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Preliminary Arboricultural Report

Tweed Valley Hospital Project

17 October 2018

C91239

ASSESSMENT & REPORT COMMISSIONED BY:

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17 October 2018

Mr Sagar Mukherjee
Level 15 Brisbane Club Tower
241 Adelaide Street
Brisbane QLD 4000

Preliminary Arboricultural Report relating to four (4) individual trees and 150+ hedgerow trees located at 771 Cudgen Road Kingscliff NSW

Dear Sagar,

We are pleased to provide you with the following Preliminary Arboricultural Assessment of four (4) individual trees and one hundred and fifty plus (150+ estimated) hedgerow (wind break) trees within the property located at 771 Cudgen Road Kingscliff NSW.

Complete use of this report is authorised under the conditions limiting its use as stated in Appendix A Item 7 of *"Arboricultural Reporting Assumptions and Limiting Conditions"*.

Should you have any queries relating to this report, its recommendations, or the options considered, please do not hesitate to contact us on 1300 272 671.

Regards,

Andy Clark
Consulting Arborist
Dip. Hort. (Arb.), AQF Level 5

Table of Contents

1 Introduction

1.1.1 ArborSafe Australia Pty Ltd was engaged by Health Infrastructure (HI) relation to completion of a Preliminary Arboricultural Assessment (report) on four (4) individual trees and 150+ hedgerow trees within the property located at 771 Cudgen Road, Kingscliff NSW.

1.1.2 The current site use is farmland and includes an existing farmhouse and various amenity sheds surrounded by areas of open paddock.

1.1.3 This report is required to assist in the planning and design of the new Tweed Valley Hospital that is proposed for construction within the site and which may adversely affect site trees.

1.1.4 The report was intended to provide information on identified site trees and how they may pose a constraint on the proposed development. Report findings and recommendations are based upon guidance provided within the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites*.

1.1.5 Observations and recommendations provided within this report are based upon information provided by the client and an arborist site visit.

2 Scope

2.1.1 Carry out a visual examination of the nominated trees located within the vicinity of the proposed development.

2.1.2 Inspect the nominated trees and their growing environment in the context of the proposed development.

2.1.3 Provide an objective appraisal of the subject trees in relation to their species, estimated age, health, structural condition and viability within the landscape.

2.1.4 Based on the findings of this investigation, provide independent recommendations on the retention value of the trees.

2.1.5 Identify and reduce potential conflicts between tree protection and site development by providing accurate information on the area required for tree protection and the restricted activities within the area for each tree prior to any proposed construction.

3 Methodology

3.1 Data Collection

3.1.1 Andrew Clark of ArborSafe Australia Pty Ltd carried out a site inspection of the subject trees on 20 July 2018 with the data collected on site later analysed by Andrew Clark and collated into report format.

3.1.2 Trees that are the subject of this report were identified within emailed plans (B & P Surveys, Level & Detail Survey, Drawing 22633B, Sheet 3 and 4, dated 15 June 2018) and during an onsite meeting with Sue Folliott, Senior Project Manager for TSA Management.

3.1.3 The subject trees were inspected from ground level. No foliage or soil samples were taken. No aerial or internal investigations were undertaken.

3.1.4 Tree height and canopy width were estimated and have been provided to the nearest whole metre. Trunk diameter at breast height (DBH) was measured with a diameter tape and provided to the nearest centimetre.

3.2 Tree Protection Zones

3.2.1 The Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) methods have been derived from the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites*.

3.2.2 The TPZ is defined as a specified area above and below ground and at a given distance measured radially away from the centre of the tree's trunk and which is set aside for the protection of its roots and crown. It is the area required to provide for the viability and stability of a tree to be retained where it is potentially subject to damage by development. The radius of the TPZ is calculated by multiplying its DBH by 12 (Note DBH is nominally measured as 1.4m from ground level).

TPZ radius = DBH × 12

3.2.3 The SRZ is the area around the base of a tree required for the tree's stability in the ground. The woody root growth and soil cohesion in this area are necessary to hold the tree upright. The SRZ is nominally circular with the trunk at its centre and is expressed by its radius in metres.

SRZ radius = (D × 50)^0.42 × 0.64

3.2.4 Retention values are determined based upon the British Standard BS 5837–2012 for Trees in Relation to Design, Demolition and Construction. This standard categorises tree retention value based upon assessment of the tree's quality (health and structure), and life expectancy. Other criteria such as its physical dimensions, age class, location and its Amenity, Heritage and Environmental significance are also considered. A breakdown of attributes required for each category can be obtained from Appendix B – Explanation of Tree Assessment Terms.

3.3 Images and Site Photographs

3.3.1 All photographs were taken at the time of the site inspection by the attending arborist. Photographs have been altered for brightness and/or cropped only. Other images used within this report have been sourced via the internet. The source of all images has been referenced accordingly.

4 Observations

4.1 Aerial Images / Draft Plans

4.1.1 No finalised design / layout plans (including underground services) were supplied or considered in the preparation of this report.

Figure 1. Satellite view of the proposed Tweed Valley Hospital site. The location of Tree 4 is identified by the red arrow.
Source: Tweed Shire Council LEP mapping tool, August 2018

