ArborSafe

Ark Hospitality Group
Bassendean Hotel Development
Old Perth Road, Bassendean WA
Arboricultural Impact Assessment

3 December 2020

Assessment and Report prepared by:

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Mr Adam Kapinkoff
General Manager
Ark Hospitality Group
Level 1, 66 King Street
Perth WA 6000

Arboricultural Impact Assessment Report regarding nine (9) trees located within the vicinity of the proposed development at the Bassendean Hotel, Old Perth Road, Bassendean

Dear Adam,

We are pleased to provide you with the following Arboricultural Impact Assessment Report for nine (9) trees within the grounds of the Bassendean Hotel.

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,

Nick Arnold
Consulting Arborist
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ArborSafe
TREE CONSULTANCY AND MANAGEMENT SYSTEMS

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1 Executive Summary

1.1.1 The following Arboricultural Impact Assessment (Report) covers nine (9) trees located within the grounds of Bassendean Hotel. The subject site was identified by *Ark Hospitality Group* (the Client) as possessing trees that may be impacted upon by a proposed development.

1.1.2 In part, the project scope was to nominate subject trees that can be retained, or require removal to facilitate the proposed development (in the context of plans supplied), as well as to identify and reduce potential conflicts between subject trees and site development. Accurate information on the area required for tree retention and methods/techniques suitable for tree protection during construction have been provided.

1.1.3 Tree retention values have been determined based upon a modified version of the British Standard and which have been prescribed into one of the following four (4) categories, A, B, C and U. Refer to Appendix C for further detail. Generally, relevant consent authorities will consider:

- **A** retention value trees as a site constraint and may require alterations to the proposed development design and/or specific protection measures to allow retention, unless the proposed development outweighs the retention value of the tree
- **B** retention value trees as a site constraint consideration, lesser changes should be considered to retain such trees
- **C** retention value trees are not considered a site constraint
- **U** retention value trees are considered a site opportunity, as such trees are recommended for removal regardless of the proposed development.

1.1.4 Trees impacted by the proposed development:

Category	Description	Total	Removal		Retain	
			located within development footprint	irrespective of future development	with specific protection	with generic protection
A	High retention value trees	0				
B	Moderate retention value trees	5	1, 2, 4, 5		6	
C	Low retention value trees	4	3, 7, 8, 9			
U	Trees to be removed irrespective of proposed development	0				

2 Introduction

2.1.1 ArborSafe Australia Pty Ltd was engaged by Mr Adam Kapinkoff (The Client) to complete an Arboricultural Impact Assessment Report on nine (9) trees located within or adjacent to the Bassendean Hotel located on the Old Perth Road, Bassendean, Perth.

2.1.2 The report has been requested as part of a Development Application (DA) that involves the renovation of the existing buildings and parking areas and the construction of a new alfresco dining area and children's playground.

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

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

3 Scope

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

3.1.2 Provide an objective appraisal of the subject trees in relation to their species, estimated age, health, structural condition, useful life expectancy (ULE) and viability within the landscape.

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

3.1.4 Nominate subject trees that can be retained or require removal to facilitate the development.

3.1.5 Identify and reduce potential conflicts between subject trees and site development by providing accurate information on the area required for tree retention and methods/techniques suitable for tree protection during construction.

3.1.6 Provide information on restricted activities within the area nominated for tree protection, as well as suitable construction methods to be adopted during demolition and/or construction.

4 Methodology

4.1 Data Collection

4.1.1 Nick Arnold of ArborSafe Australia Pty Ltd carried out a site inspection of the subject trees on 26 November 2020.

4.1.2 Trees that are the subject of this report (Figure 3) were identified during discussions with the Client, reviewing relevant (supplied) development documentation and reviewing the description of a non-exempt 'Tree' as identified within the Town of Bassendean *Local Planning Policy No. 13 Tree Retention and Provision.*

4.1.3 Pursuant with the consent authorities tree management policy (*Local Planning Policy No. 13 Tree Retention and Provision*), all site significant site trees were included within the scope of this report. Small trees/shrubs have been omitted from the report based on their species, current size and/or potential future size and contribution to local amenity.

4.1.4 The subject trees were inspected from the ground using the initial component of Visual Tree Assessment (VTA) (Matthek, 1994). No foliage or soil samples were taken and no aerial, underground or internal investigations were undertaken.

4.1.5 Tree height and canopy width were estimated and have been provided to the nearest range (in meters). Trunk diameter at breast height (DBH) and trunk diameter at the root crown (DRB) were measured with a diameter tape and provided to the nearest centimetre

4.1.6 Heritage information was sourced from the WA heritage register (inHERIT). The source of all information has been referenced accordingly.

4.1.7 No additional environmental or biodiversity searches were included within the scope of this report.

4.1.8 Data collected on site was analysed by Nick Arnold, collated into report format, and relevant recommendations were formulated.

4.1.9 Tree protection zones (TPZ) and structural root zones (SRZ) were calculated in accordance with the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites* (refer to Section 7.6).

4.1.10 Retention values have been determined based upon a modified version of the British Standard BS 5837–2012: *Trees in Relation to Design, Demolition and Construction* (refer to Appendix C).

4.1.11 All photographs were taken at the time of the site inspections by the author and have not been altered for brightness or contrast, nor have they been cropped.

4.1.12 Plans of the existing site and of the proposed development were provided to ArborSafe on 26.11.20.

4.1.13 No proposed underground service locations have been reviewed in the preparation of this report.

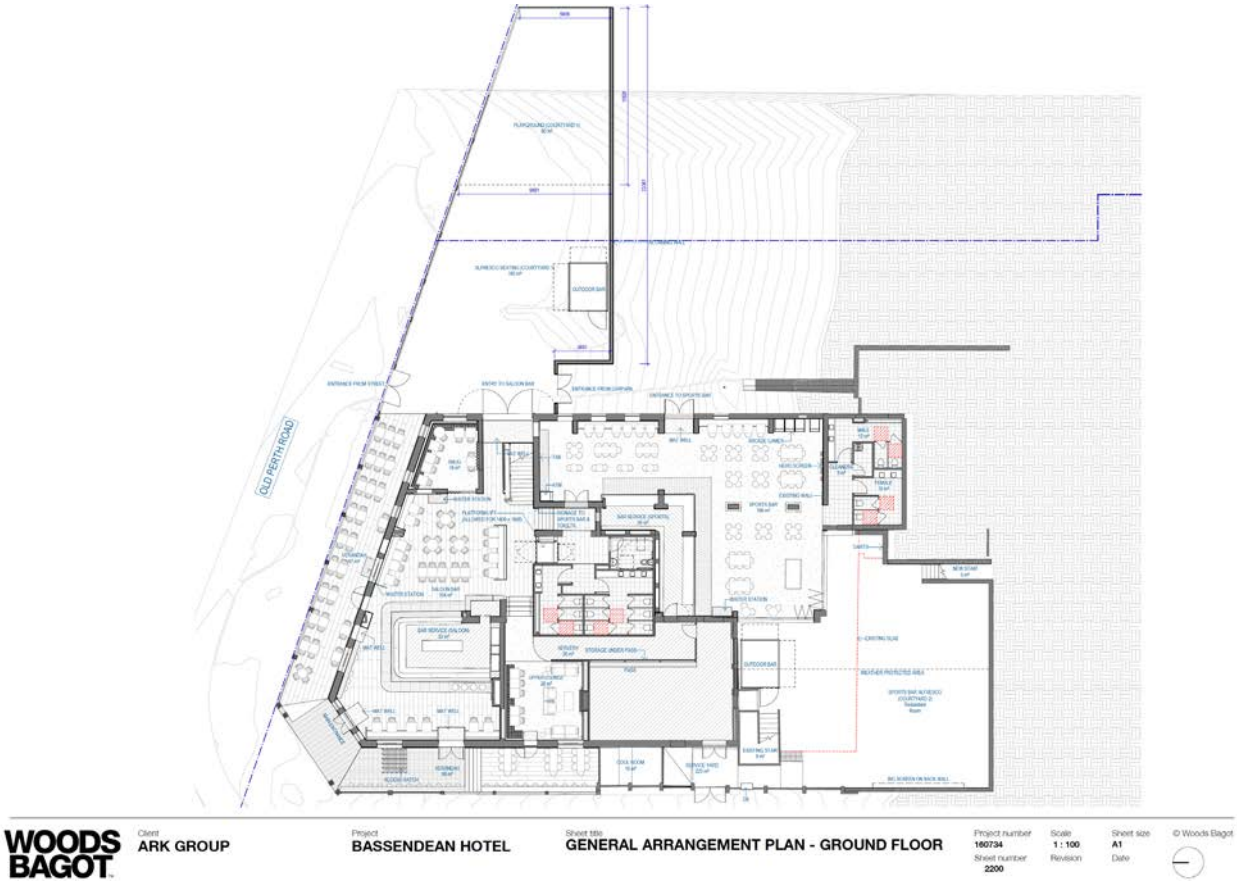


Figure 1. Excerpt from the General Arrangement – Ground Floor Plan. (Client, 26 November 2020).

