

15th February 2018

Steven Morrissey
Parks & Gardens Supervisor
Town of Bassendean
PO Box 87
BASSENDEAN WA 6934



Dear Steve,

ARBORICULTURAL REPORT FOR SHACKLETON STREET BASSENDEAN

Please find enclosed the results of the arboricultural assessment undertaken recently for the proposed upgrade at Shackleton Street, Bassendean.

Where remedial arboricultural work is to be undertaken for cultivated urban trees it is imperative that it is undertaken as outlined in the Australian Standard 4373-2007: Pruning of Amenity Trees and/ or Australian Standard 4970-2009: Protection of Trees on Development Sites. It is also strongly advised that any remedial pruning works be undertaken by, or supervised by, a qualified arborist (AQF Level 3 in Arboriculture).

If you have any questions regarding the assessment or if I can be of service to you again in the future, please feel free to contact me.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'BB', with a long horizontal stroke extending to the right.

Brad Bowden
Principal
Bowden Tree Consultancy®

B.Sc. Sustainable Forestry
Dip. Arboriculture & Parks Management
ISA Certified Arborist – Municipal Specialist AU-0020AM & Tree Risk Assessment Qualified (TRAQ)

1.0 Introduction

1.1 Scope of Report

1.2 The purpose of this report is to summarise the results of the assessment undertaken recently for the proposed streetscape upgrade at Shackleton Street, Bassendean, and to provide comment regarding tree selection and establishment for the central median island tree planting. The site visit and assessment was undertaken on the 12th February 2018 and was accurate at the time of inspection. The project brief issued by the Town of Bassendean is detailed below.

1.3 Project Brief to identify suitable trees for Shackleton Street median island plantings.

The Council adopted *Street Tree Master Plan – Tree Species Information* states in part, that alternative trees can be selected so long as the tree selection criteria is used in consultation with an Arborist for the specific location, in order to minimise future expenditure on tree related issues due to inappropriate or high risk, high maintenance species being planted.

Council adopted a following criteria for selecting street trees:

- ‘Boulevard’ style streetscapes;
- Biodiversity corridors;
- Historical, cultural or natural association;
- Form and scale;
- Impact on utility services;
- Drought tolerance;
- Performance record;
- Response to pruning;
- Planting tolerance in paved areas;
- Resistance to pest and diseases;
- Verge widths;
- Long lived; and
- Limb shear.

The Town is seeking an Arborist to inspect Shackleton Street and evaluate the proposed road layout drawing TOB5-2017-30 Sheet 1 of 15 using the above Council adopted street tree selection criteria and in addition consider the following median island criteria:

- Soil conditions of this site;
- Propose subsurface root management;
- Tree trunk diameter at maturity;
- Central island tree protection measures;
- Trees at maturity shall grow high enough to provide shade canopy over a large portion of the road - contribute to reducing the urban heat load;

- Formative tree structure pruning to prevent damage to tree canopy and /or damage to trucks when using the road carriageway;
- Management of leaf debris;

It is important that a suitably sized tree can be sourced for the proposed planting bays and that the sourced trees are healthy and will establish to create an attractive streetscape.

