Arborist Assessment Report

Prepared for

Tamworth Regional Council

PROJECT DSJN1429

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Site Address: King George Ave Tamworth

Date of Inspection: 12th of November 2022

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PREPARED BY

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Tree Contractors Association Australia Inc
A National Tree Amenity Industry Body

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SUMMARY

McArdle and Sons Arboricultural Services Pty Ltd has been engaged by TRC to prepare this Tree Assessment Report. Consulting AQF 5 Arborist Mr Dan McArdle conducted the evaluation on the 12th of November 2022.

This report is relevant to 48 mature Quercus *robur* trees located on the southwest side of the roadway of King George V Avenue Tamworth. King George V Avenue these trees were gazetted and listed on the State Significate Register (Listing No.01922) in March 2014.

Three alignments have been proposed by TRC for the construction of a concrete path from Paradise Bridge to Campbells Road Reserve approximately 2km in length.

- Option 1: **Between existing power poles and trees**: *Involves the construction of a concrete path approximately 500mm offset from the line of the power poles, leaving 2-3m offset from the edge of the path to the tree line. (Fig 6 for basic concept)*

- Option 2 **Adjacent to the fence line with the overhead power relocated**: Option 2 *would see the overhead power line relocated by either burial or moving the lines to the poles on the North- eastern side of the avenue, the path located 500mm offset the fence line, approximately 5-6m to the tree line (Fig 7 for basic concept).*

- Option 3: **Diverging around the pole:** *would leave the existing power pole as is instead of the path being offset from these poles the path would diverge around them, providing an offset to the tree line of approximately 4,25-5.25m for the majority of the path, with this also reducing to approximately 3.75-4.75 at locations where the path diverges around the poles. (Fig 8 basic concept design).*

Recommendations in Brief

- Option :1 is not acceptable design.
- Option 2 is acceptable with is the least impact on the trees.
- Option 3 is acceptable but require minor changes to design.

NOTE: Further testing was completed on 30th December on 8 identified trees for holding wood, Tree #18 has been identified for removal and replanting, whilst the 7 remaining trees (# 4, 6, 8, 31, 35, 37, and 46) are recommended for re assessment in 2-3 years, with management of the canopy structure by remedial pruning is recommended. (Appendix E)

Further detail designs will require to be referred to a suitably qualified Arborist for reviewing.

Dan McArdle
Consultant Arborist *Dip. Arb/Dip Ag*
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PROJECT Tamworth Regional Council (TRC) Has obtained funding from New South Wales Government for a feasibility report for the construction of a concrete path that connects the Tamworth CBD with the suburb of Calala via King George Ave and Campbell Road. At this stage, a feasibility is considered

appropriate due to the numerous obstacles that may prevent the project from continuing through to construction. One of these obstacles is the state heritage listed English Oaks on King George V Ave (State Heritage Register Item #01922). To ensure that the impact of the path on the trees is acceptable, an assessment of the impacts of each considered path design is required.

HISTORY of the Avenue in brief:

- **1936:** Originally, the initial tree planting was by the residents in 1936 to commemorate the reign of King George V, there were 424 trees planted which consisted of 200 trees planted at regular spacing of 13.4m over the distance of 1.5km to create an interlocking canopy over the roadway and the avenue intended to be a round through tourist drive.
- **1936:** Reference to money donated by the Country Women's Association, Return Servicemen League and the Light Horse Brigade as an important memorial to Servicemen killed in WW1.

- **1955:** the Two-Mile Bridge northeast end of the Avenue was lost to flooding, the bridge has not been replaced, ending the round tourist drive, now the only access is via the Paradise Bridge.

- **1960-70:** High Voltage powerlines were installed both sides of the Avenue of trees. Maintaining clearance extensive tree lopping was implemented. *(The line clearance is maintained to date)*

- **2012:** A proposal to remove some of the trees and widen the road to service an approved residential sub-division known as Calala. The community raised 12000 signatures from the local community to TRC objecting to the removal of the trees and additionally sought TRC to investigate the heritage significance of the trees and consider them as Heritage Items on the TRC LEP 2010.

- **2012:** Extensive tree pruning by Essential Energy Contractor.

- **2013:** The National Trust listed the avenue of trees as one of State significance, being considered a rare example of an Avenue of English Oaks forming a continuous interlocking canopy, The Avenue is considered of historical significance as it was planted as a memorial to King George V and is one of the only known commemorative plantings of its type in Australia.

- **2014:** King George V Avenue was gazetted and listed on the State Significate Register (Listing No.01922) in March 2014.

- **2016**: Conservation and Management Plan February 2016. (CMP 2016) (*Conbeare Morrison. Context design. Earthscape Horticultural Services).*

DOCUMENT HISTORY

DATE	VERSION	ARBORIST	REVIEWED
2/12/2023	DRAFT 0.1	Dan McArdle	Harper Galvin TRC
12/1/2023	DRAFT 0.2	Dan McArdle	Arborist AQF5 Jim McArdle
23/1/2023	Version 1. 23-1-2023	Dan McArdle	Dan McArdle/Jim McArdle
20/2/2023	Version 2.0 20-2-2023	Dan McArdle	Dan McArdle/ Harper Galvin TRC
12/3/2023	Version 3.0 12-3-2023	Dan McArdle	Dan McArdle

INTRODUCTION

McArdle and Sons Arboricultural Services Pty Ltd has been engaged by TRC to prepare this Tree Assessment Report.

Consulting Arborist Mr Dan McArdle conducted the evaluation using Visual Tree Assessment (VTA) level 3 method and best industry practices. The systems are in accordance with industry best practice and impact assessments and relevant Australian Standards AS4979-2009 (*Protection of trees on development site).*

. AIMS

- Prepare a tree location plan and identify the Tree Protection Zones (TPZ) and Structural Zones).
- Undertake an assessment of the current health of the existing trees, noting the size of the existing tree and the maximum size they are likely to reach.
- Discuss the impacts that other historical works in the avenue have had on the trees.
- Assess the potential short- and long-term impact that implementation each of the three design options will have on the existing trees or replacement trees planted in the future in accordance with the King George V Avenue of memorial English Oaks Management Plan.
- Provide recommendations to minimise the impact on the trees during construction of the path including plant that should be used and / or avoided, and any ground, canopy and root protection measures.
- Recommend if each design options would be acceptable for construction with regards to impact, they will have on the long-term health of the trees, including any protection measures during the construction to preserve the health of the trees; and
- Specify the priority of the design options in order from the least detrimental to the most detrimental to the health of the trees.

METHODOLOGY

An ISA (International Society of Arboriculture) accepted limited risk assessment using a best industry practice tool - A Visual Tree Assessment (VTA) method was employed. The VTA system is based on the theory of tree biology, physiology and tree architecture and structure and is a method used to identify visible signs on trees that indicate health and potential hazards.

The collection of data is performed in the field by an AQF Level 5 arborist. The assessment summarises the species, height and diameter, the trees health and structural condition for each tree, hazards, Tree useful life expectancy and retention categories were assigned to the tree.

Testing on site may include:
Mallet sounding, non- invasive testing for hollows, probing cavities, white ant infestation. Basic pH kit for soil test for alkaline/ acid. Root mapping and invasive tests will determine depth of decay around cavities.

This data was recorded in a Tree Survey Table and various assessment methods were used including:

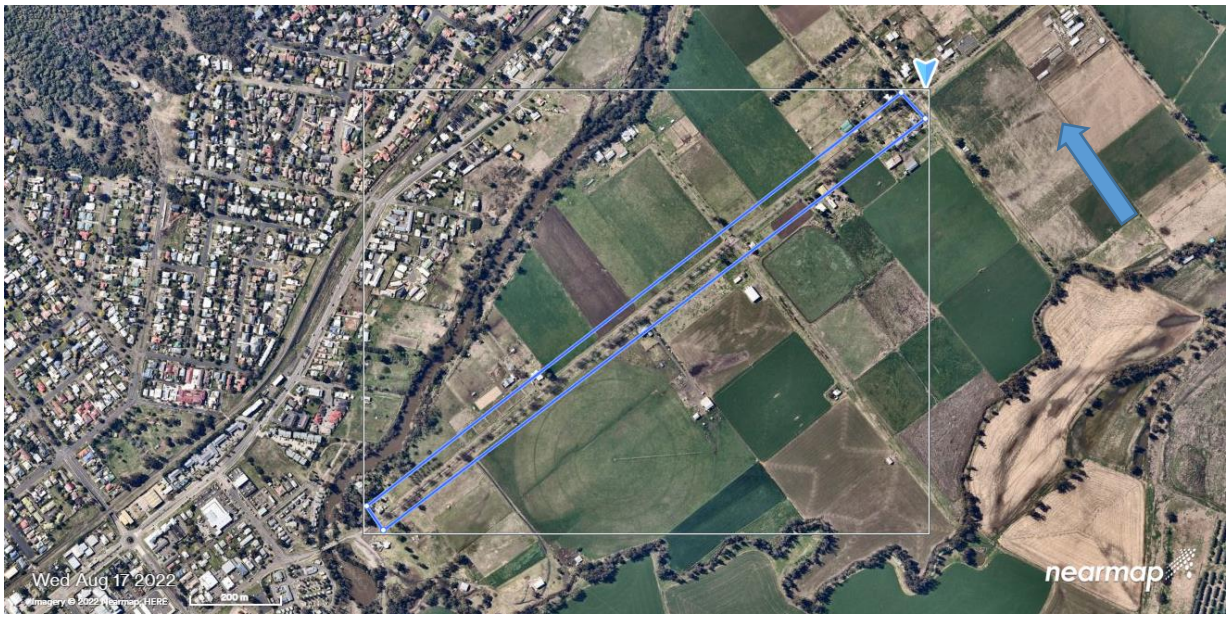
1. Tree Useful Life Expectancy (TULE) (Burrell Approved TCAA use 2014) This rating of the expected life span of the tree and considers; age, life span of the species, local environmental conditions, location, and tree safety and heritage status.
2. Health & Structural Condition of Tree Assessment. This describes the vigour and vitality of the tree**.**
3. Tree Hazard & Site Assessment. This assessment identifies structural defects that predispose a tree to failure located near a target. It is a useful WH&S requirement.
4. Some trees have special restrictions including cultural, historical or threatened category and may be reviewed as part of this report or further reporting.