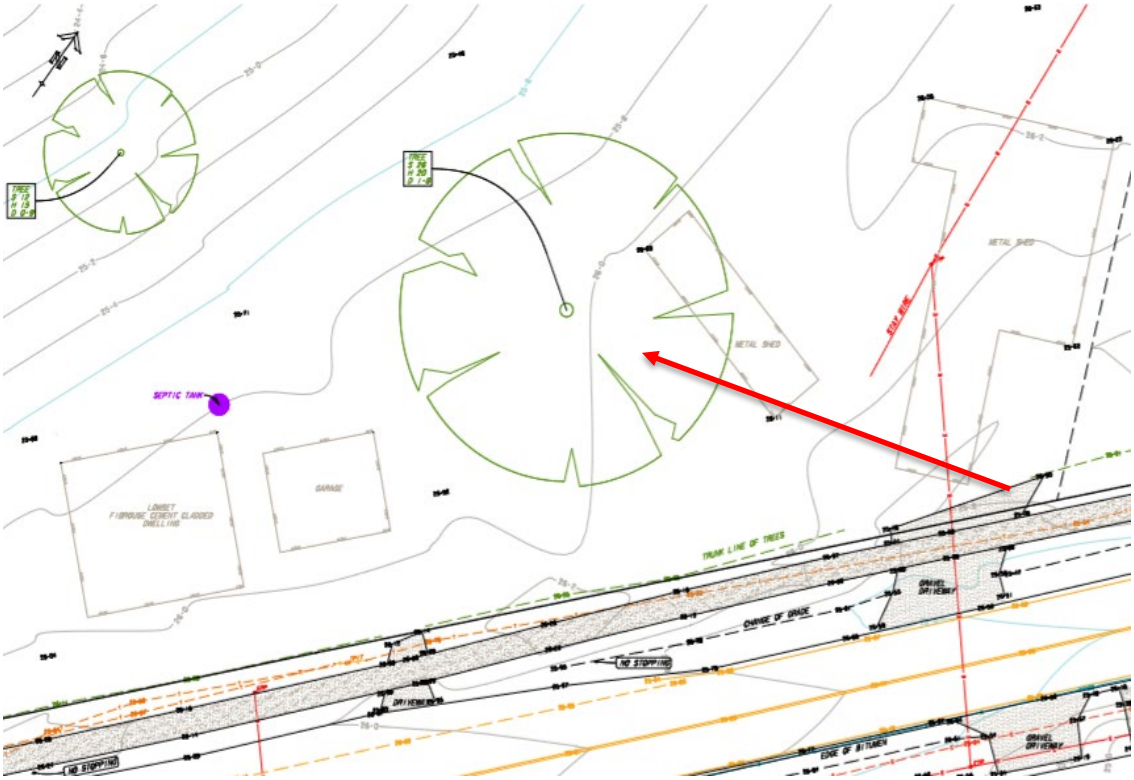


Figure 2. Surveyed plan showing the position of trees 3 & 4 in relation to the existing house site. Tree 4 is identified by a red arrow.
Source: segment of the B & P Surveys, Level & Detail Survey, drawing 22633B, sheet 4, date 15 June 2018 – Provided by TSA Management

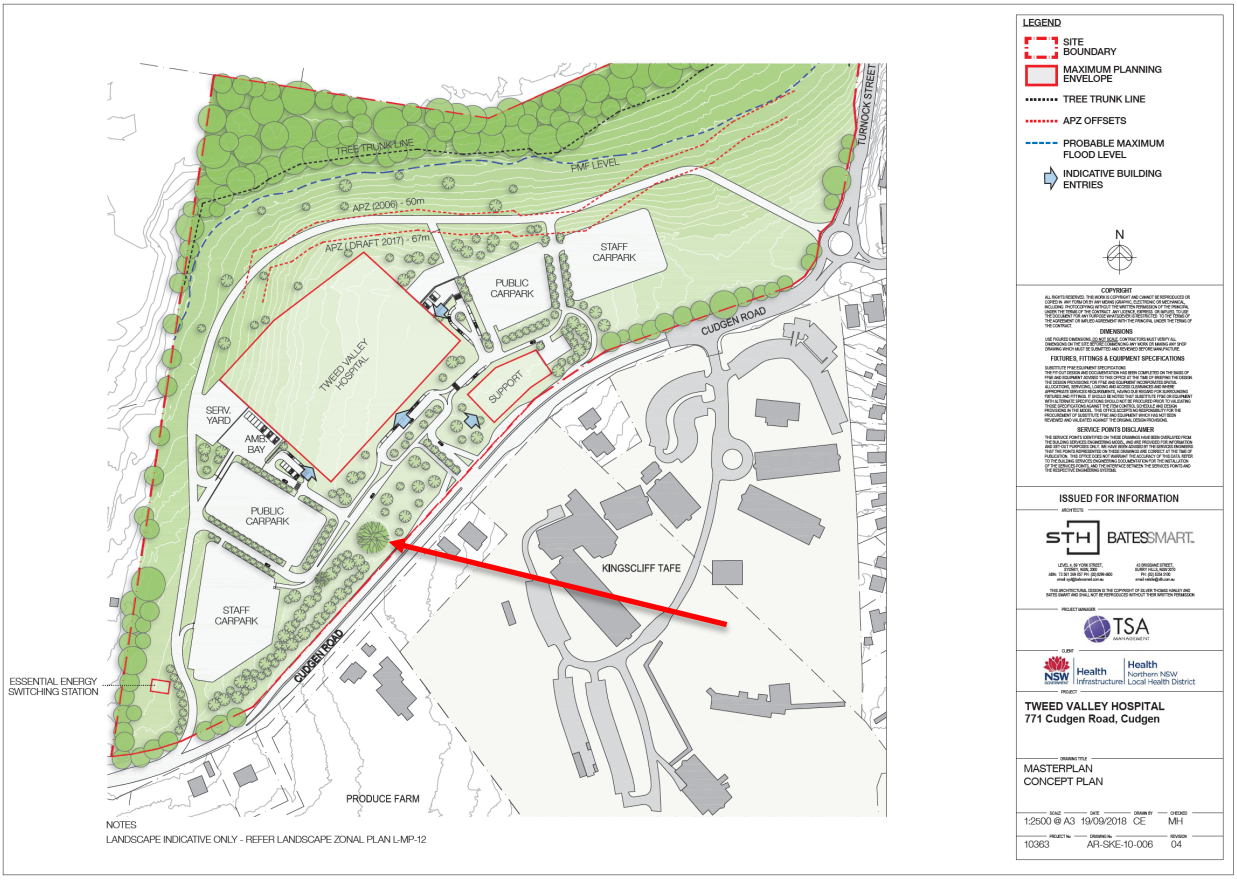


Figure 3. Masterplan Concept sketch (19/9/2018) of the proposed Tweed Valley Hospital layout at 771 Cudgen Road, Kingscliff. The location of Tree 4 is identified by a red arrow. Source: Provided by TSA Management, 16 Oct 2018

4.2 Site Details

4.2.1 The subject site is currently zoned as primary production land and is partially utilised as a commercial market garden and associated farmland.

4.2.2 Cudgen Road forms the southern boundary of the site, with Turnock Street along the eastern boundary and adjacent farmland and bushland located to the west and north. The Kingscliff TAFE is located on the opposite side of Cudgen Road, and occupies the majority of the site to the south of the proposed hospital development. Residential housing is located on the opposite side of Turnock Street to the east of the site.

4.2.3 The land bordering Cudgen Road was relatively level and is the area proposed for the Hospital development. Adjacent the level area the land sloped down towards an area of low-lying, bush covered wetland in the north of the site.

4.2.4 An existing house, and associated farm sheds, were located adjacent to Cudgen Road along the site's southern boundary. The four (4) individual site trees subject to this report are located adjacent to the existing property as represented in Figure 4.

4.2.5 The soil profile was assumed to be typical of an intensive market garden / agricultural cropping operation, in that the usable land has been previously cleared, additional fill would not have been added, soil fertility would likely deviate from its natural state following fertiliser applications and site topography would be uniform following extensive tillage.

4.3 Heritage/Significance Status

4.3.1 The subject trees were not identified as trees of significance or of significant heritage value following a search of the Local Tweed Shire Council or Office of Environment and Heritage websites.

4.3.2 The four (4) individual subject trees represent species which are considered common to the local area, and although established, are not considered of special species significance.

4.4 Site Trees

4.4.1 A total of four (4) individual trees and one hundred and fifty plus (150+) wind break trees were inspected and are the subject of this report. Complete attributes for each individual tree and a broad overview of the remaining windbreak trees can be found in Appendix C – Preliminary Tree Assessment Data.

4.4.2 Trees to be included within the report were detailed by the client in an onsite meeting on 20 July 2018. No trees beyond the scope outlined by the client were inspected as part of this report.

4.4.3 The individual subject trees were identified within the surveyed drawings and consist of the more prominent trees situated within or adjacent to the existing house site. The additional one hundred and fifty plus (150+) trees identified in this report acted as a wind break and are arranged in a linear row along the entire Cudgen Road boundary. The wind break row consisted of a mixture of planted exotic pine species and self-propagated local tree species.

