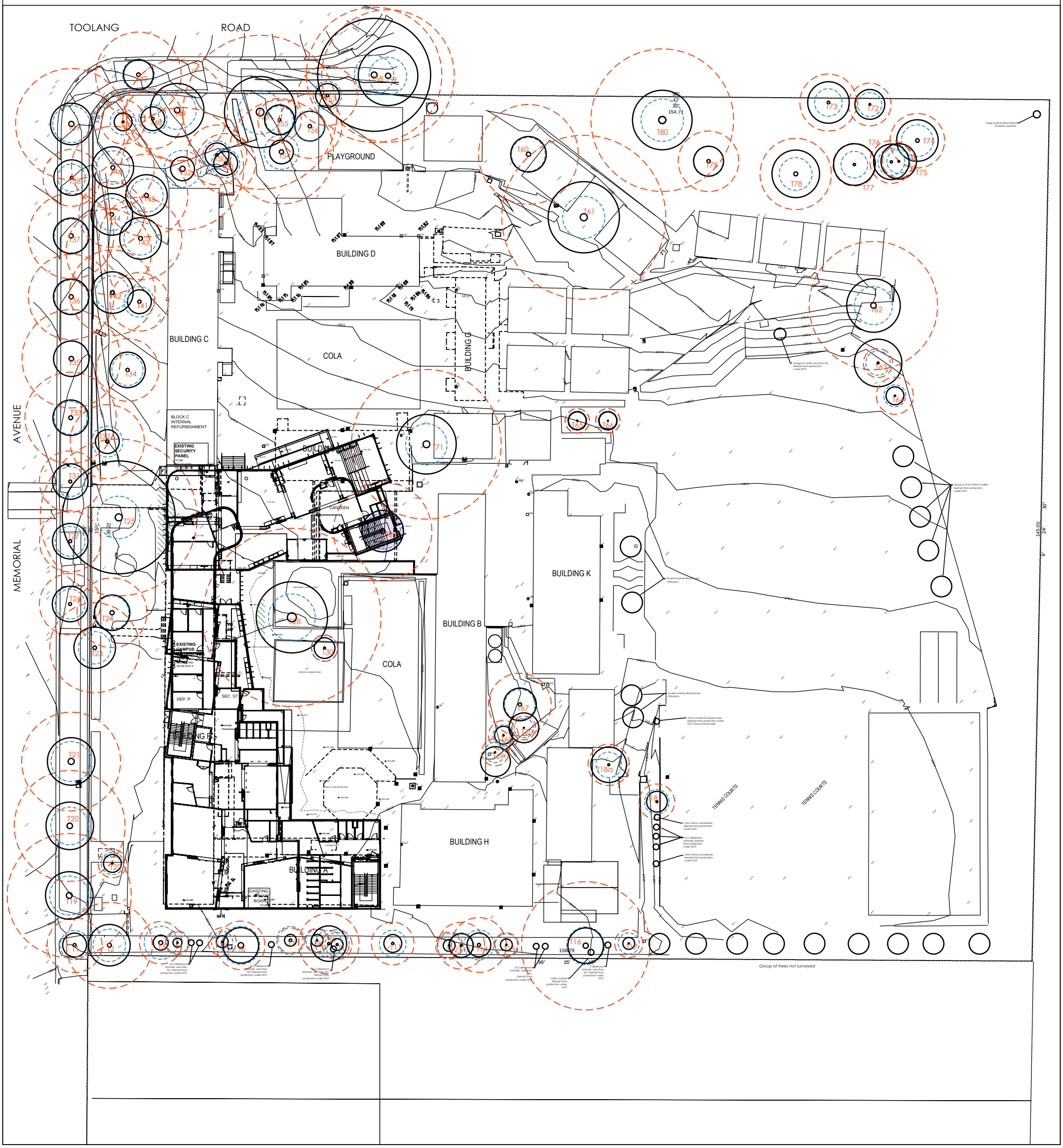
LEGEND

+101.45	Existing levels
+ RL 101.55	Proposed levels
+ TOW 101.55	Proposed Top Of Wall levels
—·—·—	Boundary
-------	To be removed / demolished
———	Building





Assessed tree within development footprint to be removed



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PROJECT: **ST. IVES NORTH PUBLIC SCHOOL**

CLIENT: **JDH ARCHITECTS**

STAGE: DA - MAIN WORKS

DRAWING: TREE REMOVAL PLAN

SCALE	ISSUE	SHEET
N.T.S. @ A3	DA	T - 07

DRAWN	CHECK	DATE	REVISION
DP	AM	21-12-18	E

14. General Tree Protection Notes

14.1. Structural Root Zone (SRZ)

The SRZ is a radial area extending outwards from the centre of the trunk calculated as follows:

$$\textbf{SRZ (Radius)} = (D \times 50)^{0.42} \times 0.64$$

14.2. Tree Protection Zone (TPZ)

The TPZ is a radial area extending outwards from the centre of the trunk equal to the DBH x 12. This area shall be protected by a TPF (*see below*). For all trees to be retained a TPZ is to be created and maintained.