LIMITATIONS

There are several limiting factors in the information in this brief report.

- The plans, information and data / reports and Conservation Management Plan 2016 information supplied to me from TRC is assumed to be correct in details.
- All inspection were ground base.
- This report is limited to the inspection of 48 mature trees on the Southwestern side of King George V Avenue, between Paradise Bridge and intersection at the property known as" Little Joe".
- The constructions options are specific to a concrete path and the impacts of the 3 specified design and or proposed design change.

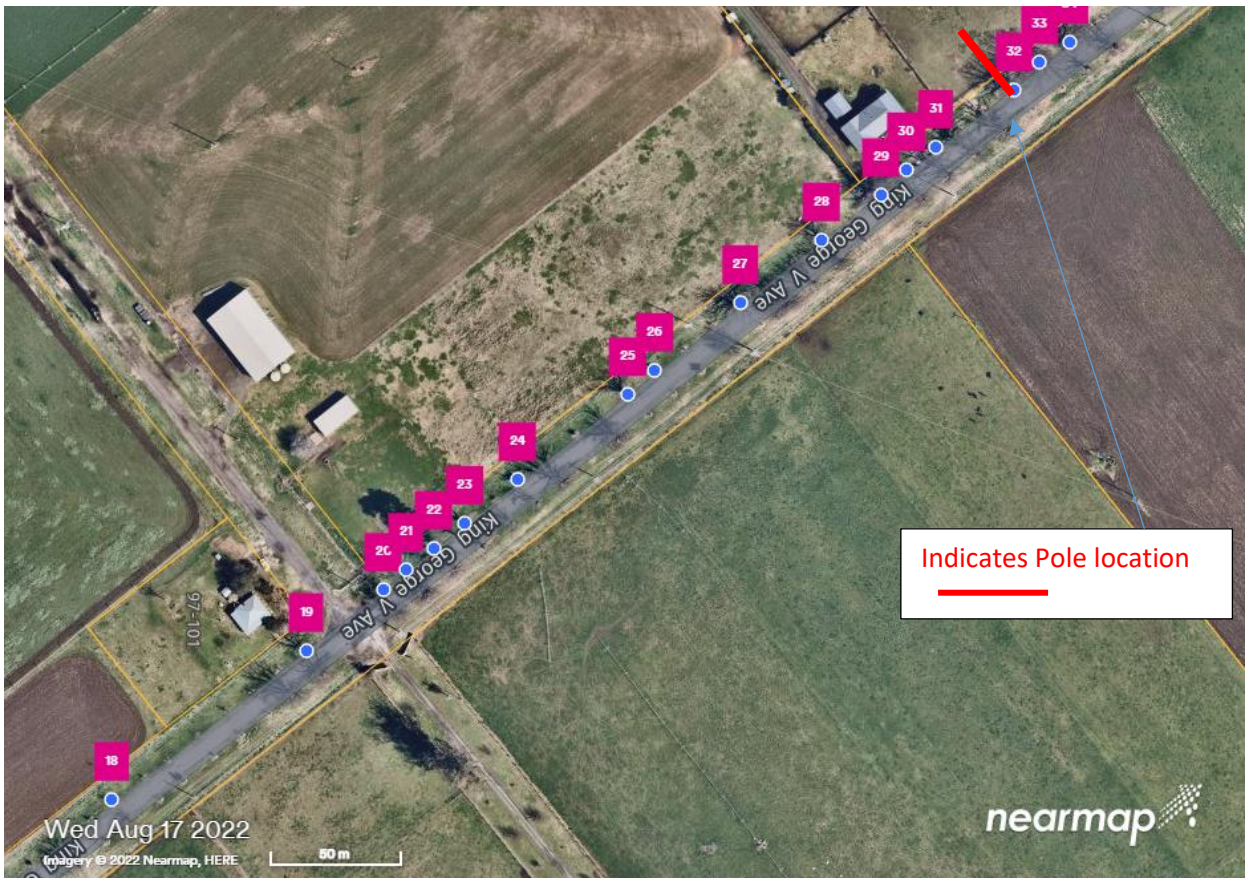
THE SITE AERIAL.



SITE MAP: King George V Ave Site (Fig 1).

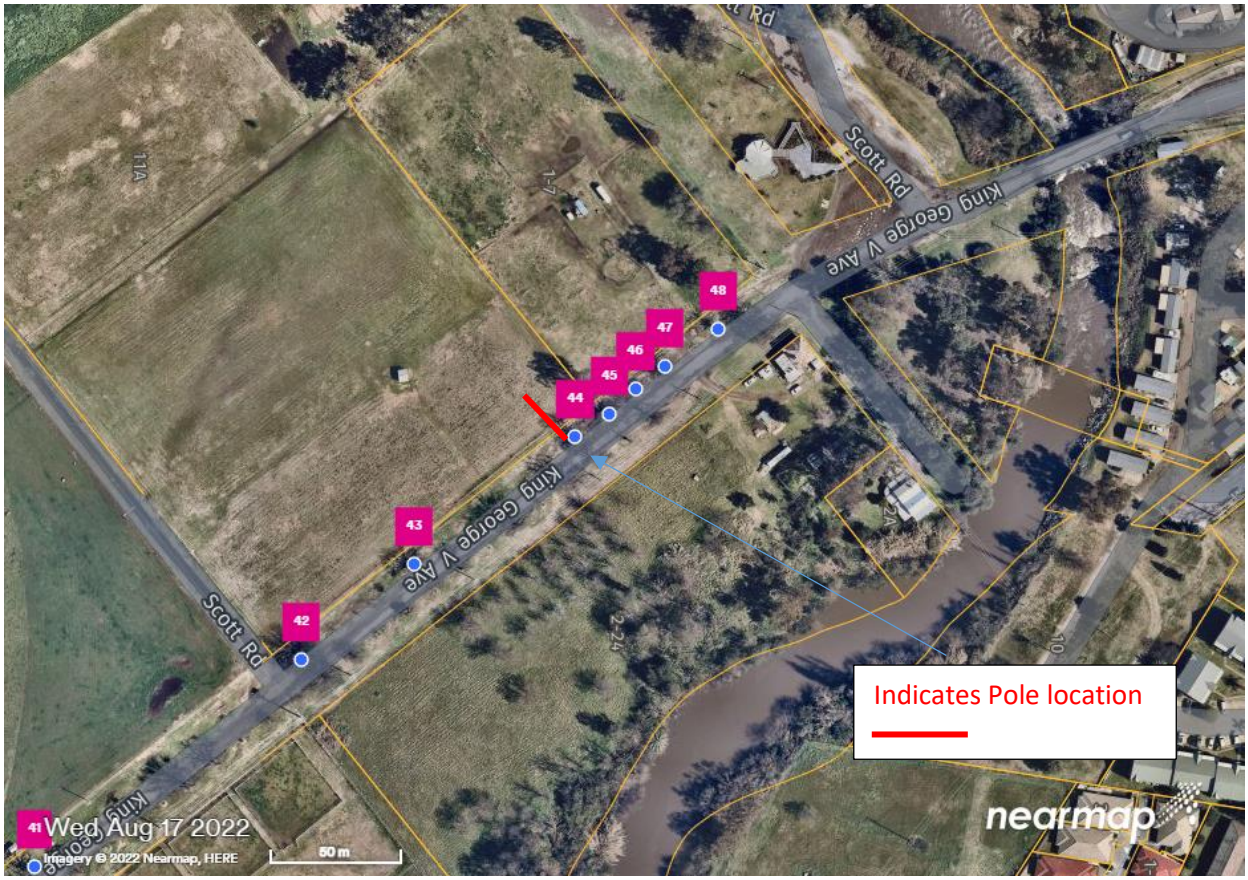
TREE LOCATATION MAPS

SITE Tree Location Trees 1-17(Fig 2) *(Courtesy of Nearmap)*



SITE Tree Location Trees 18-33(Fig 3) *(Courtesy of Nearmap)*

SITE Tree Location Trees 34-42 (Fig 4) *(Courtesy of Nearmap)*



SITE Tree Location Trees 42-48(Fig 5) *(Courtesy of Nearmap)*

SITE

This report is relevant to 48 mature Quercus *robur* trees located on the southwest side of the roadway.

During the inspection I have noted that there are existing metal tags on some of the trees, I had intended to use these existing tag numbers, this would have maintained a consistency of my report to any previous report and the specific tree.
However, during the process, I found many of the tags missing and I could not determine the location or consistency of the numbers on the trees or where trees had been removed or missed.
It is important to note the I have allocated a white plastic tag on the roadside of the trees at approximately 2m from the ground level.

Tree # 1 is located on the south-eastern side of the intersection of Campbell Road and King George V Avenue and is adjacent to the property known as “Little Joe” at the eastern end of the site.

SITE OBSERVATIONS

All the trees including new plantings are located off the road seal edge by 2m, the spacing between each tree is approximately 13.5 m spacing. The formation of the interlocking canopies is limited to areas of the existing mature trees and relevant in section only.

There is a swale drain which runs the length of the site, the lowest part of the swale or depth is approximately 2.5m from the butt of the tree.

The ground cover is mixture of grasses with no other hard surface material present excluding access points to Farm / Residential properties these noting surfaces are gravel.

The area is exposed to floods and recently as 2 weeks prior to this assessment, the area was isolated from the CBD, there is evident of flood debris remains on the existing fence lines.

Several houses and farms have gravel driveway or gate entrance access through the avenue of trees. The carriage way services general residential traffic, farms and farm machinery and hay transport, Equine Vet Business, horse stud pedestrians and cyclists. On the day of the inspection road usage was frequented by 15 vehicle movements, with less than 6 walkers/ joggers and 1 cyclist.

The area surrounding the King George V Avenue is rural grazing usage or cultivated farmland, topography is flat, description is river flats, silt rich soils and the area subject to flooding. The area is highly productive and consists of dry land and irrigation farming.

