29th January 2021

Jerry Hutter
Supervisor Horticulture
City of Kalamunda
PO Box 42
KALAMUNDA WA 6926

Dear Jerry,

ARBORICULTURAL ASSESSMENT AT THE KALAMUNDA HISTORY VILLAGE

Please find enclosed the results of the arboricultural assessment undertaken recently for the tree adjacent to the toilet block at the Kalamunda History Village, Kalamunda.

Where recommendations for remedial arboricultural work have been made, it is imperative that it is undertaken as outlined in the Australian Standard 4373-2007: Pruning of Amenity Trees. 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,

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 arboricultural assessment and provide recommendations for the mature marri tree (*Corymbia calophylla)* located adjacent to the toilet block (east side) within the Kalamunda History Village, at Williams Street, Kalamunda. The site visit and visual tree assessment was undertaken from ground level on the 20th January 2021 at 1330hrs and was accurate at the time of inspection. No soil excavation or below ground level inspection was undertaken unless specified. Viewing conditions were fine.

1.3 Concern has been raised regarding tree condition following the identification of fungal canker infection at the trunk basal area and subsequent impact on the structural condition of the tree. This report should be read in conjunction with the PiCUS sonic tomography report dated 20th January 2021 which summarises the further investigation testing undertaken at the trunk basal area to evaluate the internal wood condition.

1.4 Executive Summary

1.5 The local-native tree identified within this report provides a range of benefits to the ecosystem, to human beings for environmental and health reasons, and to the climate. Assessment has revealed a compromised structural condition attributable to acutely-angled stem attachments and marri canker infection, whilst degradation resulting from termite activity and wood decay fungi was also observed. Tree health condition was assessed as average-high (reduced) and is indicative of the capacity of the tree to produce new response growth and woundwood.

1.6 Where tree retention is desired, it is recommended to undertake the installation of a cable brace within the upper crown to provide supplementary support to the codominant stem union, to mitigate the potential for stem union failure. Additionally, deadwooding works are recommended to remove the large dead branches from the crown of the tree and reduction pruning to shorten the length of a marri canker infected branch.

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2.0 Site Observations

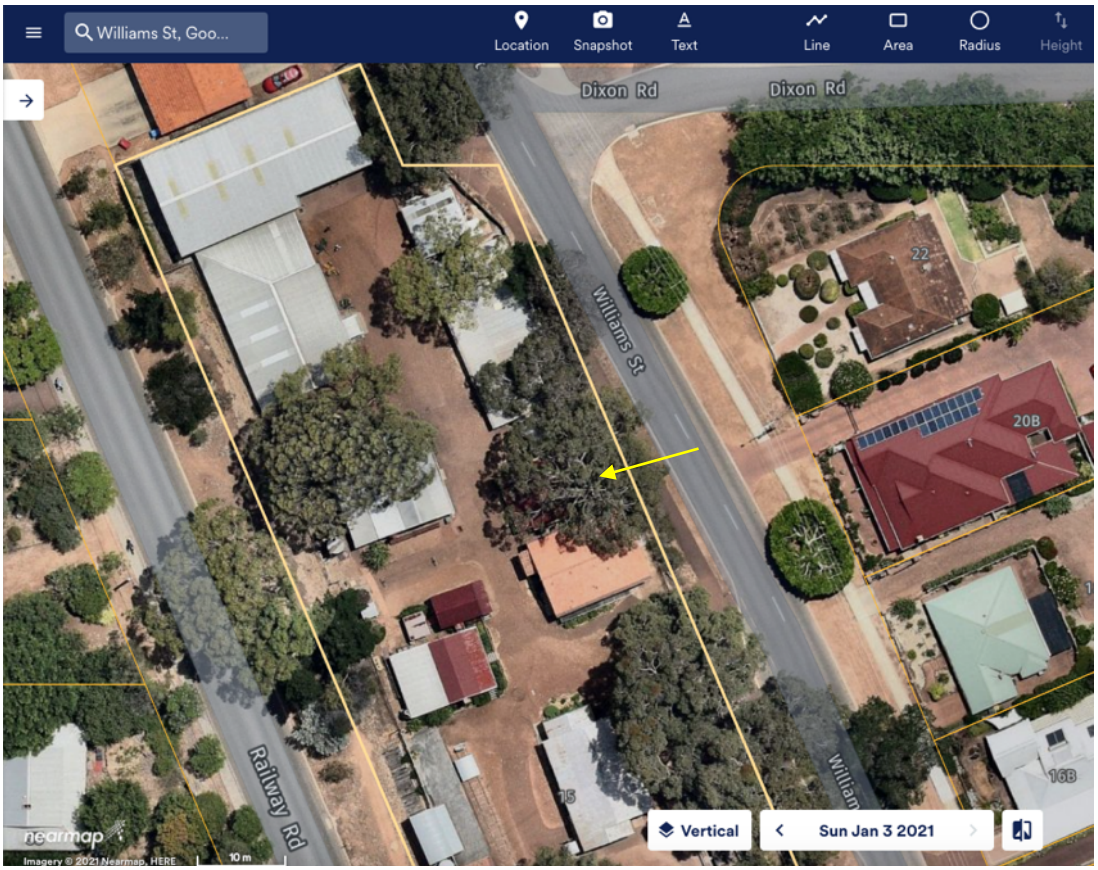

Figure 1. Aerial photo of site and location of the assessed tree (see arrow).