4.4.4 The four (4) individual subject trees can be identified on site using small green numbered tree tags, which are typically located at approximately 2.0m from ground level on the southern side of the trunk.

4.4.5 The row of wind break trees ran along the boundary between Cudgen Road and the listed property and consist of approximately one hundred and fifty plus (150+) mature *Pinus elliottii* (Slash Pine), planted at approximate 3–4m spacings, interspersed with semi-mature, naturally regenerating trees of mixed species endemic to the area.

4.4.6 The naturally regenerating/self-sown trees observed along the wind break row consisted of three predominant species, these being *Cupaniopsis anacardioides* (Tuckeroo), *Macaranga tanarius* (Macaranga) and Schefflera actinophylla (Umbrella Tree). These naturally regenerating / self-sown trees were typically smaller in stature, under 5m, semi-mature and of a suppressed growth habit due to their location under the existing pine canopy.

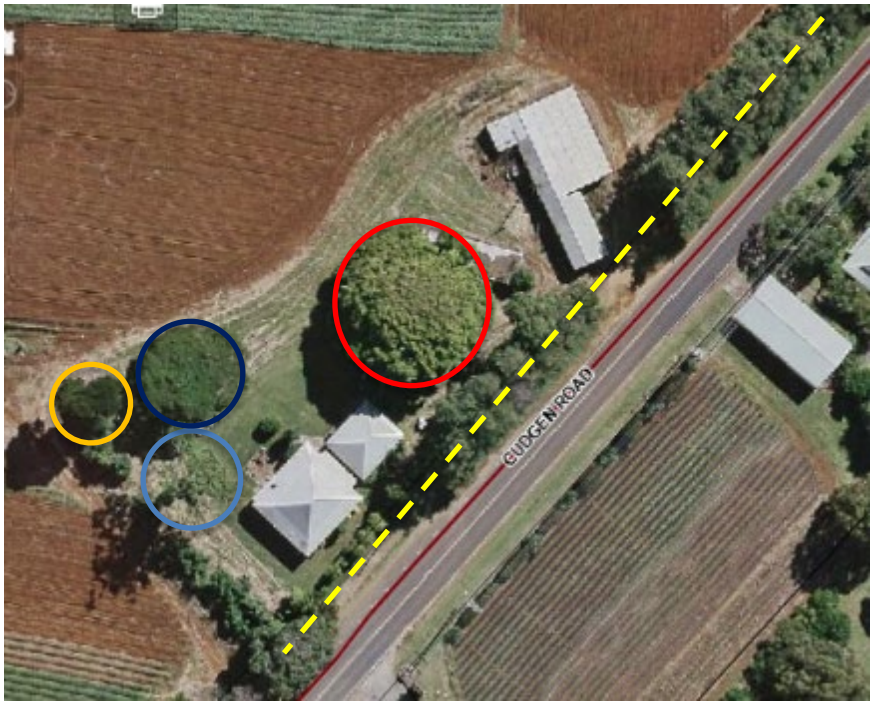


Figure 4. The location of the four (4) individual site trees around the existing house site and the line of windbreak trees. Tree 1 – light blue circle, Tree 2 – orange circle, Tree 3 – purple circle, Tree 4 – red circle, Windbreak and regenerating trees – yellow dash line. Source: Image obtained from Tweed Shire Council LEP mapping tool, August 2018. Coloured circles and lines placed by the author.

5 Tree Retention Values

5.1 Determining Tree Retention Values

5.1.1 Tree Retention Value has been determined based on a combination of tree attributes. Tree retention value is categorised as per the British Standard BS 5837–2012: *Trees in Relation to Design, Demolition and Construction*. Attribute considered when determining the retention value include tree health, structure and form, life expectancy, suitability of the tree in the context of local landscape. Arboricultural, Cultural, Environmental and Heritage significance are all also considered within the subcategories identified.

5.1.2 Collectively tree attributes are reviewed and used to categorise tree value in a development context. Additional information explaining Tree Retention Value can be found in Appendix B – Explanation of Tree Assessment Terms.

5.2 Category A Trees (High Retention Value)

5.2.1 One (1) tree was determined to be a Category A Tree. Typically trees in this category are of high quality with an estimated remaining life expectancy of at least 25 years and of dimensions and prominence that it cannot be readily replaced in <20 years. The tree may make significant amenity contributions to the landscape and may make high environmental contributions. In some cases trees within this category may not meet the above criteria, however possess significant heritage or ecological value. Trees of this retention value warrant design consideration and amendment to ensure their viable retention.

5.2.2 The one (1) Category A Tree was tree number 4.

Figure 5. Aerial image showing the location of High Retention Value Trees. Tree attributes are to be obtained from the Appendix C – Preliminary Tree Assessment Data. Source: image obtained from Tweed Shire Council LEP mapping tool, August 2018. Coloured circle placed by the author

5.2.3 Tree 4 was a *Ficus benjamina* (Weeping Fig). The tree was located adjacent to Cudgen road, immediately east of the existing house structure. The tree was large and well established for its species and formed a significant feature within the landscape (see Figure 6).

5.2.4 Tree 4 was of good health and fair structure and had an estimated life expectancy of greater than 25 years (25–50 years). The lower trunk structure was a mass of competing stems typical of the species (see Figure 7).

5.2.5 The TPZ for Tree 4 is 15m, and the SRZ is 3.9m, measured at a radial distance from the centre of the trunk.

Figure 6. View to south of Tree 4 *Ficus benjamina* (Weeping Fig) in its growing environment. Source: Andrew Clark, 20 July 2018

Figure 7. View of the lower trunk structure of Tree 4 *Ficus benjamina* (Weeping Fig). Source: Andrew Clark, 20 July 2018

5.3 Category B Trees (Moderate Retention Value)

5.3.1 Three (3) trees were considered to have Moderate Retention Values. Typically trees in this category are of moderate quality with an estimated remaining life expectancy of 15–25 years and prominence of size dimensions that cannot be readily replaced within ten years. They may make moderate amenity contributions to the landscape and make low/moderate environmental contributions. Trees with this retention value warrant minor design consideration in an attempt to allow for their retention.

5.3.2 Category B Trees were numbered; 1, 2 & 3 (see Figure 8).

Figure 8. Aerial image showing location of three (3) Moderate Retention Value Trees. Tree 1 – light blue circle, Tree 2 – orange circle, Tree 3 – purple circle. Tree attributes are to be obtained from the Appendix C – Preliminary Tree Assessment Data.
Source: image obtained from Tweed Shire Council LEP mapping tool, August 2018. Coloured circles placed by the author

5.3.3 Tree 1 was a *Ficus obliqua* (Small Leafed Fig). The tree was considered to be in good health with a fair structure. The tree canopy had a significantly crown bias to the east, attributed to suppression from an adjacent, previously removed tree, which detracted from its overall visual / aesthetic appearance (see Figure 9).

5.3.4 The tree had established over and around a decaying stump, from the previously removed tree, causing cavities and uneven growth with the basal area and structural roots. Overall structural stability was not considered to be compromised, at the time of inspection, and root growth of this kind was considered typical of the species. A large European bees' nest was observed within the basal hollows of the tree.