Measuring the Alkalinity /Acidity of the soil was performed at 4 separate verge locations at a depth of 75mm. The Soil tested ranged between a pH of 6.0 and 6.5

High Voltage power lines run the entire length on the southwest side of the trees, a measurement from the centre of the tree trunk to the centre of the pole is 7.5m consistently along the full length of the site.

The distance between the landholder boundary fence to the centre of the tree trunk was consistent with the measurement for TREE #1 at 9m and TREE # 48 at 8.9m.

Power pole along the Southwest side were measured at between 7.0 m and 8.1m from the centre of the tree trunk.

Telstra underground service is located (Visual of pits only) 1.5m off the fence line, between the fence and the Power poles.

Several areas between the trees are used for car parking and or turn bays, causing loss of the groundcover, there is evident of compaction. Probing the soil with a 450mm long spike was not possible in the compacted areas.

SPECIES

Quercus *robur* / English Oak is native to the Northern Hemisphere of Europe, in Australia it is one of the most common park deciduous trees in south-eastern Australia, noted for its vigorous, luxuriant growth. Q. robur grows very quickly to a tree of 20m tall by up to 20 m broad, with a low-branching canopy. Its trunk and secondary branches are very thick and solid and covered with deep-fissured blackish-grey bark. The fruit is a large seed 10mm diameter and 20mm long/ nut set in a cup called "involucre".
Q. *robur* is a long-lived tree and may naturally live to an age of a few centuries or more, in Australia the climate is somewhat different to the Northern Hemisphere of Europe, one of Australia's oldest Q. *robur* tree is in Aldgate South Australia.

TABLE 1 Australia's oldest Q. *robur* tree is in Aldgate South Australia

Estimated Age	Circumference	Height	Crown Spread	Date measured
150	6.61m or DBH 2.10cm	26m	38m	2015

Courtesy of National Register of Big Trees(www.nationalregisterofbigtrees.com.au/)

Loreto Normanhurst NSW *(Photo E & F)*

131	4.08m or DBH 130cm	15m	20	2022

Courtesy McArdle and Sons

These two examples demonstrate the life span in Australia of Quercus *robur.* The Loreto tree, McArdle and Sons has been actively maintaining since 1963, the tree displays typical scars and wounds, failures and vigour of growth tissue which is consistent with the King George V Avenue of trees.

Existing Trees Observations

Each of the 48 mature trees have been individually inspected and referenced in the Tree Survey Table of this report.

The overall visual appearance of the avenue of trees display symptoms of decline or age-related senescing.

At the time of inspection tree maintenance appears to be minimal, sections within the canopies of most trees are hazardous and pose a risk to the users of the area. Die back of crown and or significantly large dead wood within many of canopies, dead branches hanging, decayed stags (high stumps), fallen branches, collapse collars or large split outs, failed sections and many displaying epicormic growth and longicorn beetle attack.

General maintenance of remedial or formative pruning has not been undertaken in recent years, as stated many of the trees contain hazardous dead or decayed wood. (See CMP 2016 recommendations) From the inspection 8 x Trees (4, 6, 8, 18, 31, 35, 37 & 46) have been referred for further testing to determine holding wood remaining. These trees failed the basic impact mallet test that is used as a preliminary measure of determining trees that require more expensive testing approach.

Historical pruning of the trees is evident, where the canopy has been totally topped and the growth habit from these points indicate old methods of pruning that are obsolete today. I estimate these pruning to be longer than 30 years ago or more. There are 16 larger trees with a DBH of 90cm and above. 11 of these trees (TREES #: 7, 13, 25, 27, 29, 32, 33, 34, 38, 39 & 42) are in Good Condition and Good Vigour, of the remaining 5 x trees (4, 21, 23, 24, & 35) which are in Poor Condition, 2 of these 5 trees are STAGS (TREE # 23 and #24 High Stumps).

Vigour of the trees is ranging from good to poor with more precise detail for each tree inspected provided in the Tree Survey Table of this report.
It is worth noting that regardless of the decay and dead wood some of the tree's vigour is good and active tissue is responsive around wounds.

Epicormic growth indicates several things within the tree, epicormic growth can indicates stress and or is related to vigour as a response. Epicormic growth is evident in 9 of the trees: (#11, 18, 21, 26, 31, 35, 36, 41 & 48).

On the southwestern side of the trees there are High Voltage wires and in general the wires are 6 -7m from the centre to the trees to the closest wire, however this varies over the length of the site. Powerline pruning to maintain clearance by utility company is more recently evident by the regrowth and stub retained on the tree.

There are 55 new tree that have been replanted to replace trees that have been removed and their current condition is described as good. These trees height range between 3-4 m with (DBH) of 10cm approximately. Location of the new planting are as follows Table 1:

TABLE 1 New Tree Planting and location.

Plantings	Located between Trees		Plantings	Located between Trees
1	4-5		2	34-35
7	18-19		6	36-37
6	19-20		3	38-39
1	23-24		1	39-40
3	24-25		1	41-42
2	26-27		8	42-43
2	27-28		3	42-43
1	28-29		5	43-44
2	31-32		1	47-48

Proposed Options

Three alignments have been proposed by TRC for the construction of a concrete path from Paradise Bridge to Campbells Road Reserve approximately 2km in length.

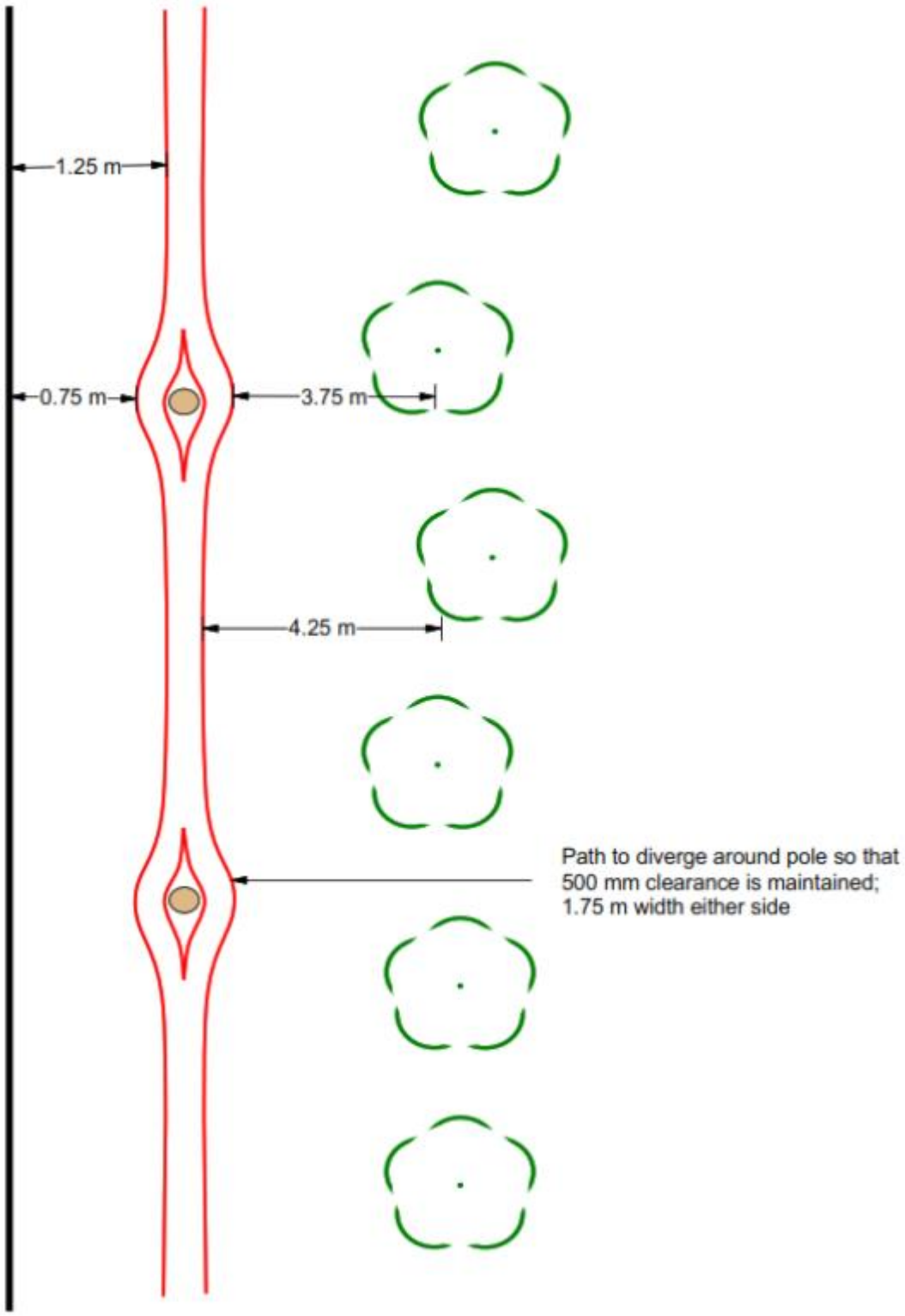
- Option 1: **Between existing power poles and trees**: *Involves the construction of a concrete path approximately 500mm offset from the line of the power poles, leaving 2-3m offset from the edge of the path to the tree line. (Fig 6 for basic concept)*

- Option 2 **Adjacent to the fence line with the overhead power relocated**: Option 2 *would see the overhead power line relocated by either burial or moving the lines to the poles on the North-eastern side of the avenue, the path located 500mm offset the fence line, approximately 5-6m to the tree line (Fig 7 for basic concept).*

- Option 3: **Diverging around the pole:** *would leave the existing power pole as is instead of the path being offset from these poles the path would diverge around them, providing an offset to the tree line of approximately 4,25-5.25m for the majority of the path, with this also reducing to approximately 3.75-4.75 at locations where the path diverges around the poles. (Fig 8 basic concept design).*

(Fig 6) Option 1: Between existing power poles and trees: *Involves the construction of a concrete path approximately 500mm offset from the line of the power poles, leaving 2-3m offset to the tree line.*