2.0 Site Investigation

2.1 Streetscape Enhancement & Tree Installation

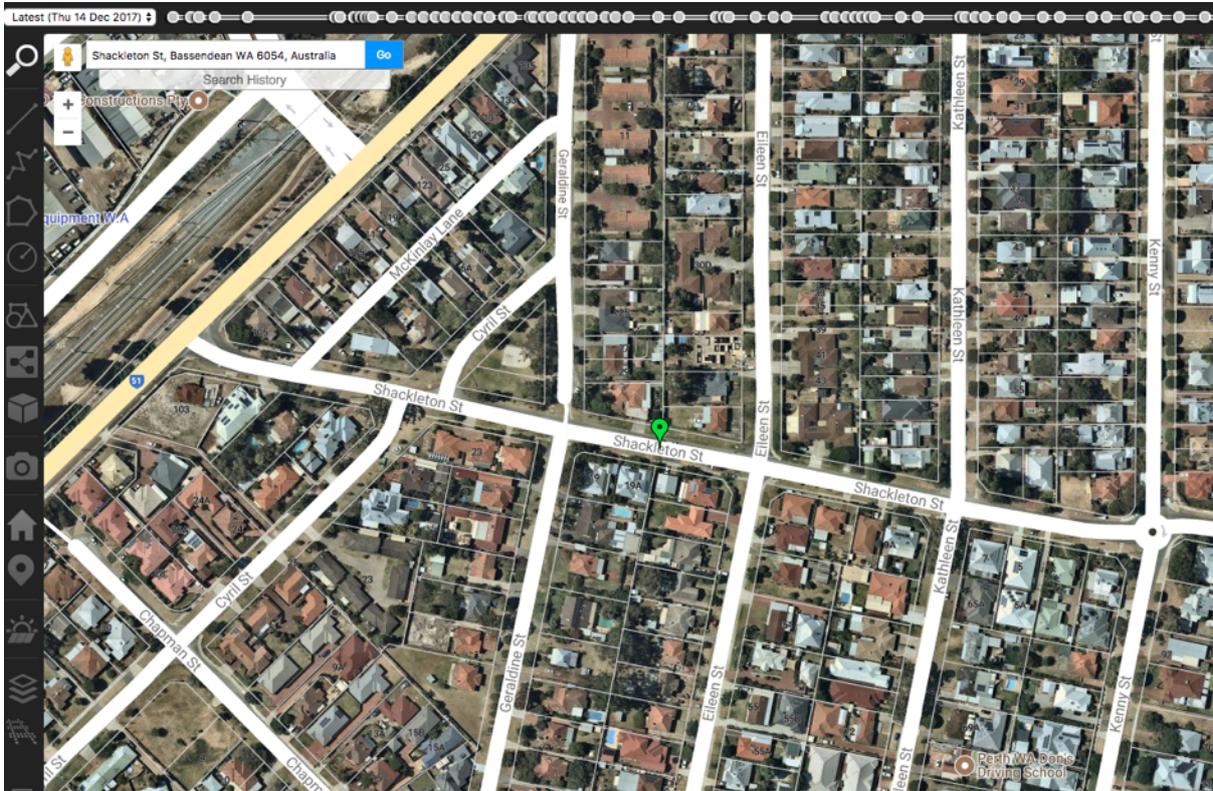


Figure 1. Aerial photo of site, with the planned upgrade for Shackleton Street to occur between Guildford Road and Kenny Street and include tree planting within the proposed central median islands.

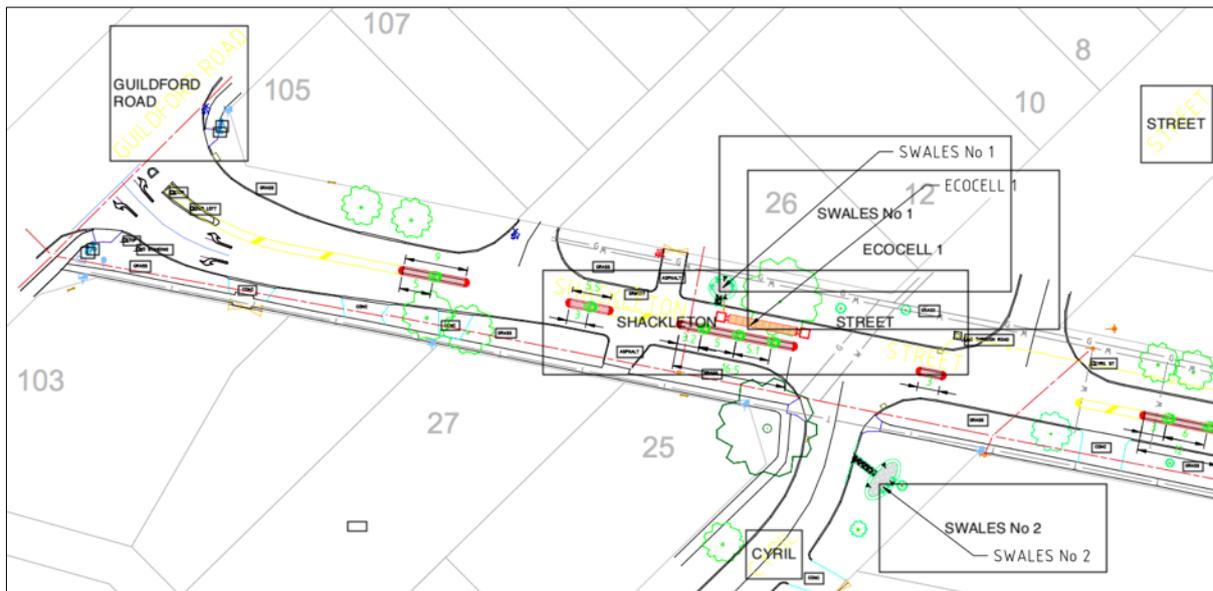


Figure 2. Approximately 26 trees are proposed for installation within the central median traffic islands, and include individual trees as well as groups of two, three and four trees.