5.3.5 The TPZ for Tree 1 is 12m, and the SRZ is 4.4m, measured at a radial distance from the centre of the trunk.

Figure 9. View to south of Tree 1 *Ficus obliqua* (Small Leafed Fig) in its growing environment. Source: Andrew Clark, 20 July 2018

5.3.6 Tree 2 was a *Cupaniopsis anacardioides* (Tuckeroo). The tree was of a large size for the species and considered in good health with a fair structure. The tree canopy had a significantly crown bias to the north east, attributed to suppression from an adjacent previously removed tree, which detracted from its overall visual / aesthetic appearance (see Figures 10 and 11). Several wounds from previous lateral branch failures were observed within the crown.

5.3.7 The TPZ for Tree 2 is 7.2m, and the SRZ is 2.8m, measured at a radial distance from the centre of the trunk.

Figure 10. View to south of Tree 2 Cupaniopsis anacardioides (Tuckeroo) in its growing environment. Source: Andrew Clark, 20 July 2018

Figure 11. View to west of Tree 2 Cupaniopsis anacardioides (Tuckeroo) in its growing environment. Source: Andrew Clark, 20 July 2018

5.3.8 Tree 3 was a *Delonix regia* (Poinciana). The tree was of a moderate height for the species and was in good health with a fair structure. Several included unions between co-dominant stems were observed. Although these unions were considered stable at the time of assessment they could detract from the tree's long-term structural stability.

5.3.9 The TPZ for Tree 3 is 9.4m, and the SRZ is 3.4m, measured at a radial distance from the centre of the trunk.

Figure 12. View to west of Tree 3, *Delonix regia* (Poinciana) in its growing environment. Source: Andrew Clark, 20 July 2018

5.4 Category C Trees (Low Retention Value)

5.4.1 The wind break / hedge trees described in Section 4.4.5 of this report, including the various associated regenerating / understory trees, were considered Category C Trees. Trees in this category are typically of low quality with an estimated remaining life expectancy of 5–15 years, or young trees that are easily replaceable, may have poor health and/or structure, are easily replaceable, or are of undesirable species and do not warrant design consideration.

5.4.2 Category C trees are identified as wind break and regenerating trees within Appendix C of this report.

Figure 13. Aerial image showing location of Low Retention Value wind break and regenerating trees. The tree locations are identified by the yellow dash line. Source: image obtained from Tweed Shire Council LEP mapping tool, August 2018. Line placed by the author

5.4.3 The line of wind break trees on the boundary of Cudgen Road were identified as *Pinus elliottii* (Slash Pine), of which there were over 150 individual trees (estimated), planted at 3-4m spacings. The DBH of the larger trees was observed to be approximately 40cm (at 1.4m above ground level) with estimated heights of between 15–20m.

5.4.4 *Pinus elliottii* (Slash Pine) is regarded as an environmental weed in Queensland and New South Wales (BCC website – 2018) with a variety of control recommendations.

5.4.5 The trees provide some screen value between the site and neighbouring properties, however ease of growth (possible weedy tendencies), limited ULE and species type resulted in a classification of Low Retention Value.

5.4.6 The average TPZ for the *Pinus elliottii* (Slash Pine) was 4.8m, measured at a radial distance from the centre trunk.

Figure 14. View to the east of the line of Pinus elliottii (Slash Pine), and the regenerating trees under the canopy. Source: Andrew Clark, 20 July 2018

5.4.7 The naturally regenerating understory trees consisted mainly of three native species, namely *Cupaniopsis anacardioides* (Tuckeroo), *Macaranga tanarius* (Macaranga) and *Schefflera actinophylla* (Umbrella Tree). The trees were typically suppressed, semi-mature specimens, with a DBH in the range of 10–20cm and tree heights of between 5–10m.

5.4.8 *Cupaniopsis anacardioides* (Tuckeroo) – A small to medium sized tree found in littoral rainforests and in scrub along the coast and near estuaries (source: PlantNET website). A commonly planted amenity tree.

5.4.9 *Macaranga tanarius* (Macaranga) – Shrub or small tree commonly found as a pioneer species in disturbed sites or rainforest areas along the coast (source: PlantNET website).

5.4.10 *Schefflera actinophylla* (Umbrella Tree) – A multi-stemmed, fast growing species native to north Queensland attaining a height of 5–10m (source: PlantNET website). The species is sometimes regarded as a weed in some parts of the eastern states.

5.4.11 The trees provided some screen value between the site and neighbouring properties, however age, size, health and structure, ease of growth and species type resulted in a Low Retention Value.

5.4.12 The average TPZ for the regenerating trees is 2m, measured at a radial distance from the centre trunk.

Figure 15. A closer view of the line of regenerating trees growing under the *Pinus elliottii* (Slash Pine). Source: Andrew Clark, 20 July 2018

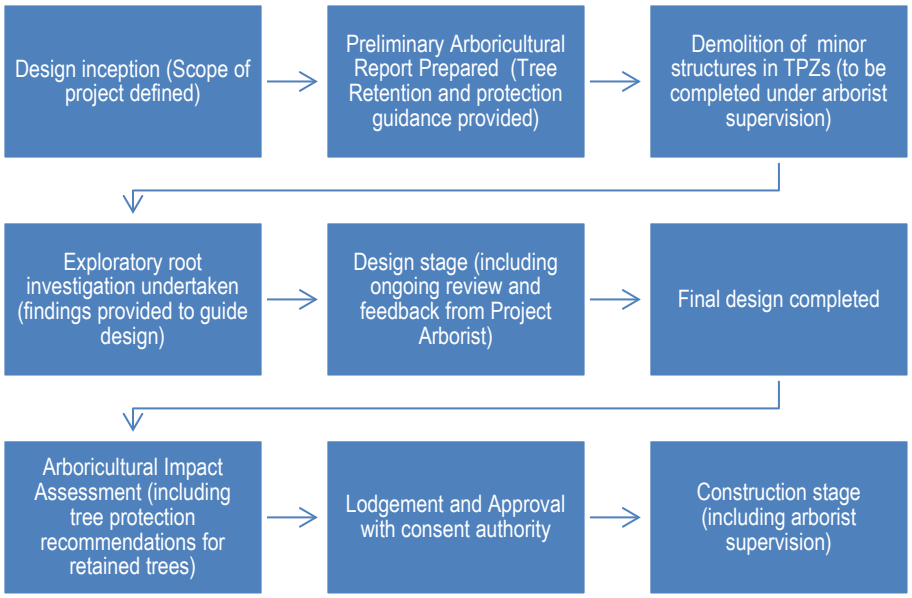
5.5 Category U Trees (Unsuitable for Retention)

5.5.1 Zero (0) trees were found to be in such a condition that they cannot realistically be retained as viable trees in the context of the current land use for longer than five years. These trees may be dead and/or of a species recognised as a weed that resulted in them being unretainable. These trees should be removed irrespective of any future development on the site.

6 Discussion

6.1 Project timelines

6.1.1 It is important to ensure that trees worthy of retention (i.e. Category A Trees and where possible Category B Trees) are considered throughout the design and construction stage. The following timeline is based upon guidance provided within the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites* with specific consideration to this project to identify appropriate involvement from the Project Arborist.