5 Observations

5.1 Location

5.1.1 The site was located within the grounds of the Bassendean Hotel located on the Old Perth Road (Figure 2), the area designated in this report has been outlined in red by the author.

5.1.2 The site was located within the Town of Bassendean (TOB) Local Government Area (LGA).

5.1.3 Site soils are likely to consist of altered Bassendean sands as would be considered typical in a modified urban environment. No formal soil testing was undertaken in the preparation of this report.

Figure 2. Whole site image (location). Red lines delineate the site and area containing the subject trees that are to be impacted by the proposed development. (Landgate, November 2020).

5.2 Site Trees

5.2.1 A nominal numbering convention was applied to the subject trees (Figure 3). Trees were not tagged as part of this report.

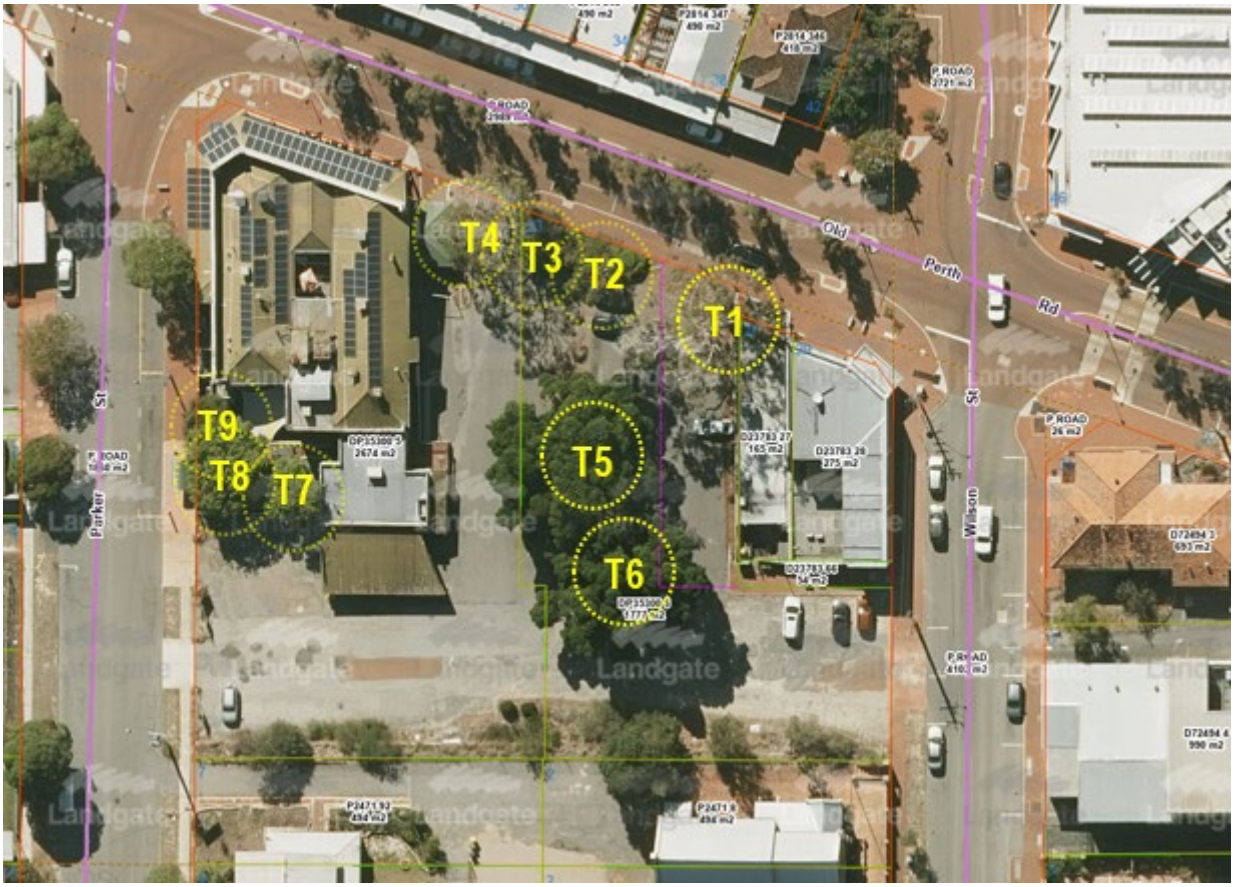


Figure 3. Site map showing subject trees. Tree attributes are to be obtained from Appendix E – Tree Assessment Data. (Landgate/ArborSafe, November 2020).

5.3 Tree Retention Values

5.3.1 Retention values were determined based upon a modified version of the British Standard BS 5837–2012: *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 C – Tree Retention Values.

Category	Tree numbers
A	
B	1, 2, 4, 5, 6
C	3, 7, 8, 9
U	

5.4 Environment Status

5.4.1 No additional environmental or biodiversity searches were undertaken in the preparation of this report. Findings of the site inspection indicated that none of the subject trees were considered to be of special environmental significance (as known to the author at time of assessment).

5.4.2 Heritage Status

5.4.3 The proposed development site has no trees identified as being of national, state or local heritage significance (inHERIT).

5.4.4 The site is within the grounds of the Bassendean Hotel, which is considered to have significant heritage value (Category 2/2a). The site is listed within the WA Heritage Inventory as identified below:

Heritage Listing	Listing Title	Place Number	Listing Date	M.I Place Number
Heritage Council (WA)	Bassendean Hotel	00133	May 2018	163

(WA State Heritage Register, 2020)

5.4.5 No individual listings were identified within the state heritage register pertaining to any of the trees subject to this report, furthermore, site assessment did not indicate any exceptional (tree) heritage significance.

6 Discussion

6.1 Proposed Construction

6.1.1 The proposed development has been reviewed and in summary consists of the renovation of the existing Bassendean Hotel building and the additional construction of a new alfresco dining and play area to the Hotel's east. The existing car park area is also to be resurfaced.

6.2 Impact of Proposed Development

6.2.1 A review of the proposed design has been undertaken in the context of tree retention and removal across the site.

6.2.2 The trees affected by direct conflict with the proposed construction footprint would require removal under the current design. In order to retain any/all of these trees a redesign or relocation of the development would be required. Refer to Appendix E for full details.

6.2.3 The other main development impact which affects trees, but not necessarily to the point of requiring immediate removal, is through significant root damage due to major TPZ encroachment. This damage can largely be placed into three (3) categories – soil compaction, level changes or direct root severance.

6.2.4 Negative tree impacts can manifest as either a reduction in health and/or vigour due to root loss (absorption and/or transport roots) resulting in a reduction in water and nutrient absorption capability or on tree stability if larger roots are impacted. Ultimately, the outcome for the trees depends on a number of variable factors including species, age, current health, TPZ encroachment percentage, soil type, topography, previous site use and the proposed design and construction methodology.

6.2.5 Compacted soils, especially artificially compacted soils such as those found under driveways or building platforms, have a higher bulk density down to a deeper level of subsoil. Bulk density is the term used for describing the weight of soil per unit volume. The broad engineering thinking is that the higher the density the more stable the road surface due to less soil movement in expansion, contraction, or compression. A higher bulk density is produced by compacting the soil to reduce available pore space between the soil particles. It should be noted however that deep base courses can be used to encourage roots to take a downward trajectory.

6.2.6 The effect of compacted soils on plants is somewhat influenced by the soil type but generally a reduction in available pore space reduces the available area for oxygen and water within the soil. A reduction in available soil water and oxygen inhibits root activity within the soil, as they are essential for root elongation and growth, and the lack of these properties is considered a major limiting factor.

6.2.7 A similar reduction in root activity, due to a reduction in pore space, can occur following significant soil level changes across the TPZ, although this generally occurs over a longer time frame than if the roots were directly severed. Root severance has the same effect, reduction in root function and capability, but on an instantaneous time scale where there is no time for the tree to adjust.