Figure 3. Shackleton Street, Bassendean streetscape; looking towards the west.



Figure 4. Shackleton Street, Bassendean streetscape; looking towards the east.

2.2 Comments

- 1. Soil conditions:** Soil type for the location is Bassendean sands, a free-draining yet infertile soil (nutrients generally leached from the upper soil profile adjacent to the ground surface down to the deeper levels beyond the rootplate). The streetscape/ road location is a highly modified environment in which the capacity for water infiltration, nutrient integration and oxygen diffusion (aeration) have been significantly altered, and in many instances, result in conditions unfavourable for new tree establishment and subsequent growth. The specification of woodchip mulch as the final surface treatment will provide the optimal growing conditions at the tree installation stage and into the long term.
- 2. Excavation of the existing soil within the proposed central medians of 0.5-1m and replacement with an enriched landscaping soil mix provides the most preferable option for improving the soil nutrient status, improving the likelihood for successful tree establishment, and boosting tree performance. Alternatively, enhancement of the existing soil profile utilising soil improvers and composts incorporated into the upper level of the soil profile provides another less intensive option. Improvement of the soil into which the new trees will be installed will improve the water holding capacity, availability of nutrients, and better the existing soil aeration; subsequently improving the likelihood of successful tree establishment and mitigating the requirement for replacement trees (and additional costs), thereby providing a greater return on investment.**
- 3. Tree roots:** Root growth is opportunistic, and roots will proliferate in areas with adequate moisture, aeration (oxygen) and nutrient levels - all of which are required to attain sufficient levels of growth. Root barriers and root directors provide short-term control measures only to manage root growth as trees are self-optimising and adaptable – with an increase in tree height and spread so too will the rootplate. Rootplate orientation is likely to be linear initially however may extend laterally with tree growth and maturity. Root/ kerb/ asphalt conflicts are highly probable in the long term and cannot be prevented, and are deemed normal where tree installation into such locations occur. Such conflicts should be dealt with as they arise and future remedial works may include minor root pruning and/ or kerb or asphalt replacement.
- 4. Tree protection:** Central island protection measures are required to alleviate the potential for collision injury and/ or stem breakage following vehicle impact. The use of bollards (wood or steel) at the median island ends and preferably several metres from each tree is expected to be sufficient to mitigate the potential for vehicle follow-through damage in the event of collision, and together with concrete kerbing, generally provides sufficient protection for advanced trees in residential streets with low speeds i.e. <50 km/h.

5. **Species selection:** The selection of an appropriate species for the location provides the best approach to mitigate tree/ infrastructure conflicts into the future. With 1.2m identified as the central median width, tree selection should seek to specify a species that attains a trunk diameter at maturity of approximately 50cm. Where a larger species is desired for shade and other tree-related benefits, an allowance (expectation) must be made for future median repair/ modification/ increase in width as the tree matures. The tree selection process should also avoid species known to possess a vigorous rootplate such as *Casuarina* spp., *Ficus* spp., *Tipuana tipu* etc.

6. **Tree species:** The following medium-sized trees are generally of uniform crown shape and could be considered for installation within the proposed central median/s, and include a range of deciduous (D) and evergreen (E) species. In addressing the abovementioned site-specific criteria, the broad-leaved paperbark tree is subsequently recommended for selection as the median tree species for the Shackleton Street upgrade project. Should the paperbark tree not be available from local nurseries, consideration should be given to alternative trees from the list below ranked in order of priority for selection:
 1. broad-leaved paperbark (*Melaleuca quinquenervia*) E
 2. yellow bloodwood (*Corymbia eximia*) E
 3. kurrajong (*Brachychiton populneus*) E
 4. oriental plane tree (*Platanus orientalis*) D
 5. jacaranda (*Jacaranda mimosifolia*) D/E
 6. callery pear (*Pyrus calleryana*) D
 7. Japanese zelkova (*Zelkova serrata*) D
 8. Chinese elm (*Ulmus parvifolia*) D
 9. box elder (*Acer negundo*) D



Figures 5 & 6. Wherever possible, specification of woodchip mulch as the surface treatment will provide the optimal growing conditions at the tree installation stage and into the long term, for a single tree (top image) as well as for multiple trees (bottom image) within a central median island.