(Fig 7) Option 2 Adjacent to the fence line with the overhead power relocated: Option 2 *would see the overhead power line relocated by either burial or moving the lines to the poles on the North- eastern side of the avenue, the path located 500mm offset the fence line, approximately 5m path edge to the centre of the tree line.*



(Fig 8) Option 3: Diverging around the pole: *would leave the existing power pole as is instead of the path being offset from these poles the path would diverge around them, providing an offset to the tree line of approximately 4,25-5.25m for the majority of the path, with this also reducing to approximately 3.75-4.75 at locations where the path diverges around the poles.*

TREE SURVEY TABLE

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
1	S31°.11 241 150°.94 876	Quercus *robur* English Oak	10	55	10	80	Mature good condition good vigour	A2	3.0	6.6	Review Annually
2	S31°.11 214 150°.94 861	Quercus *robur* English Oak	16	80	16	85	Mature good condition good vigour, Good rection wood at wound.	A2	3.1	9.6	Review Annually
3	S31°.11 210 150°.94 847	Quercus *robur* English Oak	8	50	10	60	Semi-mature good condition good vigour, Tree suppressed by adjacent tree	A2	2.7	6.0	Review Annually
4	S31°.11 201 150°.94 839	Quercus *robur* English Oak Resistograph	18	110	14	130	Mature moderate condition good vigour, section of crown failed, minor dead wood, borer Hollow on impact,	D3	3.7	13.2	Recommend further testing on decay Establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune**
5	S31°.11 180 150°.94 482	Quercus *robur* English Oak	18	80	15	110	Mature good condition good vigour	D2	3.4	9.6	Review Annually
6	S31°.11 179 150°.94 818	Quercus *robur* English Oak	12	60	6	70	Mature poor condition 50% declined, significant dead	D3	2.8	7.2	Remediation of dead wood. Recommend further testing on decay

		Resistograph					wood, bark lifting on trunk. Borer infestation in base.				Establish Holding wood **Resistograph Drill Test Results** **RETAIN/Remedial prune**
7	S31°.11 154 150°.94 795	Quercus *robur* English Oak	14	95	16	120	Mature good condition good vigour. Heavily pruned for HV wires canopy unbalanced, 3 x branches failed.	D2	3.5	11.4	Review Annually
8	S31°.11 125 150°.94 769	Quercus *robur* English Oak Resistograph	14	80	10	85	Mature poor condition 40% declined, significant dead wood, borers,	D3	3.1	9.6	Remediation of dead wood. Recommend further testing on decay to establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune**
9	S31°.11 116 150°.94 762	Quercus *robur* English Oak	16	70	12	85	Mature moderate condition Heavily pruned for HV wires, significant dead wood, Borers in base	D2	3.1	8.4	Remediation of dead wood.
10	S31°.11 106 150°.94 751	Quercus *robur* English Oak	16	60	12	70	Mature, moderate condition failed branch section, 300mm Dia. North side. Borer s	D3	2.8	7.2	Review Annually
11	S31°.11 095 150°.94 743	Quercus *robur* English Oak	16	60	14	85	Mature moderate condition, epicormic, beam fracture in secondary scaffolding branch 1m length over road. Borers visible in beam fracture.	D2	3.1	7.2	Remediation of deadwood and fractured branch.

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
12	S31°.11 088 150°.94 733	Quercus *robur* English Oak	14	80	14	100	Mature good condition good vigour, borer	A2	3.0	9.6	Review Annually
13	S31°.11 075 150°.94 724	Quercus *robur* English Oak	16	90	18	120	Mature good condition good vigour	A2	3.5	10.8	Review Annually
14	S31°.11 071 150°.94 713	Quercus *robur* English Oak	9	30	10	40	Semi mature good condition, tree upper canopy impacting service wires. Pole located 8m west of tree	A2	2.3	3.6	Remediation pruning wire clearance
15	S31°.11 056 150°.94 707	Quercus *robur* English Oak	14	70	12	110	Mature good condition good vigour. Low branch impacted damage by trucks. Pole located 6m East of tree	A2	3.4	8.4	Remediation pruning low branch for truck clearance to prevent further damage to tree. *Pole relocate option7*
16	S31°.11 048 150°.94 698	Quercus *robur* English Oak	6	25	4	30	Semi mature Moderate condition damage at base of tree. Bark lifting and dehydrating.	D2	2.0	3.0	Review Annually
17	S31°.11 029 150°.94 681	Quercus *robur* English Oak	8	30	6	40	Semi mature moderate condition, borer damage at base	D2	2.3	3.6	Review Annually

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
18	S31°.10 954 150°.94 614	Quercus *robur* English Oak Resistograph	8	40	6	50	Semi mature poor condition, cavity and decay at base, borer, epicormic, significant dead wood 25%	D3-C4	2.5	4.8	Remediation of dead wood. *Recommend further testing on decay to establish holding wood* **Resistograph Drill Test Results Determination removal + replant.**
19	S31°.10 888 150°.94 551	Quercus *robur* English Oak	12	50	10	65	Mature good condition good vigour	A2	2.7	6.0	Review Annually
20	S31°.10 862 150°.94 528	Quercus *robur* English Oak	5	30	6	40	Semi mature good condition Tree suppressed by adjacent tree	D2	2.3	3.6	Review Annually
21	S31°.10 853 150°.94 521	Quercus *robur* English Oak Memorial tree	14	90	14	100	Mature poor condition, poor vigour 25% leaf cover and declining. Borer, Epicormic displayed. Memorial tree	D2	3.3	10.8	Review in Summer Remediation of dead wood.
22	S31°.10 844 150°.94 510	Quercus *robur* English Oak	14	70	12	95	Mature good condition good vigour	A2	3.2	8.4	Review Annually
23	S31°.10 835 150°.94 501	Quercus *robur* English Oak	5	100	3	130	STAG, Poor Condition significant borer attack and decay.	C4	3.7	12.0	Remove tree and replant

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
24	S31°.10 814 150°.94 482	Quercus *robur* English Oak	8	90	4	110	STAG Poor condition significant borer attack and decay, 1 x dead leader.	C4	3.4	10.8	Remove tree and replant
25	S31°.10 778 150°.94 447	Quercus *robur* English Oak	16	90	14	110	Mature moderate condition, good vigour good reaction tissue, Borer at base, Significant dead wood	D2	3.4	10.8	Remediation of dead wood
26	S31°.10 768 150°.94 438	Quercus *robur* English Oak	14	60	8	80	Mature moderate condition, Significant dead wood, borer, epicormic.	D3	3.0	7.2	Remediation of dead wood
27	S31°.10 738 150°.94 412	Quercus *robur* English Oak	16	110	14	130	Mature good condition good vigour, heavily pruned for HV wires	A2	3.7	13.2	Review Annually
28	S31°.10 710 150°.94 382	Quercus *robur* English Oak	14	70	12	90	Mature good condition good vigour	A2	3.2	8.4	Review Annually
29	S31°.10 692 150°.94 370	Quercus *robur* English Oak	16	120	16	160	Mature good condition good vigour, cavity east side	A2	4.0	14.4	Review Annually
30	S31°.10 682 150°.94 363	Quercus *robur* English Oak	14	50	12	60	Mature good condition good vigour	A2	2.7	6.0	Review Annually

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
31	S31°.10 472 150°.94 353	Quercus *robur* English Oak Resistograph	12	70	12	70	Mature poor condition 50% declined, epicormic, borer, significant dead wood,	C4	2.8	8.4	Remediation of dead wood. Recommend further testing on decay to establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune**
32	S31°.10 640 150°.94 328	Quercus *robur* English Oak pH2 tested 6	16	90	14	120	Mature good condition good vigour, Tree has been topped in past, old cut site visible, attachment OK. Soil pH2 tested 6. Pole located directly behind tree @ 7.5m	A2	3.5	10.8	Review Annually *Pole relocate option*
33	S31°.10 630 150°.94 319	Quercus *robur* English Oak	16	110	16	130	Mature good condition good vigour, damage a 2m east side, heavily pruned for HV wires.	D2	3.7	13.2	Review Annually
34	S31°.10 619 150°.94 313	Quercus *robur* English Oak	12	100	16	130	Mature good condition good vigour. Borer in old branch failed sites.	D2	3.7	12.0	Review Annually

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
35	S31°.10 596 150°.94 283	Quercus *robur* English Oak Resistograph	14	90	10	110	Mature poor condition 60% declined, epicormic, significant dead wood, large, failed section @ 4m, Borer damage. Hanging branch.	C4	3.4	10.8	Remediation of dead wood and hanging branch. Recommend further testing on decay to establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune.**
36	S31°.10 586 150°.94 272	Quercus *robur* English Oak	14	80	14	90	Mature poor condition 50% declined, significant dead wood, epicormic Borer damage	D2	3.2	9.6	Remediation of dead wood
37	S31°.10 518 150°.94 209	Quercus *robur* English Oak Resistograph	14	75	12	90	Mature moderate condition, significant dead wood	C4	3.2	9.0	Remediation of dead wood. Recommend further testing on decay to establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune**

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
38	S31°.10 507 150°.94 200	Quercus *robur* English Oak	16	90	20	120	Mature good condition good vigour, Fracture in east leader primary leader.	D2	3.5	10.8	Review tree 3 months intervals Bracing may be optional to retain tree.
39	S31°.10 470 150°.94 167	Quercus *robur* English Oak 7m off wires	16	110	18	130	Mature moderate condition, significant dead wood	D2	3.7	13.2	Remediation of dead wood
40	S31°.10 452 150°.94 151	Quercus *robur* English Oak	14	80	12	90	Mature Poor form poor condition 90% declined, significant dead wood, Borer damage	C4	3.2	9.6	Remediation of dead wood or remove tree and replant
41	S31°.10 431 150°.94 133	Quercus *robur* English Oak	10	60	8	75	Mature moderate condition, borer, epicormic, 20% dead wood	D2	2.9	7.2	Remediation of dead wood
42	S31°.10 335 150°.94 048	Quercus *robur* English Oak 7m off wires	14	90	16	120	Mature good condition good vigour, heavily pruned for HV wires both sides of tree.	D2	3.5	10.8	Review Annually
43	S31°.10 292 150°.94 009	Quercus *robur* English Oak	12	65	12	75	Mature good condition good vigour minor dead wood	A2	2.9	7.8	Remediation of dead wood