6.2.8 The assumption of allowable encroachment and minimal long-term health or structural impacts to the trees rely on a combination of the following being used - root sensitive construction methods being adhered to within the TPZ, minimal excavation within the TPZ to limit root severance (i.e. construction placed outside the TPZ where possible), fill rather than excavation utilised to affect level changes where possible (i.e. to minimise root severance and allow the trees root system time to adjust), no construction occurring within the SRZ, compensatory area being available around the unimpacted aspects of the trees and the enhancement of the existing TPZ area (i.e. mulched, soil conditioning and irrigation when required).

6.2.9 Resurfacing works around existing trees can lead to mechanical damage (including the scraping and severance of roots) which can negatively impact the condition of healthy trees or even push struggling trees into a spiral of decline.

6.2.10 The development is expected to affect nine (9) site trees through encroachment via excavation into their respective TPZs.

6.3 Determining TPZ Encroachment

6.3.1 **Major encroachment**. As per the Australian Standard AS 4970–2009: Protection of Trees on Development Sites, a major encroachment into the TPZ of any tree is considered to occur when it is beyond 10% of the total TPZ area. Trees with major encroachment may require removal or, in certain instances, be retained with specific protection requirements throughout the construction stage.

6.3.2 **Minor encroachment**. Under the aforementioned standard, a minor encroachment is determined as being less than 10% of the total TPZ area. Trees with minor encroachment may be retained with specific, generic or no protection requirements throughout the construction stage.

6.3.3 **No encroachment**. Trees with no encroachment may be retained with generic or no protection requirements throughout the construction stage.

6.3.4 For the purposes of this report, trees to be removed or retained have been identified as those:

- Requiring removal due to a level of encroachment into their TPZ that would likely result in a detrimental impact upon their future health and/or stability
- Retainable and requiring specific protection requirements throughout construction (i.e. generic requirements plus arborist supervision and careful construction methods within their TPZ)
- Retainable and requiring generic tree protection measures only (i.e. protective fencing and restriction of activities within the TPZ).

6.4 Tree 1

6.4.1 Tree 1 was a semi-mature Lemon-scented Gum (*Corymbia citriodora*). Although frequently used as an urban planting within Metropolitan Perth, the species (indigenous to Queensland and Northern NSW) is now considered undesirable and has proved to be invasive in banksia/tuart woodland to the south-west of WA. Tree 1 showed signs of reduced health and vigour with evidence of previous significant limb failures.

Figure 4. View of Tree 1 in its growing environment. (Author, November 2020).

6.5 Tree 2

6.5.1 Tree 2 was a semi-mature Lemon-scented Gum (*Corymbia citriodora*). Although frequently used as an urban planting within Metropolitan Perth, the species (indigenous to Queensland and Northern NSW) is now considered undesirable and has proved to be invasive in banksia/tuart woodland to the south-west of WA. Tree 2 was located in close proximity to an inspection pit.

Figure 5. View of Tree 2 in its growing environment. (Author, November 2020).

6.6 Tree 3

6.6.1 Tree 3 was a semi-mature WA Red Flowering Gum (*Corymbia ficifolia* – hybrid). Tree 3 showed signs of reduced health and vigour including tip dieback and minor deadwood accumulation.

Figure 6. View of Tree 3 in its growing environment. (Author, November 2020).

6.7 Tree 4

6.7.1 Tree 4 was a semi-mature Lemon-scented Gum (*Corymbia citriodora*). Although frequently used as an urban planting within Metropolitan Perth, the species (indigenous to Queensland and Northern NSW) is now considered undesirable and has proved to be invasive in banksia/tuart woodland to the south-west of WA. Tree 4 showed signs of reduced health and vigour with evidence of previous root damage.

Figure 7. View of Tree 4 in its growing environment. (Author, November 2020).

6.8 Tree 5

6.8.1 Tree 5 was a mature Hill's Weeping Fig (*Ficus microcarpa var. hillii*). The tree was located within a car park setting, surrounded by hard surfaces, and is a native fig species that commonly possesses expansive root systems. Historic root exposure, damage and compaction were evident and had likely contributed to an apparent reduction in tree health manifested by dieback/thinning in the tree's upper eastern crown (see Figure 8). Cracking observed beyond the extent of the tree's dripline would suggest that significant roots extend out into the existing car park area.

6.9 Tree 6

6.9.1 Tree 6 was a mature Hill's Weeping Fig (*Ficus microcarpa var. hillii*). The tree was located within a car park setting, surrounding by hard surfaces, and is a native fig species that commonly possesses expansive root systems. Although likely suffering from the effects of compaction and impermeable surfacing, Tree 6 presented as in better health when compared to Tree 5 (see Figure 8). This difference could potentially be attributed (in part) to lower levels of observed root severance and damage when compared to Tree 5. Lower trunk wounding, possibly a result of historic limb failure, poor pruning or vehicle strike was observed on Tree 6.

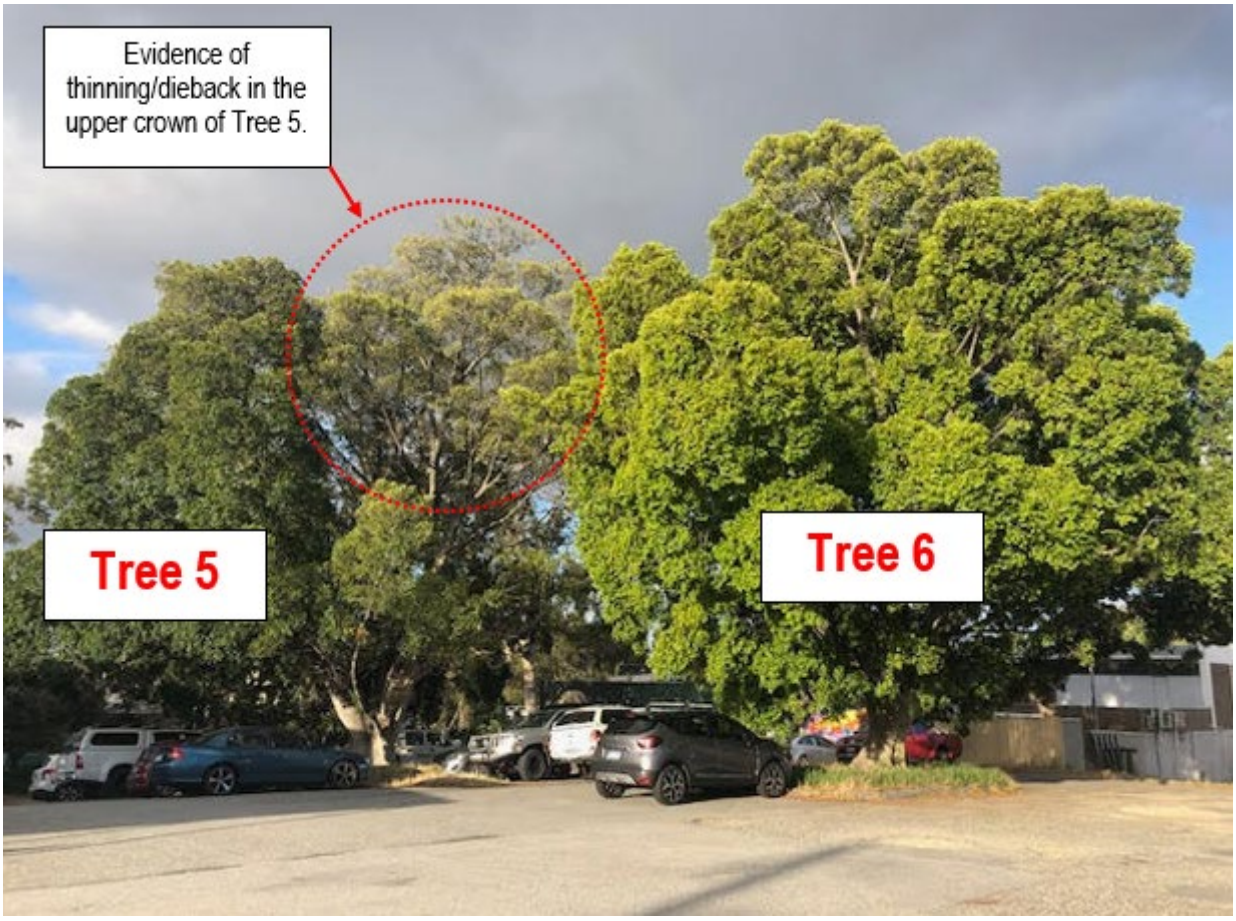


Figure 8. View of Trees 5 and 6 in their growing environment. (Author, November 2020).