Figure 7. For the majority of tree species, the likelihood of successful establishment following installation into a site that consists almost entirely of hard impermeable surfacing is low (and should be avoided); additionally, such conditions increase stress and predispose trees to pest and disease outbreaks and reduced growth rates.



Figure 8. Permeable paving provides an option for hard surfacing that improves water infiltration and aeration to the soil profile (and tree roots) below, subsequently increasing tree growth rates and boosting performance.



Figure 9. Root barriers and root directors (above) provide short-term control measures only for root growth, as trees are self-optimising and adaptable, and with an increase in tree height and crown spread so too will the rootplate size increase.



Figure 10. Selecting the correct tree species for the site is imperative to alleviate the potential for root/ surface conflicts in the long term; above – the large maturing lemon-scented gum (*Corymbia citriodora*) incorrectly selected for a very narrow car park median island, whilst insufficient planting hole preparation is also highly probable.



Figure 11. A combination of bollards (wood or steel) together with concrete kerbing generally provides sufficient protection for new trees in residential/ commercial streets with low traffic speeds i.e. <math>< 50\text{ km/h}</math>.



Figure 12. Placement of trees several metres away from the ends of the central median islands provides another technique to mitigate the potential for tree damage/ loss resulting from vehicle impact, and in doing so may reduce the total number of trees identified in the original design.

3.0 Discussion and Recommendations

3.1 Discussion

- 3.2 Tree root plate:** Root plate composition for most tree species consists of a structural root zone and an absorbing root zone, responsible respectively for the stability/ anchorage of the tree and the uptake of water/ mineral solutes from the soil. Severance of the large diameter woody roots within the structural root zone (the root plate area immediately adjacent to the tree and generally determined as trunk diameter x 5) can compromise tree stability and must be avoided. It can also result in the loss of a significant proportion of the fine, water-absorbing roots, subsequently placing considerable stress on the tree in the short term and may initiate a decline in health condition and/ or tree mortality. The severance of large diameter roots also provides an entry opportunity for infection by wood decay fungi and infestation by wood-destroying insects, increasing the potential for the degradation of wood tissue at the root collar and trunk basal area and compromising tree stability in the long term.