6.1.2 Note that only Draft or Concept Plans have been reviewed as part of this report. The project is therefore determined to be at the Design Inception stage.

6.2 Project design

6.2.1 Due to the limited space available for the proposed construction and the size (radial) of the TPZ's of High and Moderate Retention Value trees, it is anticipated that works will be required within TPZ's to ensure the project is viable.

6.2.2 When considering TPZs at the design stage, it important to consider arboricultural best practice as to the permissible extent of encroachment that allows for the viable tree retention of significant site trees.

6.2.3 An encroachment of up to 10% of the TPZ area is deemed a minor encroachment by the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites.* If the proposed encroachment is less than 10% of the area of the TPZ and is outside the Structural Root Zone (SRZ), detailed root investigations should not be required.

6.2.4 An encroachment of more than 10% of the TPZ area is deemed a major encroachment by the AS 4970–2009: *Protection of trees on building sites.* If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ the project arborist (an assigned AQF Level 5 Arborist) must demonstrate that the trees would remain viable post construction.

6.2.5 Arborist consultation throughout the design stage will allow effective, constructive guidance to be provided throughout the process. This will ensure that the final design has fully considered the potential impacts to site trees prior to the commencement of the Arboricultural Impact Assessment.

6.2.6 Based on the recently released draft 'Concept Landscape Zonal Plan' (Figure 16) the removal of a number of individual subject trees, along with sections of the existing roadside windbreak trees, was considered likely due to major encroachments potentially occurring during the proposed road construction works. This presumption was supported by a review the draft 'Tree Removal and Preservation Plan' (Figure 17).

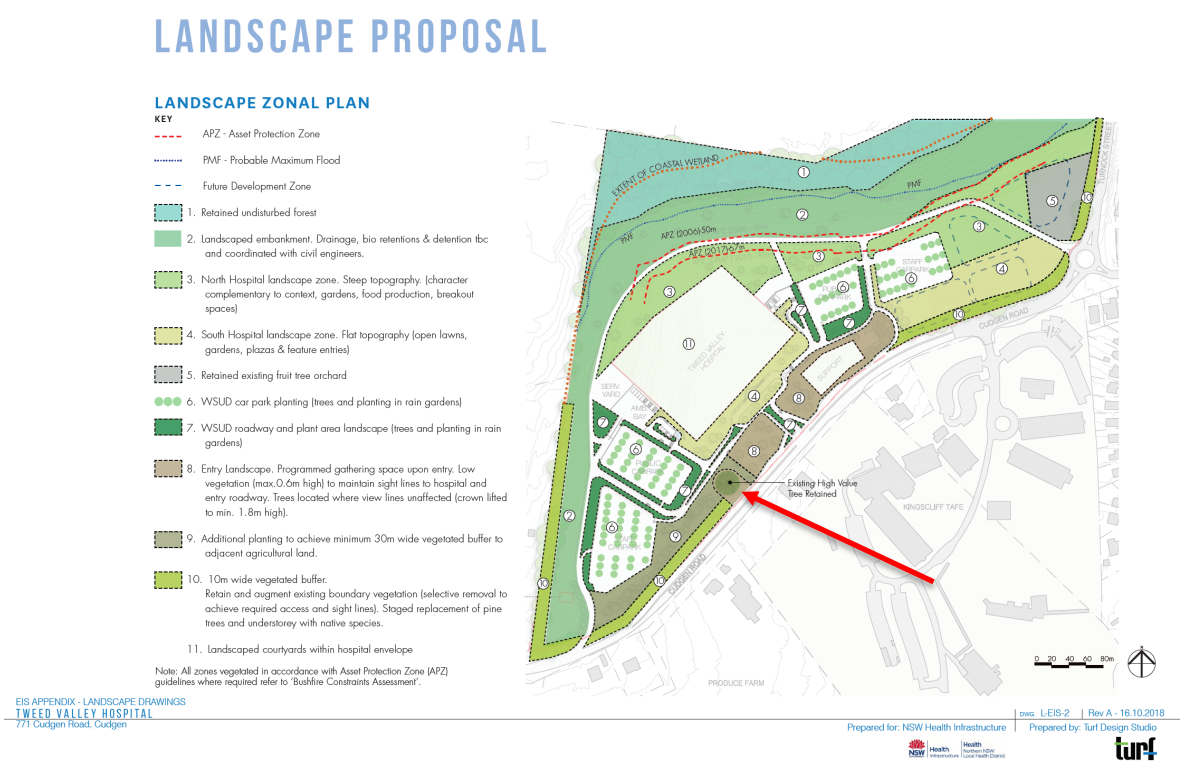


Figure 16. Concept Zonal Landscape Plan. The location of Tree 4 is identified with a red arrow.
Source: Provided by TSA Management, 16 October 2018

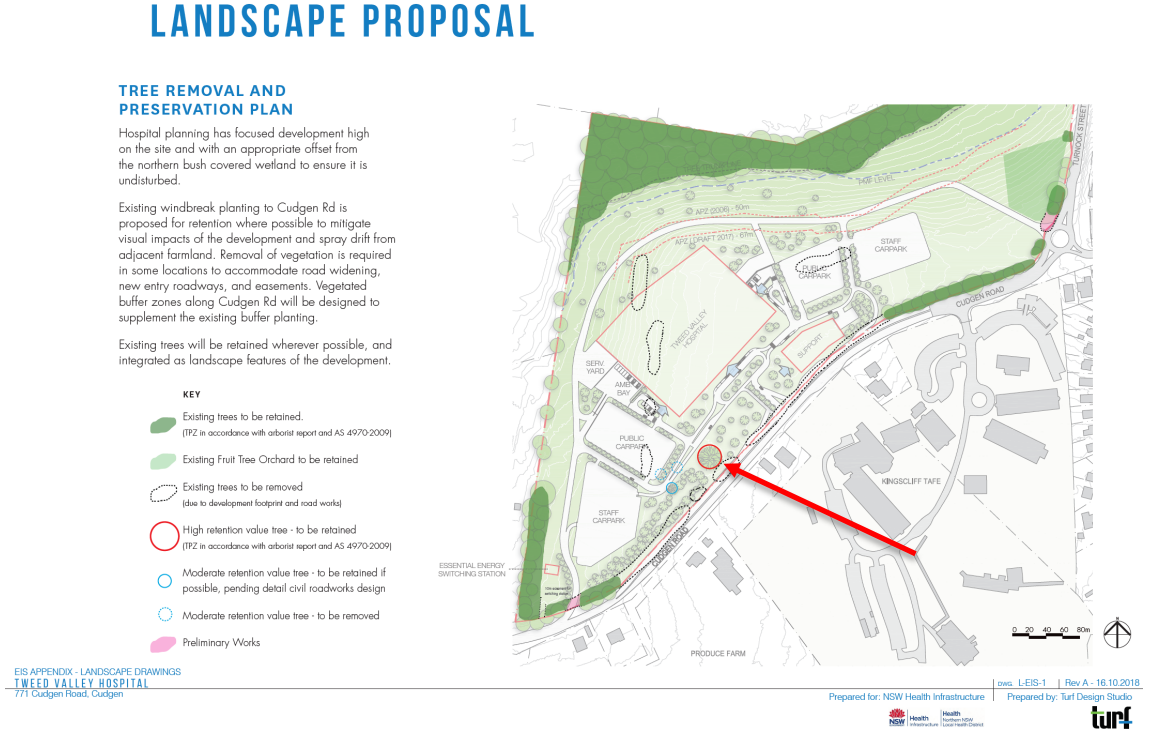


Figure 17. Concept 'Tree Removal and Preservation Plan'. The location of Tree 4 is identified with a red arrow.
Source: Provided by TSA Management, 16 October 2018

6.3 Existing Building Footprint

6.3.1 The existing farm house is located within the centre of the four subject trees identified in this report. It is anticipated that there will be minimal root activity beneath the existing building footprint due to the distance of the structure from the subject trees. Smaller outbuildings (sheds) are likely to have root development below and / or adjacent, particularly originating from Tree 4. Potential root activity should be considered at the design stage, by referring to individual tree TPZ's, and during any subsequent site demolition.