6.10 Trees 7, 8 and 9

6.10.1 Trees 7 and 8 were semi-mature Jacarandas (*Jacaranda mimosifolia*). Both trees displayed diminished form (e.g. degrading pruning wounds, poor regrowth attachments) and reduced ULEs as a result of historic lopping practices. A lack of observable basal flare at the base of Tree 8 also indicated historical soil grade changes.

6.10.2 Tree 9 was a Bottlebrush (*Callistemon* sp.) and although the tree provided some shade/screening value, its form and ULE were deemed to have been diminished by historic poor pruning practices.

Figure 9. View of Tree 7 (left), Tree 8 (centre) and Tree 9 in their respective growing environments. (Author, November 2020).

7 Tree Protection and Management Recommendations

7.1 Tree Numbering Conventions

7.1.1 It is recommended that the tree numbering convention used in this report be applied to all subject trees included within any subsequent site plans to aid transparency.

7.2 Tree Removal

7.2.1 Eight (8) trees would require removal based upon the supplied design proposal(s). The following trees would require removal to allow the proposed development:

Recommendation	Category A High retention value		Category B Moderate retention value		Category C Low Retention value		Category U No retention value	
	Qty	Tree numbers	Qty	Tree numbers	Qty	Tree numbers	Qty	Tree numbers
Remove for development	0		4	1, 2, 4, 5	4	3, 7, 8, 9	0	

7.2.2 Trees 1, 2 and 4 where considered to be Category B status Lemon-scented Gums. Although established, all three trees showed signs of reduced health and vigour possibly associated with soil compaction and/or a lack of permeable surfacing within their respective driplines. A reduction in tree health can often result in an accumulation of deadwood and reduce an individual trees resilience to potential root disturbances associated with development.

7.2.3 Based on the supplied plans (Figure 1 and Section 6), a significant encroachment into the SRZ of Trees 1, 2, 3 and 4 would be required to accommodate the proposed design. It is recommended that each of these trees is replaced (Section 7.14) with a tree of medium dimensions (at maturation). It is further recommended that replacement tree(s) with a proposed planting location to the north of the alfresco seating area (adjacent to Old Perth Road) be deciduous in nature and of a species approved by the Town of Bassendean.

7.2.4 Tree 5 presented as an established Hill's Weeping Fig also showing signs of reduced health and vigour. There was evidence of extensive historical root damage, severance and compaction which is likely to have contributed to a drop in vitality. This type of root damage and corresponding reduction in health could be expected to reduce the useful life of this tree and limit its resilience to further excavation works within the TPZ. Anecdotal evidence additionally indicated that significant roots emanating from Tree 5 extended past the drip line (as would be expected from this species). Consequently, a degree of further root severance would likely be required to accommodate the proposed design.

7.2.5 Due to these factors it is recommended that Tree 5 be removed and replaced with a single large tree or a minimum of two medium trees (at maturation).

7.2.6 Where replacement trees are located within the proposed car parking/hard surface area, root sensitive design principles are recommended (see Section 7.3).

7.3 Tree Pit Design (replacement trees located in hard surface/car park areas)

7.3.1 Once established, off-set plantings located within the car park area will have a significant proportion of their respective root zones covered by a 'hard surface'.

7.3.2 Urban trees growing in poorly designed or insufficient tree pits are typically surrounded by compacted soils or restricted soil volumes forcing roots up into cavities below paved surfaces where water (in the form of condensation) and air are often present. This kind of root activity can cause premature damage to hard surfaces and creates a sub-optimal growing environment for the tree.

7.3.3 In order to provide a sustainable growing environment and reduce the probability of premature root conflicts with surrounding hard surfaces, structured soil cell system should be incorporated into the mandated (subsoil) growth zone of each tree, where this zone is proposed to be covered by a 'hard surface'. Cellular systems are designed to preserve a non-compacted root zone whilst minimising future damage/lifting of paved areas. An example of a structured cell system is the Stratacell™ Soil Vault System:

https://citygreen.com/wp-content/uploads/2020/04/cgs-soil-vault-systems-healthy-trees-digital-1.pdf

7.3.4 The selected system is to be installed as per the manufacturer's guidelines and should provide a minimum soil volume of 20m^3 (extending to a minimum radial distance of 4m from the centre of each respective tree's trunk when in-situ) for a medium tree or 50m^3 (extending to a minimum radial distance of 6m from the centre of each respective tree's trunk when in-situ) for a large tree.

7.3.5 Back-filled soil should consist of a suitably sourced and clean (i.e. free of weeds/contaminants and providing a beneficial environment for the promotion of plant growth) sandy loam, with an indicative organic matter content of between 2–5% and clay content of between 10–20% by mass. Backfill is to be consolidated/compacted as per the manufacturer's (cellular system) guidelines.

7.3.6 It is recommended that the surrounding surface paving type and configuration be permeable in nature allowing water to freely drain through the hard surface, reducing runoff and allowing water to reach the tree's root zone. Permeable paving should extend in a radial fashion to the outer edge of the sub-surface soil vault system at a minimum.

7.3.7 Permeable paving options are to incorporate approved base course layers and geotextiles/membranes as per manufacturer's guidelines (e.g. Midland Aqua Tri-Pave or similar).

7.3.8 The site's landscape design should aim to maximise the 'open' (water permeable) garden area at the base of each tree, whilst accommodating other elements of the design. The above ground tree pit 'cut-out' for each new planting should be as large as possible but at a minimum should extend past the estimated SRZ (Structural Root Zone) of the subject tree at maturation. Where space permits, understorey plants and ground covers are also recommended within tree cut-outs to reduce potential foot traffic through planting areas.

7.3.9 Trees 7, 8 and 9 where deemed to hold diminished retention values as a result of defects linked to historic pruning practices. Consequently, removal and replacement with small to medium tree species on a one-to-one basis (minimum) within the site footprint is recommended.

7.4 Tree Retention

7.4.1 One (1) tree was recommended for retention and requires specific protection measures during construction to ensure it remains viable following the completion of works.

Recommendation (Refer Section 7.5–7.9)	Category A High retention value		Category B Moderate retention value		Category C Low Retention value	
	Qty	Tree numbers	Qty	Tree numbers	Qty	Tree numbers
Retain with specific protection requirements	0		1	6	0	

7.5 Specific Protection Measures

7.5.1 Tree 6 would be impacted by excavation works (resurfacing) within a portion of its TPZ as part of the proposed works.

7.5.2 Excavation within the TPZ is to be carried out under arborist supervision. No unsupervised excavation should occur within the SRZ of this tree. It is recommended that the proposed excavation commence at the outer extent of the TPZ and move inwards to minimise root damage to the trees.

7.5.3 Works should be undertaken using techniques that are sensitive to tree roots to avoid unnecessary damage. Such techniques include:

- Excavation using a high-pressure water jet and vacuum truck
- Excavation using an Air Spade with vacuum truck
- Excavation by hand.

7.5.4 Machine excavation is prohibited within the TPZs of retained trees unless undertaken at the direct consent of the project arborist.

7.5.5 Roots discovered are to be treated with care and minor roots (<40mm diameter) pruned with a sharp, sterile handsaw or secateurs. All significant roots (>40mm diameter) are to be recorded, photographed and reported to the project arborist.

7.5.6 Other proposed surfacing within the TPZ is to be installed above the existing grade and be of a permeable nature to allow the passage of air and moisture. If the surfacing is to be load bearing, then it is suggested that a geogrid/web or similar is incorporated to ensure the rooting area below does not become compacted or contaminated.

7.5.7 It is further recommended that the existing tree cut-out be expanded to the full extent permitted by the design but at a minimum should extend past the SRZ/basal flare of this tree to improve the tree's growing environment and future reduce root vs infrastructure conflicts (see Figure 10).

Figure 10. View of Tree 6 in its growing environment. (Author, November 2020).

7.6 Proposed Pruning

7.6.1 Zero (0) trees have proposed development within their respective crowns. It is anticipated that minor pruning only will be required of no greater than 10% of the trees total crown spread.

7.6.2 All pruning is recommended to be completed in accordance with the Australian Standard AS 4373–2007: *Pruning of Amenity Trees* (Standards Australia, 2007) and undertaken by a suitably qualified arborist (minimum AQF 3 arborist).

7.6.3 Reduction pruning should focus on the removal of smaller diameter branches where feasible and remove no greater than 10% of the total crown. Branches no greater than 50mm diameter are to be removed unless specifically approved by the project arborist.