Tree No.	GPS Location	Scientific & Common name	Height (m)	DBH (cm)	Crown Spread (m)	Basal Flare (cm)	Condition of Tree *(Health &Structure) (Defect & Measurements)*	TULE	SRZ (M)	TPZ (M)	Comments
44	S31°.10 241 150°.94 959	Quercus *robur* English Oak 7m off wires	12	60	8	70	Mature moderate condition, significant dead wood 15% declined. Pole located directly behind tree @ 7.5m	A2	2.8	7.2	Remediation of dead wood *Pole relocate option.*
45	S31°.10 230 150°.94 948	Quercus *robur* English Oak Soil pH2 testes 6.6	14	70	12	90	Mature good condition good vigour. Soil pH2 testes 6.6	A2	3.2	8.4	Review Annually
46	S31°.10 221 150°.94 938	Quercus *robur* English Oak Resistograph 7m off wires	14	80	14	100	Mature good condition good vigour, active fracture in primary union southside	D2	3.3	9.6	Review tree 3 months intervals Bracing may be optional to retain tree. Recommend further testing on decay to establish holding wood. **Resistograph Drill Test Results** **RETAIN/Remedial prune**
47	S31°.10 211 150°.94 930	Quercus *robur* English Oak	14	75	12	90	Mature good condition good vigour, cavity at base, good, reactive tissue present around wound, minor dead wood	D2	3.2	9.0	Remediation of dead wood
48	S31°.10 194 150°.94 912	Quercus *robur* English Oak	10	60	8	70	Mature poor condition 50% declined, borer, significant dead wood, epicormic.	A2	2.8	7.2	Remediation of dead wood