6.4 Cudgen Road Windbreak – Transitioning to Native Species

6.4.1 The *Pinus elliottii* (Slash Pine), growing along Cudgen Road, were considered inappropriate species for long-term retention, although the trees current amenity and screening value was acknowledged. The existing regenerating, understory trees were considered more appropriate species for long-term retention but displayed varying qualities in relation to tree health and structure due to suppression. Three methodologies are outlined below which could be utilised to reform the windbreak/buffer row.

6.4.2 Block removal – The Slash Pine are removed in staggered blocks (e.g. 30m sections) over a number of years. All pine trees within a designated block would be removed whilst retaining the best of the regenerating trees as identified in Section 5.4.7. to be supplemented with additional planting throughout the remaining area / buffer zone.

6.4.3 Thinning – Select appropriate regenerating trees (good health and structure) which would be suitable for retention and remove the surrounding Slash Pines to improve growing space and reduce competition. This will ultimately improve future structure and ULE. Remove additional pines as the regenerating trees improve and additional buffer plantings establish.

6.4.4 Buffer planting – Retain all existing windbreak and regenerating trees and plant out along the northern side of the row with desirable species. Remove all pines once the new plantings had established to the required height and density. The desired outcomes from this method could be accelerated by planting and maintaining the buffer planting during the construction phase.

6.5 Demolition

6.5.1 Demolition of existing structures within the site will be required to facilitate the project. All demolition within the TPZ's of trees to be retained would need to be supervised by the Project Arborist. Demolition at an early stage in the development would allow root investigation to be undertaken which could be used to guide the design process.

6.6 Exploratory Root Investigation

6.6.1 Root location (mapping) is important in determining how and where any proposed structures or roads and carparks can be constructed. It is likely that significant roots are located within the areas proposed for development and thus if works are to proceed that would be considered a major encroachment (>10% of TPZ area) under the Australian Standard AS 4970–2009 then identification and recording of these roots would be required.

6.6.2 Exploratory root investigation should be carried out in a manner conducive to root retention and protection. This may include the use of air excavation (Air spade) and or hydro excavation (water jet and hydro vac etc.). Root investigation should be undertaken at pre-agreed locations that will most effectively guide future design. These may be at set offsets from the trunk of the tree in a radial pattern.

6.6.3 In the event that it is necessary to "root map" the proposed excavation line to ascertain the effects of any TPZ encroachment. Common methods for root mapping include:

1. Exploratory excavation by hand.
2. Exploratory excavation using a high pressure water jet and vacuum truck.
3. Exploratory excavation using an Air Spade with vacuum truck.
4. Ground Penetrating Radar*

(* Due to the high likelihood of foreign material in the soil profile, ground penetrating radar may not provide accurate results and exploratory excavation is the preferred option.)

6.6.4 Findings from the root investigation should be compiled into a comprehensive report which identifies and documents significant roots to be retained and less significant roots that may be appropriate for severance. This information is important to qualify an area as suitable for development during the design process.

6.6.5 No underground service plans were provided in the preparation of this report.

7 Recommendations

7.1 Site Survey

7.1.1 The subject trees identified within this report should be incorporated into the current / subsequent site survey(s) (including revisions) and are to be referenced using the numbering convention provided.

7.1.2 Trunk location and size, crown spread in a north, south, east and west orientation should be clearly depicted on the site survey. Crown height (i.e. distance between the ground and lowest lateral branches) should also be displayed for High Retention Value trees.

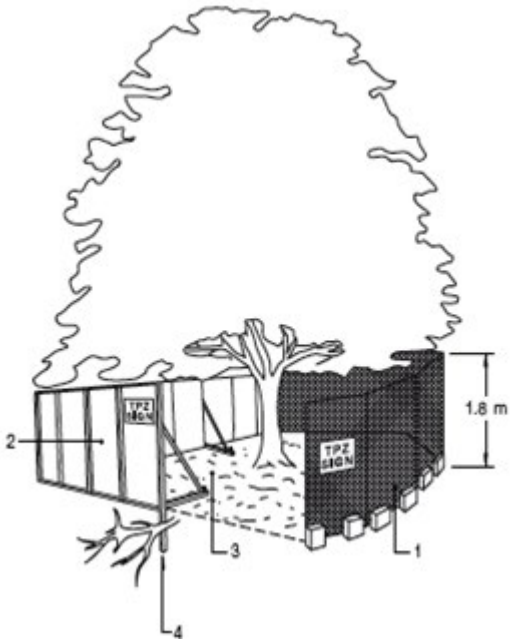
7.1.3 The TPZ's of all retainable trees (Category A, B and C) should be displayed accurately on the site survey and subsequent plans relating to the development using the distances and tree numbers contained in this report – Appendix C.

7.2 Demolition

7.2.1 Trees identified for removal during the planning phase should be removed during the pre-project enabling works and prior to the start of the construction phase. Tree removal must only be undertaken with the prior approval of the relevant consent authorities.

7.2.2 Protective fencing is to be installed as far as practicable from the trunk of any tree(s) to be retained prior to the demolition of existing structures to avoid potential root compaction and mechanical damage to the roots retained trees. Fencing should be installed as per the image below before any machinery or materials are brought to site and before commencement of works (including demolition).

7.2.3 Once installed, protective fencing must not be removed or altered without approval from the Project Arborist. The TPZ fencing should be secured to restrict access. Tree Protection Zone fencing is to be a minimum of 1.8m high and mesh or wire between posts must be highly visible. Fence posts and supports should have a diameter greater than 20mm and should ideally be freestanding, otherwise be located clear of the roots.