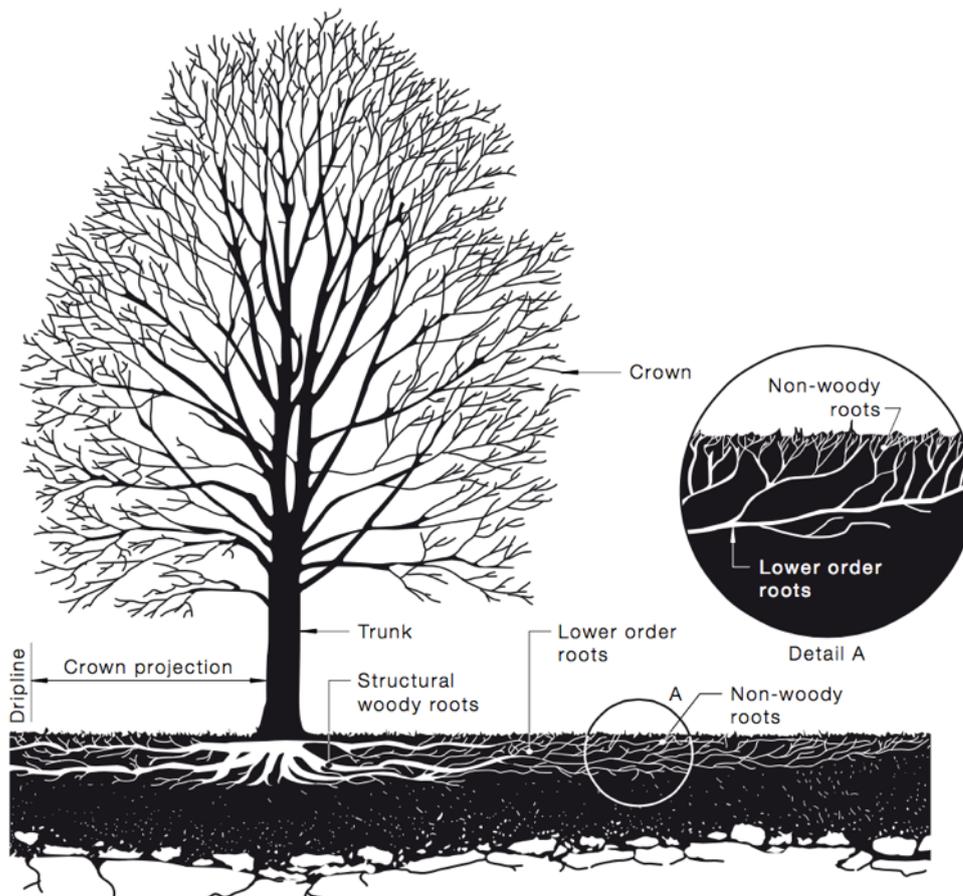


Figure 13. Typical tree structure above and below ground for cultivated urban trees. Source: AS4970-2009: Protection of Trees on Development Sites.

- 3.3 Tree benefits:** Mature urban trees confer many benefits including shade and cooler air temperatures, screening (privacy) and noise reduction, built form aesthetic amelioration, energy conservation, mitigation of the urban heat island effect, air quality improvement and oxygen production, carbon uptake/ storage and greenhouse gas reduction, minimisation of storm water run-off and improvement of water quality, fauna habitat and food source. In general, they enhance our built and natural environments with larger trees providing more benefits.
- 3.4 Advanced trees:** New tree installations should be advanced specimens of high quality, i.e. a well tapered trunk with no need of additional support or staking, an evenly balanced crown in proportion to the root ball, a crown free of branch inclusions/ v-shaped unions and multiple leaders, be actively growing with seasonal new growth, free from insect infestation and fungal pathogen attack, and have a root system free of girdling surface roots. Trees that possess the abovementioned defects should not be planted, and either be discarded or returned to the nursery, as such defects will contribute to premature tree failure in the future.
- 3.5 Recommendations**
- 3.6** Tree selection in the nursery should be undertaken by a qualified arborist or other suitably competent person to ensure structurally-sound and defect-free trees are selected for the median island installation. Whether 45L (~1m in height) or 100L (1.5-2m in height) containerised trees are selected, it is imperative that installation at the correct depth is undertaken to ensure the top of the rootball is level with the existing grade, as planting too deep can restrict aeration and have a profound negative effect on tree establishment.
- 3.7** Root directors can be used to direct initial root growth downwards with the size of root director determined by the size of the tree used. Root barrier can also be used parallel to the kerbing inside of the central median island planting hole/ pit, to mitigate the potential for adventitious root growth into the asphalt/ road base interface – an area where moisture may persist following rainfall events. N.B. Root barriers and root directors provide short-term control measures only, and seeking to constrain rootplate extension entirely will result in smaller trees often of poor health and low quality. Minor tree/ infrastructure conflicts must be expected/ tolerated and remedied as required to experience the benefits that urban trees provide.
- 3.8** Road width was measured at 7m whilst width from the northern property boundary to the low-voltage powerlines on the south side was measured at 16m. With tree selection often being a subjective decision following site-specific criteria being satisfied, it is recommended that a medium-sized tree species be selected that fully utilises the available space for crown growth, as larger trees provide more benefits to the surrounding urban environment.

4.0 Appendix I

4.1 Arboricultural Terminology

- 4.2 Crown – the leaves and branches of a tree measured from the lowest branch on the trunk to the top of the tree, whilst crown lifting involves pruning of the lower branches to improve clearance for buildings, pedestrians, vehicles etc.
- 4.3 DBH - diameter of the main trunk, measured at breast height approximately 1.4m above ground level for urban trees.
- 4.4 Deadwooding – the removal of dead, diseased or damaged branch wood from the crown of the tree.
- 4.5 Dripline – the width of the crown of the tree measured by the lateral extent of the foliage, with the crown spread measurement indicating the widest part.
- 4.6 Fall zone – is the area in which the tree or tree part is likely to fall when it fails, often calculated as 1.5 times the tree height where brittle dead branches etc. may break up and scatter debris.
- 4.7 First order structural branch – the large branches arising from the trunk that form the main structure of the crown.
- 4.8 Reduction prune – pruning to reduce the extension of a branch, back to a lateral branch that is at least one-third the diameter of the branch being removed.
- 4.9 Root collar – area at the base of the tree where the roots and trunk merge.
- 4.10 Second order branch – a branch arising from a first order structural branch.
- 4.11 Targets – an object, person or structure that would be damaged or injured in the event of tree or branch failure is referred to as the target or target area. The hazard evaluation of the target area is relative to the expected use and occupancy of that area.
- 4.12 Topping and Lopping – deleterious tree height and branch reduction work often at indiscriminate points and generally resulting in weakly-attached regrowth branches prone to failure as subsequent growth occurs.
- 4.13 Tree Protection Zone (TPZ) – the zone of the root plate most likely to contain roots that are critical for anchorage and stability, as well as the absorbing roots responsible for the uptake of water and nutrients; calculated as trunk diameter (DBH) x 12.
- 4.14 V-shaped union – ingrown bark from adjacent parts of the tree that are in contact with each other; usually branch forks, acutely-angled branch attachments or basal stems – often a high failure potential.