TREE ANALYSIS PHOTOS

TREE 1

TREE 2

TREE 3

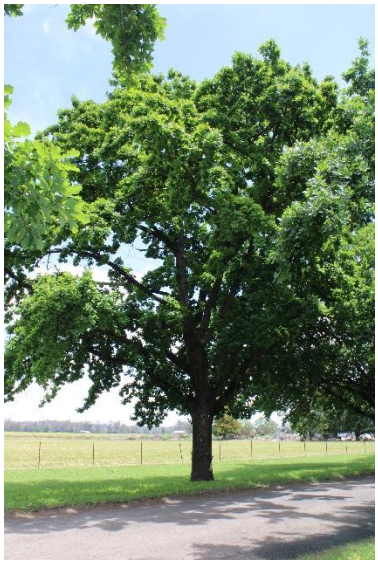
TREE 4

TREE 5

TREE 6

TREE 7

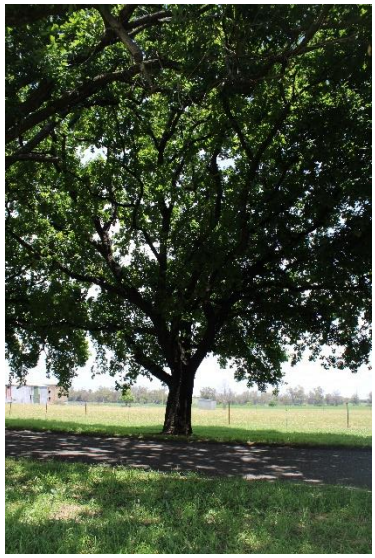
TREE 8



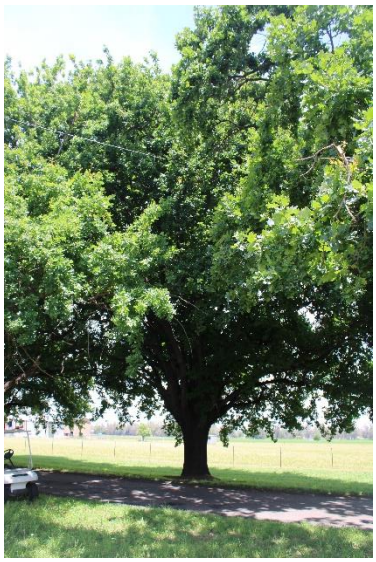
TREE 9

TREE 10

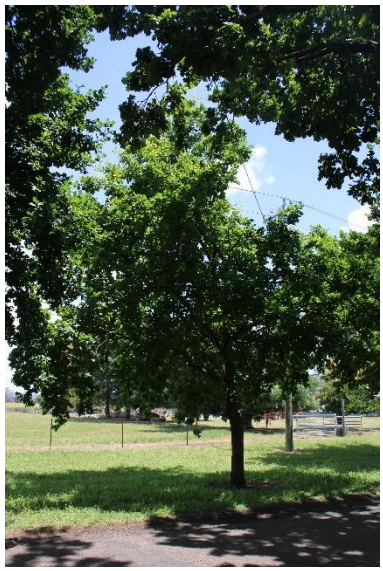
TREE 11



TREE 12



TREE 13



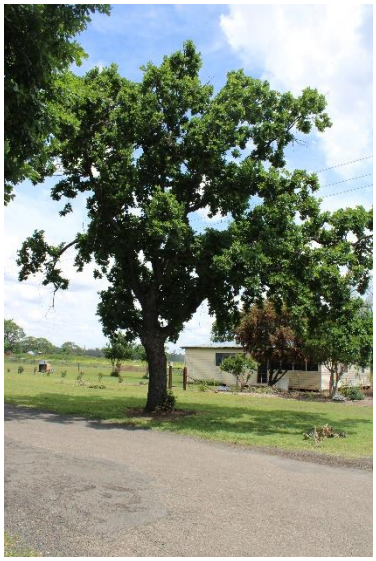
TREE 14

TREE 15

TREE 16

TREE 17

TREE 18



TREE 19

TREE 20

TREE 21

TREE 22

TREE 23

TREE 24

TREE 25

TREE 26

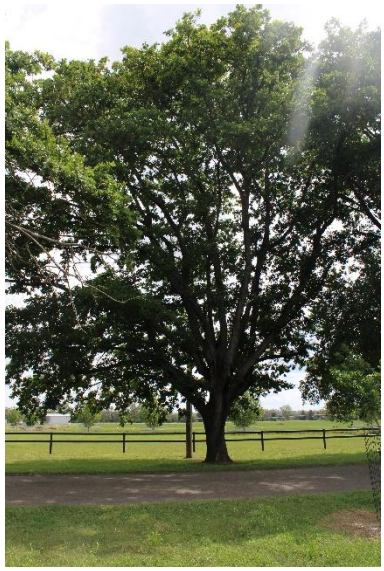
TREE 27

TREE 28

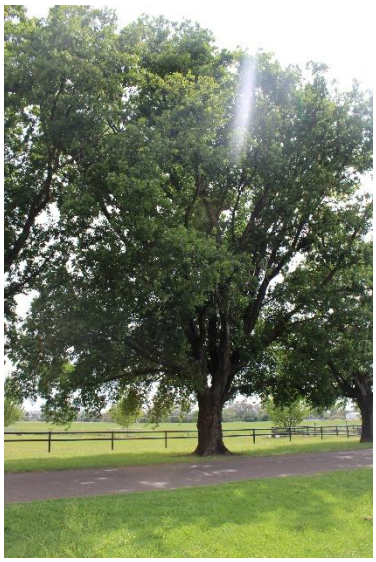
TREE 29

TREE 30

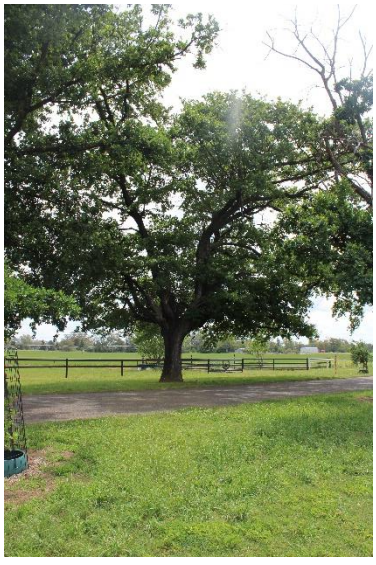
TREE 31



TREE 32



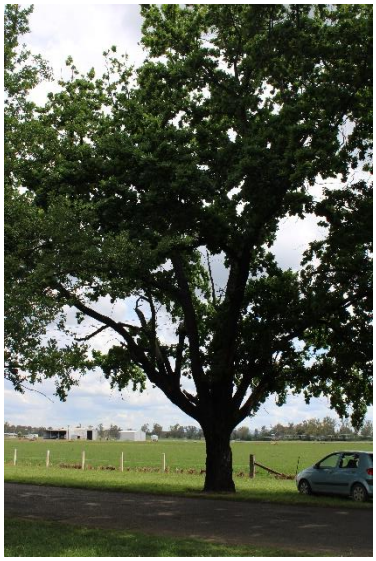
TREE 33



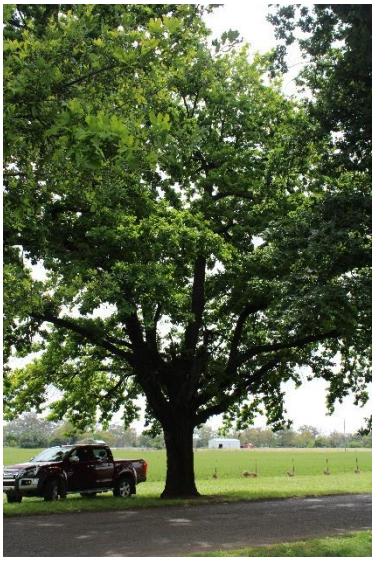
TREE 34

TREE 35

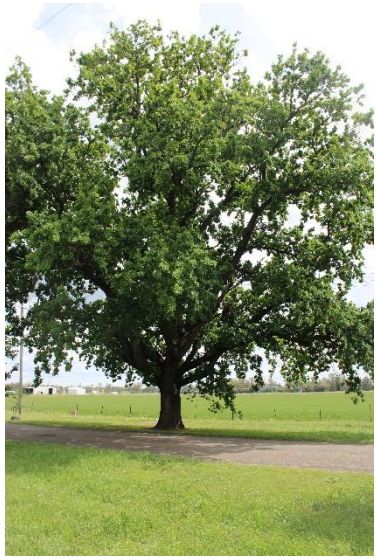
TREE 36



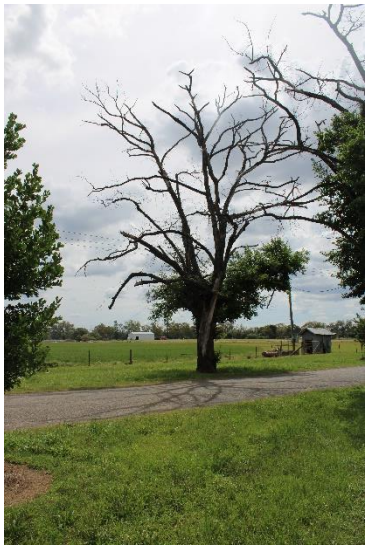
TREE 37



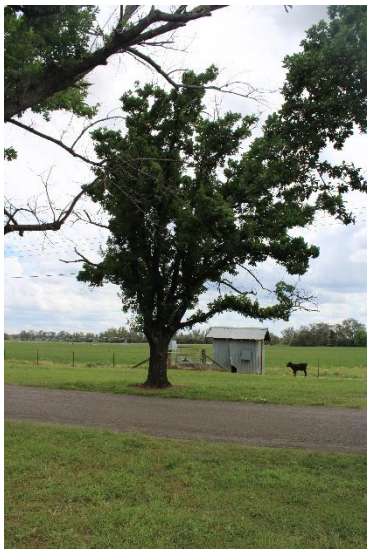
TREE 38



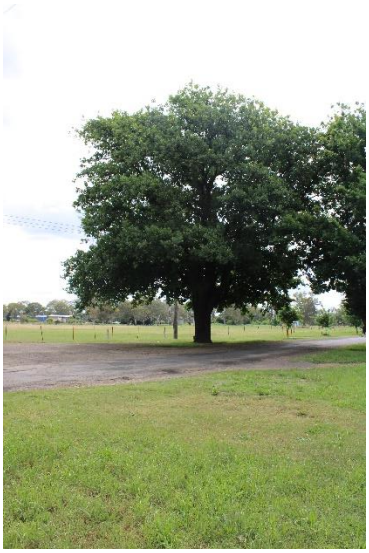
TREE 39



TREE 40



TREE 41



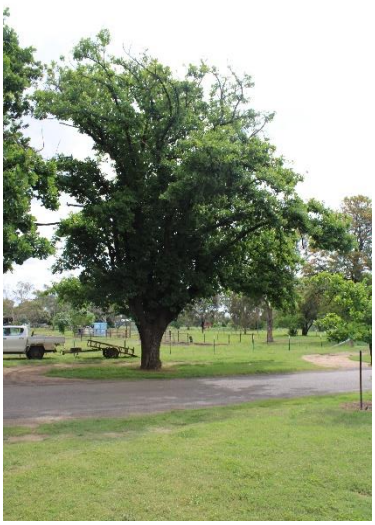
TREE 42

TREE 43

TREE 44

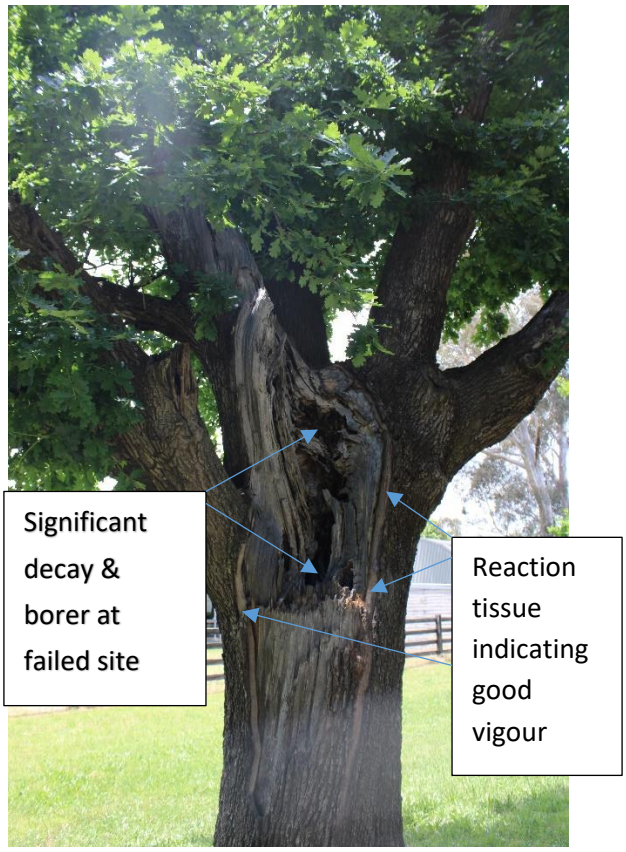
TREE 45

TREE 46

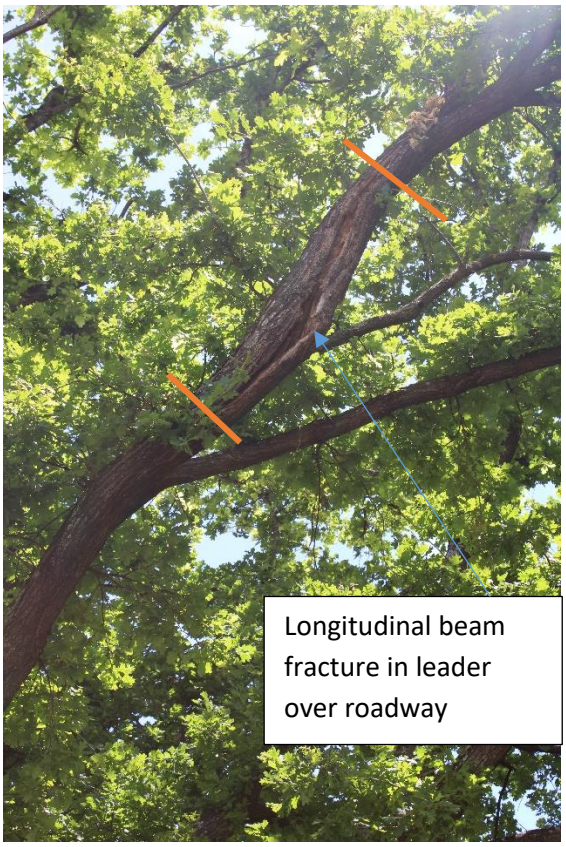


TREE 47

TREE 48



A/ TYPICAL decay damage failed section leader.



B/ TREE 11: Significant beam fracture scaffolding

C/ Typical new planting

D/ Soil compaction caused by turning traffic movements

E/ Q. *robur* Loreto Normanhurst Planted 1892

F/ Loreto Normanhurst active wound tissue.

(Above E & F Photos Loreto Q robur Circa 2014 McArdle & Sons maintaining this tree since 1963)

Fallen tree section in drop zone of the tree. Three located on the northern side of avenue.

G/ Failure point, section under canopy.

F/ Same tree indicating hanging branch.

Lower canopy height restricted for machinery access.

H/ lower scaffolding canopy

I/ Large low dome canopy typical

J/ Power pole alignment.

DISCUSSION

Although the Quercus *robur i*s endemic to Northern Hemisphere of Europe, they are widely planted throughout Australia. The species is long lived and known for wide spreading canopy sometime greater than the height of the tree, it tolerates a wide range of soil condition. It does prefer deep well watered soils and highly suited as large garden tree or as a park tree.

The tree species Quercus *robur* is deciduous, and leaf and fruit drop can be a problem on hard surface, as this may be hazardous under foot on hard surface such as concrete.

Mature trees tolerate flooding and provide habit to array of insects, birds, and other animals.

The recent drought of 2017-2019, is a factor that has impacted the trees in the region. Although not specific to King George V Avenue, this is an environmental stress event that has impacted the trees. The stress from the drought has also affected Eucalyptus trees both on the range east of the Tamworth CBD and on the authors property 40km due east of Tamworth where trees had defoliated. These trees are still recovering today.

King George V Avenue of trees were subjected to the same moisture stress, hot dry winds and environmental conditions causing stress and decline in the trees, the impacts of drought and proceeding wetter periods have impacted the trees. Acute periods of stress are detrimental to the trees, decline over a period of time 1—5 years is not uncommon and subsequently eventually death may occur.

4.1 EXISTING REPORTS

Conservation and Management Plan February 2016 (*Conbeare Morrison. Context design. Earthscape Horticultural Services)* was completed and submitted to TRC. within the CMP 2016, (Section 3.7) details of the subsequent status of the trees and recommendations for formative pruning, removals, remediation of soils and replacements trees. Over the period of 2003-2015 there are 3 separate reports that have been undertaken on the King George V Avenue of trees.

From the reviewing of the (CMP 2016), it's clear the avenue of trees have continually declined, the implementation of the recommendations from this plan have not been implemented and the trees have not been maintained to the standard recommended.

4.2 CURRENT OBSERVATIONS

Table 2 General Tree Condition is a brief overview of the trees from the inspection completed on 12th of November 2022 of the 48 Trees:

Table 2 General Tree Condition *(See Tree Survey Table for specific details)*

Condition of Tree	Number of Trees	TREE # Number
Good	25	1, 2, 3, 5, 7, 12, 13, 14, 15, 19, 20, 22, 27, 28, 29, 30, 32, 33, 34, 38, 42,43, 45, 46 & 47
Moderate	12	4, 9, 10, 11, 16, 17, 25, 26, 37, 39, 41 & 44
Poor	11	6, 8, 18, 21, 23, 24, 31, 35, 36, 40 & 48

Table 3 Observation *(See Tree Survey Table for specific details)*

Observation	Number of Trees	TREE # Numbers
Dead wood	19	6, 8, 9, 11, 18, 21, 25, 26, 31, 35, 36, 39, 40, 41, 43, 44, 47 & 48
Borer	18	6, 8, 9, 10, 11, 17, 18, 19, 23, 24, 25, 26, 31, 34, 35, 36, 40 & 48

Declined	3	23, 24 & 31
Fractured	3	11, 38 & 46
Further testing	8	4, 6, 8, 18, 31, 35, 37 & 46 (Confirmation Tree 18 for removal)
Obstructions	2	14 &15

ROOT MAPPING

Excavations were undertaken by hand tools, 9 larger trees were selected, the distance of the test holes were 4m and 6m from the centre of the tree, 50mm organic layer was removed and is not included in the measurements. (See Table 4 for details). The purpose of root mapping is to establish root layers and location at the specified depth and distance from the trees.