Figure 2. Assessed tree (see arrow); looking towards the southeast.

Assessed Tree:	**Botanical Name:** *Corymbia calophylla*
Common Name:	marri
Location:	Toilet block area - east side
Height:	23.5m
DBH:	129cm
Crown Spread (NS/ EW):	19/19m
Structure:	Fair
Health:	Average-High
Comments:	

- Adequate trunk basal flare was evident with buttressing visible and several minor surface roots were observed on the west side of the tree
- Extensive (primary) infection by the marri canker fungal pathogen (*Quambalaria coyrecup)* was evidenced by a large wound at the root collar and trunk basal area on the west side, resulting in necrosis of the vascular tissue and exposure of the sapwood, and subsequently providing an entry opportunity for infection by wood decay fungi and/ or infestation by wood-destroying insects/ termites
- Closer inspection within the large wound revealed wood decay, active termite infestation and additional infection by a resupinate fungus likely to be *Macrohyporia* sp. (further investigation required to confirm)
- Infection by the marri canker fungus was visible extending into the union of the three codominant stems however sounding with a nylon hammer failed to reveal tonal variations indicative of a thin stem wall or significant internal wood decay
- Further investigation using PiCUS sonic tomography revealed the trunk section to have 94% solid wood and 1% damaged wood, with degradation revealed predominantly within the central part of the test cross section
- The trunk forked at approximately 2m above ground level and whilst no structurally compromised v-shaped unions were observed, the stem attachments were acutely-angled i.e. limited space for normal secondary thickening of the stem attachments
- Naturally occurring dead branches to approximately 150mm in diameter were evident throughout the crown, with such branches overhanging and/ or with an orientation of fall towards the adjacent building roofs
- Previous crown lifting pruning works were evident predominantly on the west side to improve clearance above the buildings
- Marri canker infection was also evident within the middle crown on the west side of the tree, and located within a branch union - potentially compromising the structural integrity of the branch attachment
- Foliage size, colour and density was normal, and no significant foliar insect infestation and/ or disease infection symptoms were visible on sample foliage within the lower crown

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Figure 3. **Extensive infection by the marri canker fungal pathogen was evidenced by a large wound at the root collar and trunk basal area, resulting in necrosis of the vascular tissue and exposure of the sapwood, and subsequently providing an entry opportunity for infection by wood decay fungi and/ or infestation by termites; looking towards the southeast.**

Figure 4. **Closer inspection within the large wound revealed wood decay, active termite infestation and additional infection by a resupinate fungus likely to be *Macrohyporia* sp.; looking towards the east.**

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Figure 5. **The trunk forked at approximately 2m above ground level and whilst no structurally compromised v-shaped unions were observed, the stem attachments were acutely-angled with limited space for normal secondary thickening; looking towards the northwest.**

Figure 6. **Marri canker infection was evident (see arrow) within the middle crown on the west side within a branch union - potentially compromising the structural integrity of the branch attachment; looking towards the southeast.**

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3.0 Discussion and Recommendations

3.1 Discussion

3.2 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.

3.3 Tree risk: Tree failure is an infrequent occurrence and serious damage, injury or death from tree failure is rare (Lilly *et al*, 2011). Research finds that for Britain, with a population of 60 million people, the risk of any tree causing a fatality is exceedingly small (Ball & Ball-King, 2011). It is impossible to maintain trees completely free of risk and some level of risk must be accepted to experience the benefits that trees provide. The use of 'safe' or 'unsafe' when assessing trees is both imprecise and ambiguous, as a tree cannot be free from defects or potential hazards - such a state is simply unattainable. It is essential to maintain a balance between the benefits and costs of risk reduction, not only financial cost but also the loss of amenity and other tree related benefits.

3.4 Cable bracing: Cable bracing involves the installation of hardware within the crown of a tree to provide supplementary support by limiting the movement of stems and branches with weakened attachments. Non-invasive dynamic cables such as Yale Brace ™ or Cobra Cable ™ are predominantly used with the selected tensile strength of the installed cable being based on diameter of the stem (or branch) being supported: 2-tonne cables generally used for stems with a diameter less than 45cm at the stem attachment and 4-tonnes cables for a stem diameter greater than 45cm. Additionally, 8-tonne cables are available for exceptionally long and heavy stems and branches.