7.6.4 Pruning >10% of a retained tree's crown will need the express approval of the nominated project arborist.

7.7 Generic Protection and Reporting Measures

7.7.1 All retained trees require generic protection measure. Refer to Section 7.7–7.18 for further details.

7.7.2 All trees to be retained require protection during the construction stage. Tree protection measures include a range of:

- Activities restricted within the TPZ
- Protective fencing
- Trunk and ground protection
- Tree protection signage
- Involvement from the project arborist
- Project milestones
- Compliance reporting

7.7.3 Activities Prohibited within the TPZ

- Machine excavation including trenching
- Storage
- Preparation of chemicals, including cement products
- Parking of vehicles and plant
- Refuelling
- Dumping of waste
- Wash down and cleaning of equipment
- Placement of fill
- Lighting of fires
- Soil level changes
- Temporary or permanent installation of utilities and signs
- Physical damage to the tree

7.8 Protective Fencing Specification

7.8.1 Protective fencing (Figure 11) is to be installed as far as practicable from the trunk of any retained trees. Fencing should be erected as per the image below before any machinery or materials are brought to site and before commencement of works (including demolition).

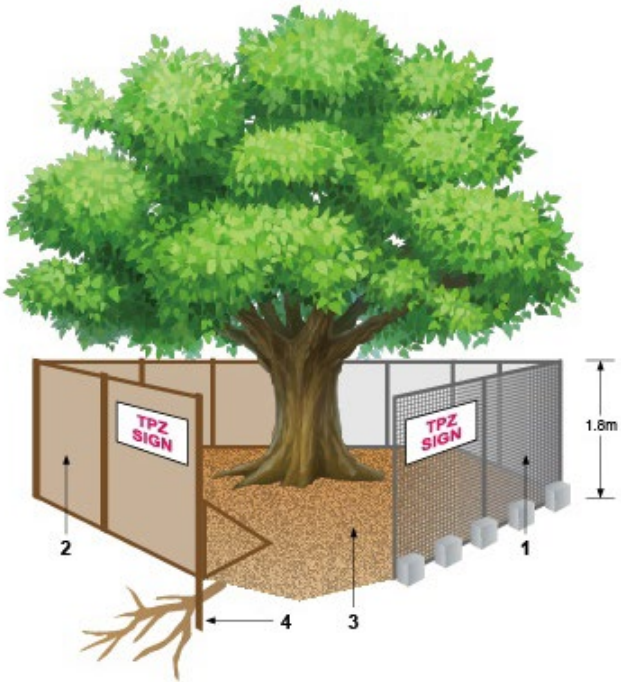
7.8.2 In some areas of the site (i.e. protection of trees on neighbouring properties) existing boundary fencing may be used as an alternative to protective fencing.

7.8.3 Once erected, protective fencing must not be removed or altered without approval from the project arborist. The TPZ fencing should be secured to restrict access.

7.8.4 TPZ 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. See image below.

7.8.5 Tree protection fencing must remain intact throughout all proposed construction works and must only be dismantled after their conclusion. The temporary dismantling of tree protection fencing must only be done with the authorisation of a consulting arborist and/or the responsible authority.

7.8.6 The subject trees themselves must also not to be used as a billboard to support advertising material. Affixing nails or screws into the trunks of trees to display signs of any type is not a recommended practice in the successful retention of trees.



Legend:
1. Chain wire mesh panels with shade cloth attached (if required), 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 discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage materials of any kind are permitted within the TPZ
4. Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

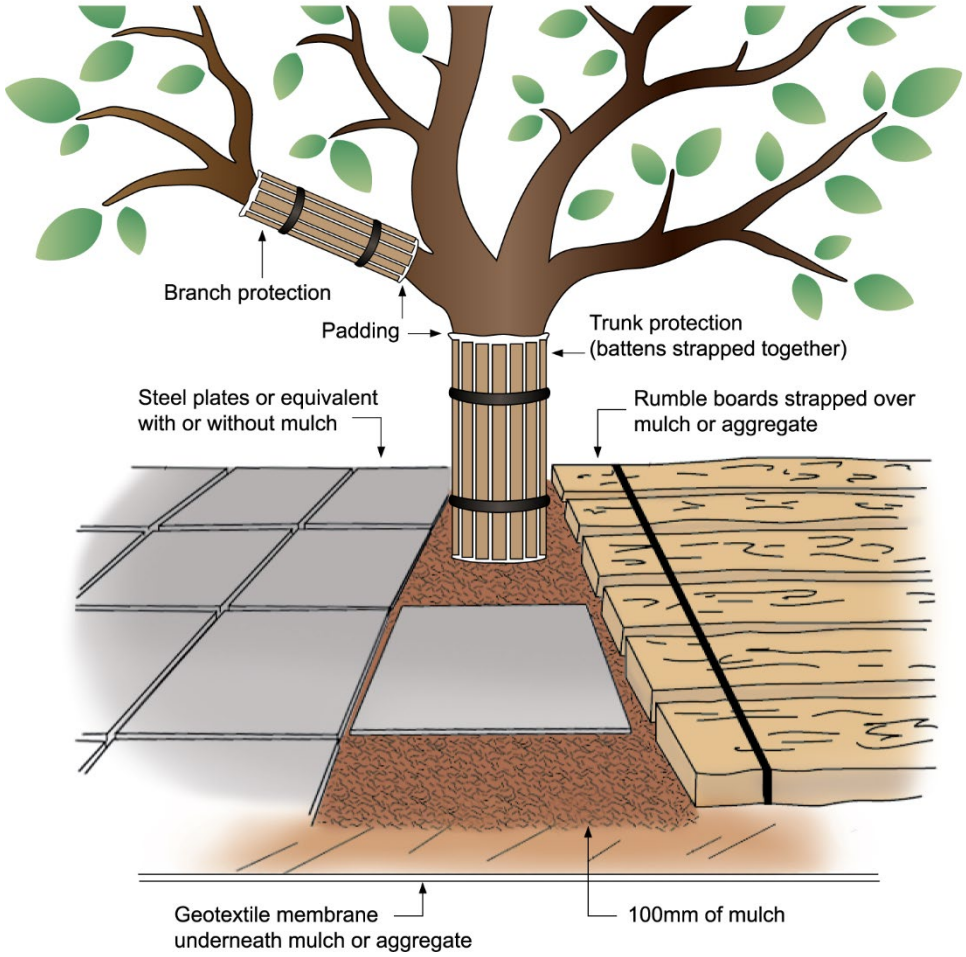
Figure 11. Depicts standard fencing techniques. (AS 4970–2009).

7.9 Trunk and Ground Protection

7.9.1 Given that proposed works are often within the TPZs of retained trees, standard protective fencing may not always be a viable method of protection. In these areas trunk protection and ground protection should be installed prior to the commencement of works and remain in place until after construction works have been completed.

7.9.2 Where construction access into the TPZ of retained 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.

7.9.3 Trunk and ground protection (Figure 12) should be undertaken in line with the Australian Standard AS 4790–2009: *Protection of Trees on Development Sites* as per the image below:



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 12. Depicts trunk and ground protection techniques. (AS 4970–2009).

7.10 Tree Protection Signs

7.10.1 Signs identifying the TPZ (Figure 13) should be placed at 10m intervals around the edge of the TPZ and should be visible from within the development site.

Figure 13. Depicts standard fencing techniques. (AS 4970–2009).

7.11 Project Arborist

7.11.1 An official "Project Arborist" must be commissioned to oversee the tree protection, any works within the TPZ's and complete regular monitoring compliance certification.

7.11.2 The project arborist must have minimum five (5) years industry experience in the field of arboriculture, horticulture with relevant demonstrated experience in tree management on construction sites, and Diploma level qualifications in arboriculture – AQF Level 5.

7.11.3 Inspections are to be conducted by the project arborist at several key points during the construction in order to ensure that protection measures are being adhered to during construction stages and decline in tree health or additional remediation measures can be identified.

7.12 Project Milestones

7.12.1 The following visits and milestones were recommended as to when on-site tree inspection by the project arborist is required:

Item	Purpose of Visit	Timing of Visit(s)	Prerequisites
1	Pre-start induction	Following sign off from Item 1. Contractor to provide a minimum of five days advance notice for this visit.	Prior to commencement of works. All parties involved in the project to attend.
2	Supervision of works in TPZ's including all regrading and excavations	Whenever there is work planned to be performed within the TPZ's. Contractor to provide a minimum of five days advance notice for such visits.	
3	Regular site inspections	Minimum frequency monthly for the duration of the project.	The checklist must be completed by the Project Arborist at each site inspection and signed by both parties.
4	Final sign off	Following completion of works.	Practical completion of works and prior to tree protection removal.