Table 4 ROOT MAPPING TABLE *(Completed 23rd December 2022) All data was recorded and photographed.*

TREE #	**1st Distance from centre of tree(m).**	**COMMENTS Hand excavation to 200mm depth** (50mm Organic layer not included)	**2nd Distance from centre of tree(m)**	**COMMENTS Hand excavation to 200mm depth** (50mm Organic layer not included)
5	4	Feeder roots less than 5 mmø @ 50mm depth	6	Feeder roots less than 5 mmø @ 140mm depth
13	4	Feeder roots less than 5 mmø @ 110mm depth	6	Feeder roots less than 5 mmø @ 140mm depth
22	4	Feeder roots less than 20mmø @ 40mm depth	6	Feeder roots less than 20mmø @ 130mm depth
29	4	Feeder roots less than 5 mmø @ 50mm depth	6	Feeder roots less than 5mmø @ 50mm depth
33	4	Feeder roots less than 10mmø @ 75 mm depth	6	Feeder roots less than 15mmø @ 80mm depth
36	4	Feeder roots less than 10mmø @ 70mm depth	6	Feeder roots less than 50mmø @ 200mm depth
38	4	Feeder roots less than 10mmø @ 130mm depth	6	Feeder less than 50mmø @ 170mm depth
39	4	Feeder roots less than 10mmø @ 50mm depth	6	Feeder roots less than 5mmø @ 75mm depth
47	4	Feeder roots less than 5mmø @ 50mm depth	6	Feeder roots less than 5mmø @ 50mm depth

TREE 22 @ 4m

Typical test site TREE 22 4 & 6m distance from the tree centre, displaying typical feeder roots.

TREE 22 @ 6m

DESIGN CONCEPT OPTIONS AND IMPACTS

Maintaining tree health and not to contributing further to the decline of the existing trees is the main objective, typically this is achieved through Tree Protection Zones management during the planning and construction phases to minimise root damage. Implementation of a tree maintenance program for the remedial pruning, removal, dead wood pruning shall be undertaken prior to the commencing works for the path construction. (Refer to Conservation Management Plan Recommendation 2016)

Three alignments options have been proposed by TRC for the construction of a 2- lane 3.5m wide single concrete path from Paradise Bridge to Campbells Road Reserve 2km distance.

There are several obstacles to overcome in the proposal these include: 1.5km length of the path is to be adjacent the State Heritage listed trees on the Southwest side of the King George V Avenue, High Voltage wire and poles, Swale drain, Structural Root zones, Tree Protection Zones, excavations, leaching constructions impacts and tree conditions.

Tree Protection Zone (TPZ) and Structural Root Zones (SRZ) have been calculated and listed in the Tree Survey Table of this report and specific measurements for each tree's DBH have been noted. The standard AS4979-2009. (*Protection of trees on development sites). Within AS 4970-2009 (Protection of trees on development sites) it states that an encroachment of any more than 10% of the calculated TPZ is considered a 'major encroachment' and certain conditions should apply. A major incursion may trigger the following requirements to protect the tree: Root mapping, design revision, low impact construction methods, or work supervision.*

Regardless of the offset of the path to the tree line, tree pruning and removing of dead wood shall be undertaken prior to the commencement of the path construction.

4.5 EXISTING POWER POLES

High Voltage power poles are located 7.5m approximately from the centre of the trees.

OPTION 1: **Between existing power poles and trees**: *Involves the construction of a concrete path approximately 500mm offset from the line of the power poles, leaving 2-3m offset to the tree line. (Fig 6 for basic concept plan)*

Construction of a concrete path within 3 m of the centre alignment of the 48 trees will encroach into the SRZ of 30 mature trees or (62.5% *of the trees will have Structural Roots impacted*) further the calculation of incursion greater than 10% into the TPZ of 44 trees or *(91.6 % of the trees will be impacted Table 5 below*).

Locating the path directly under the canopy, is encouraging people to be under these trees, given the current tree health and structure, the potential for tree sectional failure is a considerable concern. Sectional failure is within the canopy drop zone. *(See Photo G & F*) This tree is located on the northern side of the avenue but clear example of a failure.

Lower canopy scaffolding branches *(see Photos H & I*) clearly indicate the lower canopy heights and potential of increased damage to the trees canopy by machinery.

Operations of heavy equipment under the canopy of the trees within the TPZ of 3m distance from the centre of the tree has the potential to cause damage to lower canopy branches by mechanical impact, compaction to roots system will occur by track or wheeled equipment inside the TPZ and structural root damage by excavations will be the result.

Fruit drop is evident under the canopies, (acorns) these fruits on hard concrete surface will be create underfoot hazard.
The bottom of existing swale drain is located 2.5m offset from the base of the tree alignment.

Currently, the powerline trimming is reducing large sections of overhanging scaffolding branches that are extending Southwest of the tree alignment.

Attention to maintenance and the ongoing inspections will be required, the new plantings would overtime would be under the maintenance programme as they develop in the years to come.

For this option, current juvenile trees and any replacement trees will not be impacted as they will grow to the conditions and therefore not affect them negatively, the new path alignment 3 m out from the centre of the tree. There would be no impact and the new plantings will grow to their environmental conditions at this point the path could be excavated and laid.

Root Mapping (Table 4) Feeder roots were found between 40mm and 200mm below the 50mm Organic layer. The larger roots were found between 110-200mm depth. Structural roots were not investigated.

TABLE 5:

44 Trees with DBH of 40cm or above using a **3 m offset** measured from the centre of the trees.

Number of Trees	DBH (cm)	TPZ (m)	Incursion into TPZ(m)	Percentage of incursion into TPZ
1	40	4.8	1.8	12.80%
3	50	6.0	3.0	19.55%
1	55	6.6	3.6	22.09%
7	60	7.2	4.2	24.62
1	65	7.8	4.8	26.13%
6	70	8.4	5.4	27.76%
2	75	9.0	6.0	29.18%
7	80	9.6	6.6	30.43%
8	90	10.8m	7.8	32.55%
1	95	11.4	8.4	33.44%
2	100	12.00	9.0	34.25%
4	110	13.2	10.2	35.66%
1	120	14.4	11.1	36.83%

Within AS 4970-2009 (Protection of trees on development sites) it states that an encroachment of any more than 10% of the calculated TPZ is considered a 'major encroachment' and certain conditions should apply. A major incursion may trigger the following requirements to protect the tree: Root mapping, design revision, low impact construction methods, or work supervision.

Due to the path impacting the Structural Root Zones of many trees and the risk of falling branches striking path users, this option is not recommended.

Option 2 **Adjacent to the fence line with the overhead power relocated**: Option 2 *would see the overhead power line relocated by either burial or moving the lines to the poles on the North- eastern side of the avenue, the path located 500mm offset the fence line, approximately 5m path edge to the centre of the tree line. (See Fig 7).*

There are 16 poles spanning the site that would require removal for this proposal to proceed. The power poles are located approximately 7.5m offset from the centre of the tree alignment.

The distance from the fence to the centre of the trees which is consistent at 9m on average the throughout the site. The required offset of 500 mm between the fence and to path edge, less the 3.5m width of path, this leaves a balance 5m distance off the edge of the path to the trees centre alignment. The offset of 5m will not impact the SRZ of the trees, however, at 5m offset this will encroachment into the TPZ of 32 trees ranging from 12.19% to 28.35% encroachment. The path does not encroach into the TPZ for trees with a DBH less than 65cm.

The 5m offset is the maximum distance that can be achieved in the corridor for the 3.5m wide path construction whilst maintaining a 500mm distance off the fence boundary of adjoining land holders.

The following Table 6 indicated trees with a DBH 65cm or greater where the incursion is greater than 10%.

TABLE 6: 32 Trees with DBH 65cm or above using a **5 m offset** from the centre of the trees.

Number of Trees	DBH (cm)	TPZ (m)	Incursion into TPZ	Percentage of incursion into TPZ
1	65	7.8	2.8	12.19%
6	70	8.4	3.4	14.48%
2	75	9.0	4.0	16.55%
7	80	9.6	4.6	18.41%
8	90	10.8m	5.0	21.62%
1	95	11.4	6.4	23.00%
2	100	12.00	7.0	24.26%
4	110	13.2	8.2	26.48%
1	120	14.4	9.4	28.35%

NOTE: Within AS 4970-2009 it states that an encroachment of any more than 10% of the calculated TPZ is considered a 'major encroachment' and certain conditions should apply. A major incursion may trigger the following requirements to protect the tree: Root mapping, design revision, low impact construction methods, or work supervision.

- The following 16 x trees have an incursion into the TPZ of less than 10% :1, 3, 6, 10, 11, 14, 16, 17, 18, 19, 20, 26, 30, 41, 44 & 48.

- The balance of 32 x trees have either a (DBH) >65cm or (TPZ >7.2m), these trees are: 2, 4, 5, 7, 8, 9, 12, 13, 15, 21, 22, 23*, 24*, 25, 27,28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 45, 46 & 47. (23* & 24* Stags possible removal + replant). *(See Table 6*)

For the proposed design, the path could be constructed if it minimises disturbance to the feeder roots: the depth of excavation for the path should not exceed 50-75mm and unlevel ground would require a porous inert material to be used to create a level surface.