5.0 Appendix II

5.1 Author Formal Qualifications

- 5.2 Bachelor of Science (Sustainable Forestry) – 2012
Edith Cowan University, Joondalup & Murdoch University, Murdoch, WA.
- 5.3 Diploma of Applied Science (Horticulture) – 2000
Major studies Arboriculture and Parks/ Gardens management
University of Melbourne, Burnley campus, VIC.
- 5.4 Certificate IV (TAE40110) in Training & Assessment – 2014
Plenty Training, Robina, QLD.
- 5.5 Certificate of Horticultural Practice – 1994
Challenger TAFE, Murdoch campus, WA.

5.6 Additional Certifications

- 5.7 ISA Certified Arborist Municipal Specialist (AU-0020AM) - 2012
International Society of Arboriculture
www.isa-arbor.com/certification/benefits/credentialsExplained.aspx
- 5.8 ISA Tree Risk Assessment Qualification (TRAQ) - 2013
International Society of Arboriculture
<http://www.isa-arbor.com/certification/becomequalified/becomequalified.aspx>

5.9 Limitation of Liability

- 5.10 Bowden Tree Consultancy are tree specialists who use their qualifications, education, knowledge, training, diagnostic tools and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of this assessment and report.
- 5.11 Bowden Tree Consultancy cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways that the arboriculture industry does not fully understand. Conditions are often hidden within trees and below ground. Unless otherwise stated, observations have been visually assessed from ground level. Bowden Tree Consultancy cannot guarantee that a tree will be healthy or a low risk of harm under all circumstances, or for a specified period of time. Likewise, remedial treatments cannot be guaranteed.
- 5.12 Treatment, pruning and removal of trees may involve considerations beyond the scope of Bowden Tree Consultancy's service, such as property boundaries and ownership, disputes between neighbours, sight lines, landlord-tenant matters and other related incidents. Bowden Tree Consultancy cannot take such issues into account unless complete and

accurate information is given prior or at the time of the site inspection. Likewise, Bowden Tree Consultancy cannot accept responsibility for the authorisation or non-authorisation of any recommended treatment or remedial measures undertaken.

- 5.13 In the event that Bowden Tree Consultancy recommends retesting or inspection of trees at stated intervals, or installs any cable/s, bracing systems and support systems, Bowden Tree Consultancy must inspect the system installed at intervals of not greater than 12 months, unless otherwise specified in written reports. It is the client's responsibility to make arrangements with Bowden Tree Consultancy to conduct the re-inspection.
- 5.14 Trees can be managed, but they cannot be controlled. To live or work near a tree involves a degree of risk. All written reports must be read in their entirety; at no time shall part of the written assessment be referred to unless taken in full context with the whole written report. If this written report is to be used in a court of law, or any other legal situation, Bowden Tree Consultancy must be advised in writing prior to the written assessment being presented in any form to any other party.

5.15 Business Details

- 5.16 Bowden Tree Consultancy®
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5.17 Literature Cited

- 5.18 Baxter, N., (2018). *Site Plan Sketch TOB 5-2017-30*, (pers. comm.).
- 5.19 Powell, R., (1990). *Leaf and Branch*. Perth WA: Department of Conservation & Land Management.
- 5.20 Standards Australia, (2009). *AS4970-2009 Protection of Trees on Development Sites*, Sydney: SAI Global
- 5.21 Standards Australia, (2007). *AS4373-2007 Pruning of Amenity Trees*, Sydney: SAI Global
- 5.22 Town of Bassendean, (2018). *Street Tree Masterplan – Tree Species Info*. Sourced: <http://www.bassendean.wa.gov.au/greening-bassendean.aspx>