7.13 Compliance Reporting

7.13.1 Following each inspection, the project arborist shall prepare a report detailing the condition of the trees. These reports should certify whether or not the works have been completed in compliance with the consent relating to tree protection.

7.13.2 These reports should contain photographic evidence where required to demonstrate that the work has been carried out as specified.

7.13.3 Matters to be monitored and included in these reports should include tree condition, tree protection measures and impact of site works which may arise from changes to the approved plans.

7.13.4 The reports and Compliance Statements shall be submitted to the Project Manager (as well as the Clients' nominated representative) following each inspection.

7.13.5 The reports and any Non-Compliance Statements shall be submitted to the Project Manager (as well as the Clients' nominated representative) if tree protection conditions have been breached. Reports should contain clear remedial action specifications to minimise any adverse impact on any subject tree.

7.14 Offset Tree Planting

7.14.1 Offset planting should reflect the number of trees removed and the initial loss of amenity and biomass. New trees should be of long-term potential and sourced from a reputable supplier.

7.14.2 Replacement tree species must suit their location on the site in terms of their potential physical size and their tolerance(s) to the surrounding environmental conditions. To avoid unethical or unprofessional tree selection and/or their placement within the landscape, replacement tree species must be selected in consultation with a consulting arborist, who can also assist in implementing successful tree establishment techniques.

7.14.3 Replacement tree species must have the genetic potential to reach a mature size potential of those trees removed to facilitate the development. As a guide, potential height will be a minimum of 10m (or more) for large trees and produce a spreading canopy so as they may provide amenity value to the property and contribute to the tree canopy of the surrounding area in the future.

7.15 Additional Excavation/Trenching within TPZs

7.15.1 In the event additional excavation is required within the TPZs of retained trees identified within this report, or any other site trees, arborist involvement will be required to ensure works are undertaken in accordance with the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites.*

7.15.2 Where excavation or trenching is required to facilitate installation of underground services within the TPZs of any site trees arborist supervision is required. Works should be undertaken using techniques that are sensitive to tree roots to avoid unnecessary damage. Such techniques include:

1. Excavation by hand
2. Excavation using a high-pressure water jet and vacuum truck
3. Excavation using an Air Spade with vacuum truck.

7.15.3 Machine excavation should be prohibited within the TPZs of retained trees unless undertaken at the direct consent from the project arborist and/or the responsible authority.

7.16 Plant Health Care

7.16.1 When managing a tree affected by development incursions within its TPZ, plant tonic and growth stimulant drenching should be undertaken. Plant tonic and growth stimulant drenching is the process of adding diluted products directly to the root area of a tree to promote and assist trees to cope with loss of roots during the development process. They also assist trees to provide better resistance to sap sucking insects and fungal attack/disease and improve the establishment of beneficial microbial populations and nutrient uptake. See Appendix D – Plant Health Care and Mulching

7.17 Irrigation

7.17.1 Regular checks are required to ensure retained trees are receiving the correct amount of water. The majority of a tree's fine water absorbing roots are located in the top 10–30cm of soil. To undertake a basic soil moisture test, dig a small hole to a depth of 40cm at the dripline of the tree. If the soil is moist at this depth, water is not needed. Slow irrigation that provides an even coverage and targets the absorbing roots is the key to successful irrigation and encourages a deeper tree root system. Irrigation near the trunk is unnecessary as for most trees there are generally fewer water absorbing roots in this area. Irrigating the soil from half-way between the trunk and the dripline as well as beyond the dripline will provide water where it will most effectively be used. Preferably, water your trees during the cooler evening and early morning period when temperatures are lower, humidity is higher, and the air is calmer thereby reducing water evaporation from the soil surface. Irrigation in the middle of the day is not harmful to most trees however it is less efficient.

7.18 Mulching

7.18.1 Mulching regulates soil moisture and temperature levels, suppresses weeds, minimises soil compaction and reduces run off during periods of heavy rain. Acquiring wood chip mulch from programmed tree works (and by purchasing it from local tree contractors) would be a proactive way to improve the growing conditions around trees that ultimately will result in improved tree health and vitality.

7.18.2 Mulch should aim to cover an area at least as large as a tree's crown projection (and preferably larger) for it to be effective. It should also be laid at a uniform thickness of 75–100mm. Mulch should also be placed over damp to wet soil and never over dry soil. Application during the cooler months of the year is ideal. In areas where grass exists where you wish to mulch, spray the grass first with a non-selective herbicide and allow it to wilt and die before placement. This practice will negate grass growing up through the mulch over time.

7.18.3 Mulching within the canopy areas of trees not only improves long term tree health but also acts to reduce tree risk by reducing targets that pass and/or congregate under their canopies. This in turn will minimise the likelihood of injury in the event of a branch failure.

8 References

- Heritage Council, 2020. *inHERIT State Heritage Register*. Government of Western Australia.
- Matthek, C. a. B. H., 1994. *The Body Language of Trees: A Handbook for Failure Analysis.* H. M. Stationery Office: University of Michigan.
- Standards Australia, 2007. *AS 4373–2007 Pruning of Amenity Trees,* GPO Box 476 Sydney NSW 2001: Standards Australia.
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- The British Standards Institution, 2012. *BS5837–2012: Trees in relation to design, demolition and construction,* London: BSI Standards Limited.
- Town of Bassendean 2020. *Local Planning Policy No. 13. Tree Retention and Provision*.
- Urban, J., 2008. *Up By Roots - Healthy Soils and Trees in the Built Environment.* Champaign (Illinois): International Society of Arboriculture.

Plans of the existing site and of the proposed development were provided to ArborSafe on 26.11.20 and include:

- Bassendean Hotel Concept Design Reports, Seedesign Studio, 16 November and 19 November 2020
- Bassendean Hotel Site Plan, Project No. 160734, Sheet 1100, Woods Bagot, November 2020
- Bassendean Hotel General Arrangement Plan – Ground Floor, Project No. 160734, Sheet 2200, Woods Bagot, November 2020

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.

Appendix B. Explanation of Tree Assessment Terms

Tree number: Refers to the individual identification number assigned within the ArborSafe software to each assessed tree on the site and the number which appears of the tree's tag.

Tree location: Refers to the easting and northing coordinates assigned to the location of the tree as obtained from the geo-referenced aerial image within the ArborSafe software.

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

Trees in group: The number of trees encompassing a collective assessment of more than one tree. Typically grouped trees have similar attributes that can be encompassed within one data record.

Height: The estimated range in metres attributed to the tree from its base to the highest point of the canopy. Where required height will be estimated to the nearest metre.

Diameter at Breast Height (DBH): Refers to the tree's estimated trunk diameter measured 1.4m from ground level for a single trunked tree. These estimates increase in 50mm increments. Where required DBH will be measured to give an accurate measurement for single trunked trees, trees with multiple trunks, significant root buttressing, bifurcating close to ground level or trunk defects and will be measured as per the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites*.

Tree Protection Zone (TPZ): 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. TPZ radius = DBH × 12. (Note "Breast Height" is nominally measured as 1.4m from ground level).TPZ is a theoretical calculation and can be influenced by existing physical constraints such as buildings, drainage channels, retaining walls, etc. (Standards Australia, 2009).

Structural Root Zone (SRZ): The area close to the base of a tree required for the tree's anchorage and 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 = $(D \times 50)^{0.42 \times 0.64}$ (Standards Australia, 2009).

Canopy spread: The estimated range in metres attributed to the spread of the tree's canopy on its widest axis. Where required crown spread will be estimated to the nearest metre.

Origin: Refers to the origin of the species and its type.

Category	Description
Locally Endemic	Occurs naturally in the local area and is native to a given region or ecosystem.
WA Native	Occurs naturally within the state but is not indigenous.
Australian Native	Occurs naturally within Australia and its territories but is not a state native or indigenous.
Exotic Evergreen	Occurs naturally outside of Australia and its territories and typically retains its leaves throughout the year.
Exotic Deciduous	Occurs naturally outside of Australia and its territories and typically loses its leaves at least once a year.

Health: Refers to the health and vigour of the tree.

Category	Description
Excellent	Canopy full with even foliage density 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. Exceptional specimen.
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, none or minimal deadwood.
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, may contain 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.

Age: Refers to the life cycle of the tree.

Category	Description
Young	Newly planted small 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.

Structure: Refers to the structure of the tree from roots to crown.