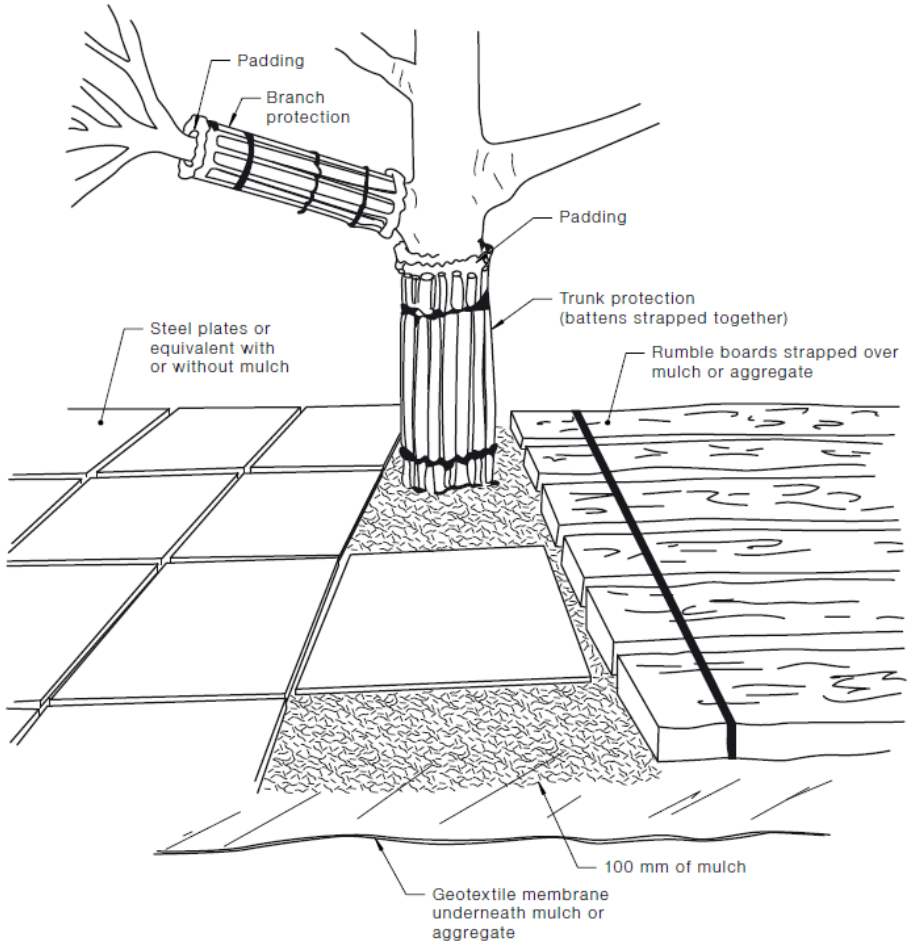
Legend:

1. Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.
2. Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the TPZ.
3. Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

Figure 18. Depicts standard fencing techniques. Source AS 4970–2009

7.2.4 Where demolition access into the TPZ of trees cannot be avoided, the root zone of each tree must be protected using either steel plates or rumble board strapped over mulch/aggregate until such a time as permanent above ground surfacing (cellular confinement system or similar) is to be installed.

7.2.5 Trunk protection must also be installed. Trunk and ground protection should be undertaken in line with AS 4790–2009 as per the image below and installed prior to the commencement of works and remain in place until after construction works have been completed.



Notes:

1. For trunk and branch protection use boards and padding that will prevent damage to bark. Boards are to be strapped to trees, not nailed or screwed.
2. Rumble boards should be of a suitable thickness to prevent soil compaction and root damage.

Figure 19: Depicts trunk and ground protection techniques. Source AS 4970–2009

7.3 Underground Services

7.3.1 An investigation as to the location, condition and size of underground services should also be undertaken and plotted on drawings. Any utility that needs replacement or upgrading, which is located within the TPZ of a tree appropriate for retention should be identified at the design stage. Non-destructive service installation methodologies maybe required.

7.4 Building Design

7.4.1 The design stage should allow for consultation with the Project Arborist. The Project Arborist should be used to provide feedback and guidance as to the effects of the proposed design upon the site's tree population.

7.4.2 Sensitive construction methods may be permissible within the TPZ's marked for retention. Tree sensitive construction measures such as pier and beam, suspended slabs, cantilevered building sections, screw piles and contiguous piling can minimize the impact on the root zones of trees marked for retention. The Project Arborist will be able to provide feedback upon these approaches and advise as to their viability in relation to tree retention.

7.5 Prepare an Arboricultural Impact Assessment

7.5.1 Once designs are finalised, an Arboricultural Impact Assessment (AIA) should be prepared to detail the impacts of the development on the site's tree population, on an individual tree basis. The Arboricultural Impact Assessment should provide information on tree removal and retention as well as specific guidance, on an individual trees basis, as to required protection / remediation measures.

8 References

- Standards Australia AS 4970–2009: *Protection of Trees on Development Sites*, Standards Australia, G.P.O. Box 476, Sydney, New South Wales, 2001
- Brisbane City Council (BCC), Website – Weeds register
- NSW Government Office of Environment and Heritage, 2015, Website
- British Standard BS 5837–2012: *Trees in Relation to Design, Demolition and Construction*
- B & P Surveys, Level & Detail Survey, Drawing 22633B, Sheet 3 & 4, dated 15 June 2018.

9 Appendices

9.1 Appendix A – Arboricultural Reporting Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. Any titles and ownership of any property are assumed to be good. No responsibility is assumed for matters legal in character.
2. It is assumed that any property/project is not in violation of any applicable codes, ordinances, statutes or other government regulations.
3. Care has been taken to obtain all information from reliable sources. All data has been verified in so far as possible, however, the consultant can neither guarantee nor be responsible for the accuracy of the information provided by others.
4. The consultant shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services.
5. Loss or alteration of any part of this report invalidates the entire report.
6. Possession of this report or a copy thereof does not imply right of publication or use for any purpose by anyone but the person to whom it is addressed, without the prior written consent of the consultant.
7. Neither all nor any part of the contents of this report, nor any copy thereof, shall be used for any purpose by anyone but the person to whom it is addressed, without the written consent of the consultant. Nor shall it be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the written consent of the consultant.
8. This report and any values expressed herein represent the opinion of the consultant and the consultant's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.
9. Sketches, diagrams, graphs and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys unless expressed otherwise.
10. Information contained in this report covers only those items that were examined and reflect the condition of those items at the time of inspection.
11. Inspection is limited to visual examination of accessible components without dissection, excavation or probing. There is no warranty or guarantee expressed or implied that the problems or deficiencies of the plants or property in question may not arise in the future.

9.2 Appendix B – Explanation of Tree Assessment Terms

Tree name: Provides the botanic name, (Genus, species, sub-species, variety and cultivar where applicable) in accordance with the International Code of Botanical Nomenclature (ICBN), and an accepted common name.

Age: Refers to the life cycle of the tree

Category	Description
Young	Newly planted tree not fully established may be capable of being transplanted or easily replaced.
Juvenile	Tree is small in terms of its potential physical size and has not reached its full reproductive ability.
Semi-mature	Tree in active growth phase of life cycle and has not yet attained an expected maximum physical size for its species and/or its location.
Mature	Tree has reached an expected maximum physical size for the species and/or location and is showing a reduction in the rate of seasonal extension growth.
Senescent	Tree is approaching the end of its life cycle and is exhibiting a reduction in vigour often evidenced by natural deterioration in health and structure.