3.5 The cable is installed at a distance/ height that is approximately two-thirds the distance from the stem/ branch union out to the end of the stem/ branch. Whilst cable bracing is used generally between two stems/ branches, triangular configurations as well as more intricate spider or spoke configurations are also used when several compromised stems are to be supported. The intention of the non-rigid cable brace is to act as a catch belt in the event of excessive movement or separation at the stem/ branch unions prior to failure; therefore the cable tension should be relaxed (not taut) during normal weather conditions.

3.6 Termites: Treatments for the control of the active termites in mature trees should be non-invasive and avoid creating further damage to the tree. The treatment should avoid drilling into the live tissue of a tree as this can increase the potential for infection by wood decay fungal pathogens and additional

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insect pests – further compromising tree structure and stability. Options for chemical treatment of termites include:

- Bait stations - termites concentrate at the bait station, ingest the chemical and transport it back to the colony
- Dusting – a chemical dust is applied directly to foraging termites within a mound and it is carried back into the colony
- Barrier treatment – a chemical barrier is applied in such a location i.e. along a property boundary that foraging termites would pick up the chemical and transport it back to the colony

In all cases the termite colony/ mound where it is visible should be destroyed and removed. N.B. Chemical treatments should only be applied by licensed pest controllers.

3.7 Recommendations

3.8 Undertake the installation of a non-invasive 4-tonne cable brace such as Yale brace in a triangular configuration at a height of approximately 16m above ground level, to provide supplementary support to the three codominant stems.

3.9 Undertake deadwooding to remove the dead branches greater than 50mm in diameter from the crown of the tree. N.B. Broken branch stubs of nominal length in native tree species have the potential to provide food source, roost sites and habitat and can be retained to assist a range of local native fauna.

3.10 Undertake reduction pruning by 1-2m within the middle crown on the west side to reduce branch length (see figure 6 for branch with canker infection within union) and alleviate end weight and loading on the branch attachment - to mitigate the potential for branch failure.

3.11 Undertake a non-invasive, no drill treatment for control of the active termite infestation. Such treatment may include dusting and/ or the installation of bait stations, and should be undertaken by a licensed pest controller.

3.12 Consider further investigation in 12 months using PiCUS sonic tomography at the trunk basal area to evaluate the rate of degradation and/ or production of response growth (new wood).

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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 were the roots and trunk merge.

4.10 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.

4.11 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.

4.12 Tree Protection Zone (TPZ) – the zone of the root plate most likely to contain roots that are critical for anchorage and stability (structural root zone – SRZ, generally calculated as trunk diameter x 5) and the absorbing roots responsible for the uptake of water and nutrients collectively; calculated as trunk diameter (DBH) x 12.

4.13 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.

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4.14 Tree Structure and Health

4.15 The structural condition ('Structure') for each tree or group of trees has been assessed using the following qualitative criteria:

- Good – generally free of structural defects
- Fair – defects evident that may be typical for the species and age class, and which could be corrected through remedial pruning works
- Poor – significant defects that are not likely to be corrected through remedial pruning or arboricultural works
- TBA – to be assessed, requiring further investigation to evaluate tree structural condition

4.16 The vitality ('Health') for each tree or group of trees has been assessed using the following qualitative criteria:

- High – consistent crown density and foliage colour, good shoot extension and an insignificant number of naturally-occurring internal dead branches
- Average – crown condition that may representative for the species and/ or seasonal, possessing satisfactory shoot extension and/ or minimal decline and dead branches
- Low – poor shoot extension, sparse crown density and not likely to be corrected through improvement of site resources and plant nutrition
- Moribund – final stages of a decline spiral

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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 (recertified 2018)
International Society of Arboriculture
www.isa-arbor.com/certification/benefits/credentialsExplained.aspx

5.8 ISA Tree Risk Assessment Qualification (TRAQ) – 2013 (recertified 2018)
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

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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 Ball, D.J. & Ball-King, L. (2011). *Public Safety and Risk Assessment.* Great Britain: Earthscan

5.19 Lilly, S., Matheny, N. & Smiley, E., (2011). *Best Management Practices - Tree Risk Assessment*, Champaign, IL: International Society of Arboriculture

5.20 Mattheck, C. & Breloer, H. (1994). *The Body Language of Trees - A Handbook for Failure Analysis*. London, England: The Stationery Office.

5.21 Standards Australia, (2007). *AS4373-2007 Pruning of Amenity Trees*, Sydney: SAI Global

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