Category	Description
Good	Sound branch attachments with no visible structural defects, e.g. included bark or acute angled unions. No visible wounds to the trunk and/or root plate. No fungal pathogens present.
Fair	Minor structural defects present, e.g. apical leaders sharing common union(s). Minor damage to structural roots. Small wounds present where decay could begin. No fungal pathogens present.
Poor	Moderate structural defects present, including bifurcations with included bark with union failure likely within 0–5 years. Wounding evident with cavities and/or decay present. Damage to structural roots.
Hazardous	Significant structural defects with failure imminent (3–6 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 presents a greater risk and/or more hazards 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 within the tree's location and environment which may influence the ULE value.

Category
0 Years
<5 Years
5–10 Years
10–15 Years
15–25 Years
25–50 Years
>50 Years

Defects: Visual observations made of the presenting defects of the tree and its growing environment that are, or have the capacity to impact upon, the health, structural condition and/or the useful life expectancy of the tree. Defects may include adverse physical traits or conditions, signs of structural weaknesses, plant disease and/or pest damage, tree impacts to assets or soil related issues.

Tree Significance: Includes environmental, social or historical reasons why the tree is significant to the site. The tree may also be rare under cultivation or have a rare or localised natural distribution.

Arborist Actions: A list of arboricultural and/or plant health care works that are aimed at maintaining or improving the tree's health, structural condition or form. Actions may also directly or indirectly reduce the risk potential of the tree such as via the removal of a particular branch or the moving of infrastructure from under its canopy.

Appendix C. Tree Retention Values

Based upon a modified version of the British Standard 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.

Category A	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.
Category B	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 10 years. They may make moderate amenity contributions to the landscape and make low/moderate environmental contributions. Trees with this retention value warrant lesser design consideration in an attempt to allow for their retention.
Category C	Trees in this category are 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.
Category U	Trees in this category are 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.

Appendix D. Plant Health Care and Mulching

Guide to plant health tonics and root growth stimulants

Considering the varying sizes of trees in common urban landscapes, it is suggested that an application volume of combined water and product solution of 80–150L for small to medium sized trees (5-10m height), 150–250L for medium to large sized trees (10-20m height) and 250–400L for large to very large sized trees (+20m height). Note: a lesser volume of total mixed product could be used if a more concentrated mix is drenched and water irrigation used to further drench the area and therefore dilute the stronger mix application.

The following product recommendations have been based on previous successful works undertaken by ArborSafe. The information provided is to be used as a general guide only, depending on your tree species, health or location. We recommend you always refer to the manufacturers label before applying any product. You may need to further consult with ArborSafe or your Project Arborist to develop a more specific program for your tree needs.

- **Soil Conditioner** concentrate such as Kelpro, Seasol or similar 600–800mL/100L of water. A concentration of beneficial nutrients stimulating plant growth and root establishment, ideal for trees under stress.
- **Nitrogen Boost** concentrate such as Nitrosol liquid plant food or similar 300mL/100L of water. A general-purpose fertilizer that contains a nitrogen boost (the most abundantly used element for tree growth). NB: Care must be taken when applying general fertilizer, particularly where plants can be affected Phosphorus toxicity.
- **Root Biostimulant** concentrate such as Auxinone or similar 400mL/100L of water. A scientific blend of hormone root growth stimulants and vitamins assisting in the regeneration of roots.
- **Microbial Formulation** concentrate such as Noculate Liquid or similar 500mL/100L of water. Generally containing strains of beneficial soil microorganisms, humic acid, kelp, essential amino acids, vitamins, biotin, folic acid and natural sugars designed to enhance the establishment of beneficial microbial populations.
- **Carbohydrate Energy Source** such as Molasses 500-800mL/100L of water. Molasses is the by-product of sugar refining. It contains all the nutrients from the raw sugarcane plant and is a carbohydrate energy source that feeds soil microorganisms and increases microbial activity.
- **Surfactant/Wetting Agent** (optional) such as Dispatch (Liquid) 200–300ml/100L of water. Improves the infiltration and penetration of applied water and irrigation.

We recommend you always refer to the manufacturers label before applying any product using the above as a guide only.

Guide to mulching and maintenance for established trees

Whether a tree is a newly planted young tree, or a well-established mature tree, the area around its base is a key factor in its long-term retention and viability. Maintaining a soil environment that is conducive to tree root development is vital for trees of all ages. This guide provides information on appropriate maintenance practices around the base of trees including mulching and the restriction of activities that may cause harm to tree roots or trunks.

1. Why mulch?

Mulching is a plant health care action which can be undertaken to improve plant and soil health (Figure 14), as well as overall landscape aesthetics. Placing an organic (or sometimes inorganic) material on the soil surface reduces the level of direct sunlight contact. Mulching should not be confused with composting which involves incorporating organic matter such as composts or manures into the soil profile. All plants in their natural ecologies (except for some arid and coastal ecologies) are naturally mulched by the falling of leaves, bark, flowers and other organic material.

This action is of great importance in successful cultivation of plants as it:

- assists in the regulation of soil moisture and temperature levels
- helps to suppress weeds
- minimises soil compaction
- reduces run-off during periods of heavy rain
- adds organic matter to the soil, and
- improves overall structure, nutrition and water holding composition.

Mulch is best comprised of organic materials such as wood chips, leaf litter, straw or hay as these will degrade over time. Long-term mulching improves soil health and structure as it encourages the activities of earthworms, microflora and beneficial fungi. Inorganic materials such as stones and gravel can be moderately effective as mulch but will not provide the ongoing improvements to soil health.

Figure 14. An excellent example of how to mulch a young tree. (Lachlan Andrews, September 2015).

2. How to mulch

- Apply mulch to damp soil, as placing over dry soil makes it difficult to rehydrate. Applying during the cooler months of the year is an ideal time.
- If mulching on top of a pre-existing grass area, grass or weeds must first be hand weeded and/or sprayed with a non-selective herbicide and left to wilt and die before applying mulch.
- Mulch should be applied at a uniform thickness of 75–100mm and re-applied approximately every 12 months. Do not place mulch up against the trunk of a tree as the damp mulch can cause bark to decay.
- Apply over a wide area, at least as large as a tree's crown projection (preferably larger), within and outside the current root mass to encourage lateral root development and expansion.
- Wood chip mulch (such as that generated from wood chippers) is considered an ideal mulch for landscape use as it contains a wide variety of materials that are of different sizes (such as bark, foliage and timber), is relatively cheap to purchase, and can be obtained in large quantities. Stockpiling of mulch after tree contractors have conducted works at a site is a way of generating 'free' mulch and ensuring that plant material from tree pruning and/or removals is recycled on site, not imported from external suppliers, saving costs and making the site more self-sustaining.
- The use of mulch made from pine bark or red gum chips are discouraged as they seldom degrade and therefore do not add nutrition to the soil profile. The uniform particle size and resin content can provide an impervious layer to water as well as retarding gaseous exchange.
- Mulching within the canopy areas of larger trees (Figure 15) can not only improve long-term tree health but can also act to reduce tree risk by decreasing the number of targets that pass and/or congregate under their canopies. This in turn will minimise the likelihood of injury in the event of a branch failure.
- When using wood chip mulch, ensure that if it has been made from live plant material that is stored and allowed to compost for between 3 and 6 months prior to use. Never apply fresh, 'green' mulch around trees as this can induce what is called the nitrogen drawdown, which can result in the removal of nitrogen from the soil resulting in plants with nutrient deficiencies.

For further information refer to the Australian Standard AS 4454–2012: *Composts, Soil Conditioners and Mulches*.