Health: Summarises the health and vigour of the tree

Category	Description
Excellent	Canopy full with dense foliage coverage throughout, leaves are entire and are of an excellent size and colour for the species with no visible pathogen damage. Excellent growth indicators, e.g. seasonal extension growth.
Good	Canopy full with minor variations in foliage density throughout, leaves are entire and are of good size and colour for the species with minimal or no visible pathogen damage. Good growth indicators.
Fair	Canopy with moderate variations in foliage density throughout, leaves not entire with reduced size and/or atypical in colour, moderate pathogen damage. Reduced growth indicators, visible amounts of deadwood/dieback, and epicormic growth.
Poor	Canopy density significantly reduced throughout, leaves are not entire, are significantly reduced in size and/or are discoloured, significant pathogen damage. Significant amounts of deadwood and/or epicormic growth, noticeable dieback of branch tips, possibly extensive.
Dead	No live plant material observed throughout the canopy, bark may be visibly delaminating from the trunk and/or branches.

ArborSafe Structure Descriptors

Structure: Summarises the structure of the tree from roots to crown

Category	Description
Good	Good form and branching habit. Minor structural defects that are insignificant and typical or common within the species. e.g. included bark, co-dominant stems. No fungal pathogens present. No visible wounds to the trunk and/or root plate.
Fair	Moderate structural defects present that impact longevity e.g. apical leaders sharing common union(s). Minor damage to structural roots. Small wounds present where decay could begin. No fungal pathogens present. A fair representation of the species.
Poor	Significant structural defects present that have a significant impact on longevity and result in a poor representation of the species e.g. Branch/stems with included bark with failure likely within 0–5 years. Wounding evident with cavities and/or decay present. Damage to structural roots.
Hazardous	Serious structural defects with failure determined to be imminent (<12 months). Defects may include active splits and/or partial branch or root plate failures. Tree requires immediate arboricultural works to alleviate the associated risk.

Useful Life Expectancy (ULE): Useful Life Expectancy refers to an expected period of time the tree can be retained within the landscape before its amenity value declines to a point where it may detract from the appearance of the landscape and/or becomes potentially hazardous to people and/or property. ULE values consider tree species, current age, health, structure and location. ULE values are based on the tree at the time of assessment and do not consider future changes to the tree's location and environment which may influence the ULE value.

Category:
0–5 Years
5–10 Years
10–20 Years
20–30 Years
30–50 Years
>50 Years

Tree Retention Value: (based upon BS 5837–2012: *Trees in relation to design, demolition and construction* – recommendations)

Category and definition	Criteria (including sub-categories where appropriate)		
Category U			
Trees in such a condition that they cannot realistically be retained as viable trees in the context of the current land use for longer than 5 years.	• Trees that have a severe structural defect that are not remediable such that their failure is expected within 12 months. • Trees that will become unviable after removal of other Category U trees (e.g. where for whatever reason the loss of companion shelter cannot be mitigated by pruning). • Trees that are dead or are showing signs of significant, immediate and irreversible overall decline. • Trees infected with pathogens of significance to the health and or safety of other trees nearby • Low quality trees suppressing adjacent trees of better quality. • Noxious weeds or species categorised as weeds within the local area. Note: Category U trees can have existing or potential conservation value* which might make it desirable to preserve.		
	1. Arboricultural Qualities	**2. Landscape qualities**	**3. Cultural and environmental values**
Category A			
Trees of High Quality with an estimated remaining life expectancy of at least 25 years and of dimensions and prominence that it cannot be readily replaced in <20 years.	Trees that are particularly good examples of their species, especially if rare or unusual (in the wild or under cultivation); or those that are important components of groups or avenues.	Trees or groups of significant visual importance as arboricultural and/or landscape features. (e.g. feature and landmark trees).	Trees, groups or plant communities of significant conservation, historical, commemorative or other value (e.g. remnant trees, aboriginal scar trees, critically endangered plant communities, trees listed specifically within a Heritage statement of significance).
Category B			
Trees of Moderate Quality with an estimated remaining life expectancy of 15–25 years and of dimensions and prominence that cannot be readily replaced within 10 years.	Trees that might be included within Category A but are downgraded because of diminished condition such that they are unlikely to be suitable for retention beyond 25 years.	Trees that are visible from surrounding properties and/or the street but make little visual contribution to the wider locality.	Trees with conservation or other cultural value (trees within conservation areas or landscapes described within a statement of significance, locally indigenous species).
Category C			
Trees of Low Quality with an estimated remaining life expectancy of 5–15 years, or young trees that are easily replaceable.	Trees of very limited value or such impaired condition that they do not qualify in higher categories.	Trees offering low or only temporary/transient landscape benefits.	Trees with no material conservation or other cultural value.

*Where trees would otherwise be categorised as U, B or C but have significant identifiable conservation, heritage or landscape value even though only for the short term, they may be upgraded, although they might be suitable for retention only.

Tree Quality

		Health**			
		Excellent/ Good	Fair	Poor	Dead
Structure	Good	A	B	C	U
	Fair	B	B	C	U
	Poor	C	C	U	U
	Hazard*	U	U	U	U

*Structural hazard that cannot be remediated through mitigation works to enable safe retention.

** Trees of short term reduced health that can be remediated via basic, low cost plant health care works (e.g. mulching, irrigation etc.) may be designated in a higher health rating to ensure correct retention value nomination.

9.3 Appendix C – Preliminary Tree Assessment Data

Tree no.	*Botanical Name*	Common Name	Trees in group	DBH Total (cm)	DRB (cm)	Radial TPZ (m)	TPZ area (m2)	Radial SRZ (m)	Tree Height (m)	Canopy (m)	Health	Structure	Age	TLE (Yrs.)	Defects	Significance	Arborist comments	Tree Quality Score	Tree Retention value subcategory
1	*Ficus obliqua*	Small Leafed Fig	1	100	200	**12.0**	452.39	**4.4**	15-20	10-15	Good	Fair	Mature	15-25	Decay, suppression, excessive end weight, previous failure, cavities			B	1
2	*Cupaniopsis anacardiodes*	Tuckeroo	1	60	65	**7.2**	162.86	**2.8**	10-15	5-10	Good	Fair	Mature	15-25	Co-dom stems, wounds, previous failure,			B	1
3	*Delonix regia*	Poinciana	1	78	110	**9.4**	277.09	**3.4**	5-10	15-20	Good	Fair	Mature	15-25	included union			B	1
4	*Ficus benjamina*	Weeping Fig	1	140	150	**15.0**	706.86	**3.9**	10-15	20-30	Good	Fair	Mature	25-50	included union, crossing branches			A	1
Windbreak Trees	*Pinus elliotti*	Slash Pine	150+	40	45	**4.8**	72.38	**2.4**	15-20	10-15	Good	Fair	Mature	15-25	Co-dom stems, small dead branches, previous failures, wounds, die-back, poor pruning			C	
Various Regenerating Species	*Cupaniopsis anacardioides (Tuckeroo), Macaranga tanarius* (Macaranga), Schefflera actinophylla (Umbrella Tree).	Tuckeroo, Macaranga, Umbrella Tree	150+	15	20	**2.0**	12.57	**1.7**	5-10	5-10	Good	Fair	Semi-mature	15-25	Co-dom stems, suppressed, small dead branches, previous failures, wounds, die-back, poor pruning			C	