The TPZ function is primarily to protect the root zone by restricting access however the canopy of the tree shall also be protected from damage or injury. The Project Arborist shall approve the extent of the TPZ.

The TPZ shall be mulched to a depth of 75mm with an approved organic mulch. Supplementary watering shall be provided in dry periods to reduce water or construction stress, particularly to those trees which may have incurred root disturbance.

An area equivalent to the encroachment is required to be provided (additional to and contiguous with the remaining TPZ) to offset against the encroachment. This additional area is to be protected during construction.

In the TPZ the following activities shall be excluded:

- Excavation, compaction or disturbance of the existing soil.
- The movement or storage of materials, waste or fill.
- Movement or storage of plant, machinery, equipment or vehicles.
- Any activity likely to damage the trunk, crown or root system.
- Scaffolding.

14.3. Tree Protection Fencing (TPF)

Prior to site establishment, tree protection fencing shall be installed to establish the TPZ for trees to be retained. Tree protection fencing shall be maintained entire for the duration of the construction program.

Tree protection fencing shall be:

- To enclose as much of the TPZ as can reasonably be enclosed, allowing for pedestrian access and 1m offset around construction footprint and scaffolding.
- Cyclone chain link wire fence or similar, with lockable access gates.
- Certified and Inspected by the Project Arborist
- Installed prior to the commencement of the works.

- Prominently signposted with 300mm x 450mm boards stating "**NO ACCESS TO THIS AREA - TREE PROTECTION ZONE CONTACT PROJECT ARBORIST 0407 006 852**".

14.4. Trunk and Root Zone Protection

Other measures may be required in addition to tree protection fencing. These specific protection measures will be installed as directed by the Project Arborist to protect the canopy, trunk or branches from the risk of damage.

The Project Arborist shall be consulted if there is risk of damage to a retained tree. The Project Arborist may require:

- A 75mm layer of approved mulch to be installed to the TPZ.
- A temporary drip irrigation system to be installed to the TPZ.
- Additional root protection to be installed.
- Additional trunk and branch protection to be installed.

14.5. Tree Damage

In the event of damage to a tree or the TPZ of a tree to be retained the Project Arborist shall be engaged to inspect and provide advice on remedial action. This should be implemented as soon as practicable and certified by the Project Arborist.

14.6. Excavation within the TPZ

Excavation within the TPZ shall be avoided. All care shall be undertaken to preserve tree root systems. Excavation within the canopy drip line or TPZ shall subject to the approval and supervision of the Project Arborist. Excavation shall be executed by hand to avoid damage to roots.

If excavation within the TPZ is required other than that anticipated in this report the Project Arborist shall be notified. A root mapping exercise may be required and should be certified by the Project Arborist. Root mapping shall be undertaken by either ground penetrating radar (GPR), air spade, water laser or by hand excavation. The purpose shall be to locate woody structural roots greater than 50mm in diameter.

Where roots 50mm dia. or greater are encountered, alternative construction method shall be considered to ensure roots are not severed. Adequate allowance must also be made for future radial root growth. In paved areas, consideration should be given to raising the proposed pavement level and using a porous fill material in preference to excavation.

If there is no avoiding placing services through the TPZ excavate outside the TPZ and underbore below the root ball of the tree as directed by the Arborist.

14.7. Fill

All fill material to be placed within the TPZ should be approved by Arborist and equal to 5-7mm Round River Pea Gravel to provide aeration and percolation to the root zone. Otherwise no fill should be placed within the TPZ of trees to be retained.

14.8. Pavements

Proposed paved areas within the TPZ should be placed on or above grade to minimise excavation, and avoid root severance and/or damage. Pavements should be permeable or avoided otherwise.

14.9. Pruning

All pruning work required (including root pruning) should be in accordance with Australian Standard No *4373 -2007 - Pruning of Amenity Trees*.

If required, roots should be severed with clean sharp implement flush with the face of the excavation and maintained in a moist condition. Root pruning shall be performed under the supervision of the Project Arborist.

14.10. Tree Removal

Tree removal work shall be carried out by an experienced Level 3 Arborist in accordance with the NSW Work Cover Code of Practice for the Amenity Tree Industry (1998).

Care shall be taken to avoid damage to trees during the felling operation. Stumps shall be grubbed-out using a mechanical stump grinder to a minimum depth of 300mm without damage to other retained root systems.

14.11. Post Construction Maintenance

In the event of any tree deteriorating in health after the construction period, the Project Arborist shall be engaged to provide advice on any remedial action. Remedial action shall be implemented as soon as practicable and certified by the Project Arborist.

Tree protection fencing with additional trunk and root protection shall be removed following completion of construction. The mulch layer in the TPZ shall be retained and replenished where required to maintain a 75mm thickness.

15. References

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2. **AS 4373 - 2007 Pruning of Amenity Trees**; Standards Australia.

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18. NSWRFS, (2006), NSW RFS; **Planning for Bush Fire Protection, Appendix 2**; NSW Rural Fire Service, Granville, with NSW Department of Planning.