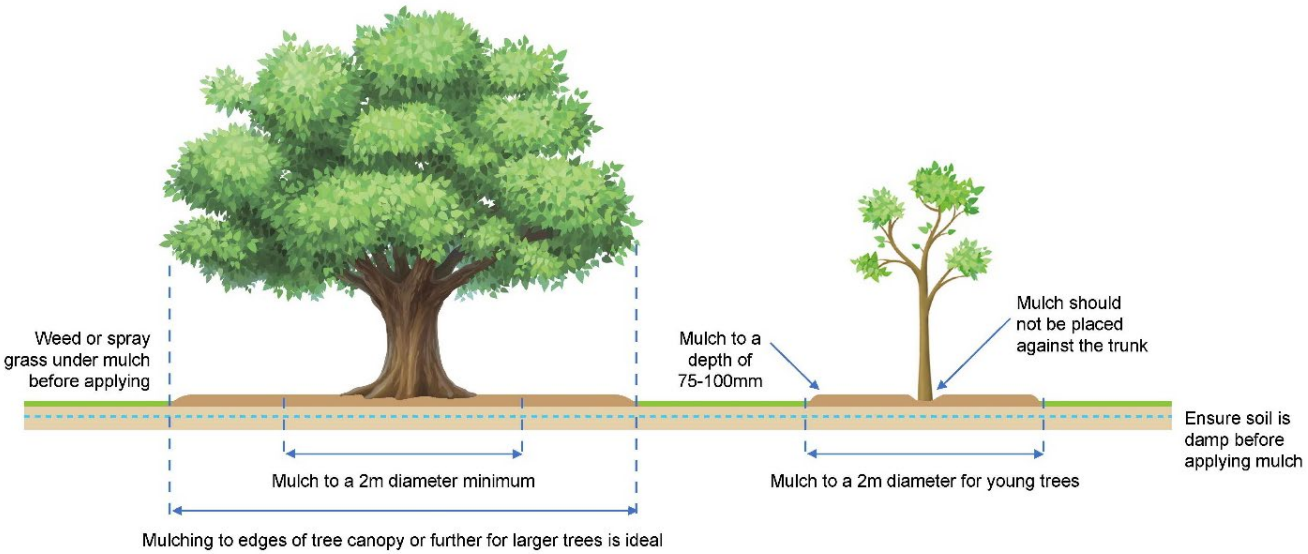

Figure 15. Mulching established and young trees (ArborSafe Australia, 2020).

3. Root and trunk damage

The function of tree roots is primarily to provide water and nutrient uptake for the tree, provide stability through structural roots that anchor it to the ground and as a means of food and nutrient storage. Damage to tree roots can lead to a reduction to any or all of these functions.

Damage to tree roots (Figure 16 and Figure 17) and the lower portion of a tree's trunk is a common and often unnecessary occurrence that can lead to the entry of decay fungi into a tree's structural framework. Once present, decay may develop in larger structural roots and/or the base of the trunk, which can result in a reduction in tree health and in severe cases even compromise stability.

Works such as trenching and excavation are often the cause of root damage to trees. Refer to ArborSafe's Guide – Tree protection during construction or the Australian Standard AS 4970–2009: *Protection of Trees on Development Sites* for things to consider when performing construction activities near trees.

Everyday activities such as grass cutting via mowing or brush cutters can result in serious root damage or wounding to the lower trunk. Young trees with their trunks damaged by machinery often need replacing, while damage to the trunks and/or surface roots of established trees is not only detrimental to tree health but can also result in costly repairs to machinery.

Another advantage to mulching around the trunk and root crown is that it limits damage to both parts from mowing equipment. This in turn reduces mechanical damage and compaction.

Figure 16. An example of damage to tree roots caused via mowing. (Luke Dawson, June 2017).

Figure 17. Image showing wound caused to upper portion of surface root by mower. (Luke Dawson, June 2017).

4. How to avoid root and trunk damage

The following points serve to highlight ways to avoid damage to tree roots and trunks caused via grass cutting activities:

- Mulching around young and established trees negates the need for brush cutter and/or lawn mower use around the base of a tree. Mulching therefore not only creates a barrier between tree roots and trunk that are susceptible to damage, it improves soil condition, minimises soil compaction and decreases the total area required for mowing.
- Where mulching is not feasible, raising the cutting height of mowers and maintaining grass at a greater height can avoid unnecessary 'scalping' of roots and damage to mowers/blades.
- Where surface roots are located away from the trunk and in a location where neither the application of mulch nor the raising of mower height is inappropriate, it may be possible to raise the soil grade directly around the root/s to minimise damage. It is important that the application of new material does not result in significant changes to the soil profile that may inadvertently damage roots. Material applied should be permeable and allow the development of turf which will protect the roots. Coarse sand or a planting mix with a high sand to organic matter ratio (e.g. 80/20 mix) spread at a depth of 75–100mm could suitably protect the surface root from damage, while allowing turf to redevelop within the area.
- ArborSafe is able to answer any questions regarding the material, depth and method of application to be used to ensure the tree/s remain viable for the long-term.

Appendix E. 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	Recommendation
1	*Corymbia citriodora*	Lemon-scented Gum	1	69	85	8.3	215.38	3.1	15-20	10-15	Fair	Fair	Semi-Mature	10-15	Crossing/rubbing branches; Deadwood/stubs > 100mm; Dieback; Previous failure(s); Resin exudation/kino; Soil compaction;	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Tree showing signs of reduced health/vigour. Evidence of previous limb failure(s).	B	2	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
2	*Corymbia citriodora*	Lemon-scented Gum	1	41	52	4.9	76.05	2.5	15-20	5-10	Fair	Fair	Semi-Mature	10-15	Co-dominant stems; Deadwood/stubs < 30mm; Inappropriate location;	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Located in close proximity to adjacent inspection pit. Contacting pole at base.	B	2	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
3	*Corymbia ficifolia (hybrid)*	West Aust. Red Flowering Gum	1	30	35	3.6	40.72	2.1	5-10	5-10	Fair	Fair	Semi-Mature	10-15	Co-dominant stems; Deadwood/stubs < 30mm; Dieback; Epicormic growth;	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Tree showing signs of reduced health/vigour.	C	1	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
4	*Corymbia citriodora*	Lemon-scented Gum	1	50	63	6.0	113.10	2.7	15-20	10-15	Fair	Fair	Semi-Mature	10-15	Deadwood/stubs < 30mm; Dieback; Exposed root(s); Mechanical damage to root(s); Soil compaction;	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Tree by entrance way showing signs of reduced health/vigour.	B	2	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
5	*Ficus microcarpa var. hillii*	Hill's Weeping Fig	1	127	137	15.0	706.86	3.8	10-15	15-20	Fair	Fair	Mature	10-15	Co-dominant stems; Damaging infrastructure; Deadwood/stubs > 30mm; Decay; Dieback; Disease pathogens; Exposed root(s); Hanger(s); Included bark; Major root damage/severance; Mechanical damage to root(s); Poor pruning; Soil compaction; Wound(s);	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : An estabilised tree located within existing parking area exhibiting exposed/damaged roots, minor sooty mould and noticable crown thinning/die back possibly associated with root damage/soil compaction. Site observations would indicate that significant roots extend well beyond dripline under existing surfacing.	B	2	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
6	*Ficus microcarpa var. hillii*	Hill's Weeping Fig	1	106	99	12.7	508.30	3.3	15-20	15-20	Good	Fair	Mature	15-25	Co-dominant stems; Damaging infrastructure; Deadwood/stubs > 30mm; Disease pathogens; Included bark; Mechanical damage to root(s); Previous failure(s); Soil compaction; Wound(s);	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Tree located within existing parking area showing signs of good health and vigour despite minor sooty mould affliction and possible sun scorch in upper crown. Evidence of previous scaffold limb failure/vehicle impact on lower stem. Roots lifting adjacent asphalt seal.	B	12	Retain tree with specific protection requirements (i.e. Generic measures plus supervision of works within the TPZ and/or use of root sensitive construction techniques).
7	*Jacaranda mimosifolia*	Jacaranda	1	38	44	4.6	65.33	2.3	5-10	5-10	Fair	Poor	Semi-Mature	10-15	Co-dominant stems; Decay; Epicormic growth; Exposed root(s); Poor pruning; Weak union(s); Wound(s);	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Tree form has been diminished by historic lopping practices.	C	12	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
8	*Jacaranda mimosifolia*	Jacaranda	1	55	55	6.6	136.85	2.6	5-10	5-10	Fair	Poor	Semi-Mature	10-15	Co-dominant stems; Crack(s)/split(s); Crossing/rubbing branches; Decay; Epicormic growth; Poor pruning; Soil grade changes; Weak union(s); Wound(s);	Attractive landscape feature; Amenity value/shade;	26-11-2020 : Nick Arnold : Form has been diminished through historic lopping practices and clearances for adjacent overhead lines. Additional evidence of soil grade changes.	C	12	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.
9	*Callistemon sp.*	Bottlebrush	1	45	47	5.4	91.61	2.4	5-10	5-10	Fair	Fair	Semi-Mature	5-10	Co-dominant stems; Crossing/rubbing branches; Decay; Epicormic growth; Poor pruning; Wound(s);	Amenity value/shade; Screen value;	26-11-2020 : Nick Arnold : Historic lopping has dimished form and likely reduced ULE.	C	2	Remove - tree located within proposed development footprint or has major encroachment into its TPZ.

ArborSafe

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