The Power pole distance from the centre of the pole to the centre of the trees on average is 7.5 m (*centre of the easement)*. To relocate the wires underground would require excavations are required to submerge

the HV wires underground. This would require a trench with minimum 1m depth and 7.5m from the trees, this excavation will encroachment into the TPZ by 10% of 8 trees with a DBH greater than 95cm.

Placing the wires underground at 1.5m depth will require low impact excavation, by underground boring methods which is preferred over open trench method which will eliminate the damage to the root system.

Heavy equipment for the excavation, pole and wire relocation has the potential to cause significant compaction to the area and increase the potential of canopy damage around the larger trees.

Construction of the path at 5m offset can be achieved and with low impact equipment, this could be done with a small, tracked excavator and all machinery movements inside the path alignment of 3.5m only, the 5m TPZ can be always maintained. This would exclude all concrete truck; concrete would be required to be pumped from the existing roadway to the path formation.
Because the works are within the TPZ of the tree's supervision by qualified AQF 5 Arborist will be required during all excavations works.
Two advantages of this would be:

- The need of trimming the trees for wire clearance and the damage caused would be removed.
- The path users are not directly under the trees canopy.

One disadvantage would be:

- The cost to relocate the wires underground or the relocation of the aerial wires to the northern side of the avenue.

Option 3: **Diverging around the pole:** *would leave the existing power pole as is instead of the path being offset these poles the path would diverge around them, providing an offset to the tree line of approximately 4,25-5.25m for the majority of the path, with this also reducing to approximately 3.75-4.75 at locations where the path diverges around the poles. (Fig 8 for basic concept design).*

A minimum of 5m offset from edge of path to the centre of the trees must be maintained for all mature trees in the site. For juvenile trees, a minimum of 3m offset from edge of path to tree centres must be maintained.
For 16 poles along the alignment, there is sufficient space for the entire 3.5m path width to fit on the roadside without the need to diverge around them. There are however 3 critical poles where this is not the case; poles 0639607, 0639578 and 0639483 are located at trees 44, 32 and 15 respectively.

Tree 15: At tree 15, there is sufficient space for the path to diverge around the pole as described in the design brief.
However, there is an opportunity for the path to be constructed at its full width on the roadside of the pole. If this was done, the distance from the near edge of the path to the centre of Tree 15 would be 4.4m. This would be acceptable provided that low impact construction methods and minimal excavation (to a maximum depth of 50mm) is undertaken under the supervision of a suitably qualified arborist. The arborist would be able to prune any key roots if discovered and determine if work needs to stop due to the discovery of large roots.

Tree 32: There is inadequate space at this pole for the path to diverge around the pole; the maximum path width on the fence side would be 1.6m and on the roadside 0.95m.
To resolve this design issue, the relocation of the pole is recommended. A location on the same alignment, but a distance of at least 8m to the east will allow for the path to pass Tree 32 at the full width and divert around the pole at the new location.
Alternatively, the path could divert around the pole in the existing location at a reduced width. The maximum width of 1.6m on the fence side could be replicated on the roadside using the same

methodology detailed for Tree 15 (low impact construction methods, maximum depth of excavation of 50mm, supervision of qualified arborist).

Tree 44: At tree 44, there is adequate space on the roadside for the path to achieve the required 1.75m width. However, the maximum width achievable on the fence side is 1.3m
The design could diverge around the poles as described, with a reduced width on the fence side or the pole could be relocated to allow the path to remain at the full width, diverting around it at the new location.

It is recommended that if constructing the path within 5m of a mature tree's centre is the preferred option, that exploration excavation be undertaken prior to committing to this option to ensure that there are no large roots present at these locations that would prevent construction from continuing.

TREE PROTECTION

Tree Protection fencing must be installed prior to start of the path construction and excavations.
Relevant Australian Standards for Tree Protection and temporary fencing are as follows:

- AS4979-2009 Protection of trees on development sites.
- AS4687-2007 temporary fencing and hoardings.

The standard AS4979-2009. (Protection of trees on development sites). Provides guidance principles for protecting trees on lands subject to development. It follows in sequence, the stages of development from planning to implementation.

TREE PROTECTION ZONES AND STRUCTURAL ROOT ZONES (TPZ/ SRZ)

Trees that have been identified for retention must be protected from physical damage the following: general construction machinery, excavations, stockpiling, contaminants and compaction or damage of their root systems by compaction.

- TPZ have been calculated noted in the TREE SURVEY TABLE as a radius measurement from the centre of the tree.
- SRZ have also been calculated and noted in the TREE SURVEY TABLE.

Tree Protective Fencing is required to be installed 500mm from the edge of propose path alignment of 5m offset from the centre of the tree. Bunting may be optional used along the road edge only for safety reasons to restrict access by vehicle.
Tree Protection Fencing must be installed prior to construction activity, this also includes all trees at access points and trees on council land.

Signage displayed on the Tree Protection Fencing with the wording “TREE PROTECTION ZONE NO ACCESS” with the Project Arborist Contact Number Displayed.
The installation of approved Tree Protection Fencing (*see AS 4687 Temporary fencing and hoarding Table 3)* as requires by Clause 4.3 of the *AS 4970 2009 Protection of Tree on Development Sites*.

CONCLUSION

Three concrete path design concepts proposed have been examined in depth. Consideration to the trees health and reducing construction impact to the health and structure of State Heritage listed trees is considered.

The National Trust listed the avenue of trees in 2013 as one of State significance, being considered a rare example of an Avenue of English Oaks forming a continuous interlocking canopy.

The significance of the interlocking canopy which is the term used in the State significant register on many trees has diminished with the decline of their condition, further ongoing management of the trees is required, safety to users of the area is compromised. There are many instances of dead branches, decayed trees and longicorn beetle infestation, all indications that the avenue of trees is in decline.
50 x new plantings on the southwestern side of the Avenue have been undertaken and their development at this point is good.

Conservation Management Plan was undertaken in 2016, recommendations made in the CMP report to manage the trees into the future are clearly defined.
Presently the CMP has not been implemented fully and fallen a long way behind in maintenance of the trees.

Three design concepts have been the basis of this report for a 3.5m wide concrete path to be constructed on the southwestern side of the Avenue of trees for approximately 2.0 km length.
Designing a footpath under trees canopies will require the trees to maintained, so the risk to persons is As Low As Reasonable Practicable (ALARP). Regular maintenance can be achieved, and remediation of dead or declining trees undertaken with regular inspections by a qualified Arborist will be ongoing.

AS 4970-2009 *(Tree Protection of development sites*) it states that an encroachment of any more than 10% of the calculated TPZ is considered a 'major encroachment' and certain conditions should apply. A major incursion may trigger the following requirements to protect the tree: **Root mapping, design revision, low impact construction methods, or work supervision.**

Option 1: Is not acceptable option.
Construction of a concrete path within 3 m of the centre alignment of the 48 trees will encroach into the SRZ of 30 mature trees or (62.5% *of the trees will have Structural Roots impacted*) further the calculation of incursion greater than 10% into the TPZ of 44 trees or *(91.6 % of the trees will be impacted*).

Construction of concrete path would cause significant damage to the trees and root system by the following:

- Construction equipment is within the SRZ & TPZ.
- Damage to the lower canopy branches by machinery impacts.
- Increase the risk of structural root damage and structural stability of the tree compromised.
- Increase the risk of root rot by root damage.

Other impacts

- Alter the drainage and location of the swale drain.
- Directly increase the risk of users by being directly under the canopies of trees with structural compromised primary unions, branches and increasing deadwood or failure potential.
- Trip hazards from Acorn fruits on hard surfaces under foot.

In the location of the new planting or replacement trees, the TPZ reduces to less than 2m with the path being outside the TPZ. The immature trees will grow to their environmental conditions.

OPTION 2: Acceptable option *(Pending costs)*
(Requires Low impact construction methods and Work supervision AS 4970 2009)

Relocating the High Voltage wires underground @ 7.5m offset from the tree alignment which is the centre of the easement can be achieved, if the relocation is via underground boring excavation only, this will reduce root damage within the TPZ and also the ongoing wire clearance trimming.

The distance of 7.5m easement is encroaching into the TPZ of 32 trees by 12.19% -28.35% overall, any excavation in this TPZ of the trees above require low impact construction method and Arborist supervision.

Excavation for the path at an offset of 5m from the centre of the tree alignment to the path edge by removing the 50-75mm Organic layer only, so that the 3.5m wide path could be laid without disturbing the feeder roots, unlevel ground would require suitable porous inert material to be used as base material for levelling the surface.

To prevent leaching all pathing requires suitable plastic liner between the lower concrete and soil layer.

Previous experience with High Voltage wire location has proven expensive exercise and would consider this a limiting factor in relocation of the existing poles & wires.

NOTE: In reference to soil disturbance, the CMP has recommended "Soil Improvements" ripping to reduce compaction under the tree and improving soil by adding lime (leaching)or gypsum.

Within AS 4970-2009 it states that an encroachment of any more than 10% of the calculated TPZ is considered a 'major encroachment' and certain conditions should apply. A major incursion may trigger the following requirements to protect the tree: Root mapping, design revision, low impact construction methods, or work supervision.

Option 3 Acceptable option *(Economical option)*

There are 3 poles that have a critical influence on this concept design for a split path around the poles, these are as follows:

- TREE 14/15: A split path can be achieved 1.75m between the pole and the fence and maintain a 5 m offset.

- TREE 32: The distance is not adequate and will not support a split path 1.75m wide, the path will be 1.6m wide between the fence and the pole is 150mm narrower than required, however the offset would also be required to be reduced to 4.2m to accommodate the full 1.75m path width on the roadside. The design requires a change in the concept and the pole to be relocated 8m west. The path would not be split but retain the 3.5m width and maintain the 5m offset from the centre of tree alignment. The path could then maintain its width and pass the pole at its new location on the roadside.

- TREE 44: A split path maintaining a 5 m offset from the tree alignment cannot be achieved, the narrowing of the path width 1.3 m between the fence and the pole is 450mm narrower than the required 1.75 desired split path width. The design requires a change in the concept and the pole to be relocated 8m east. The path is not split but retain the 3.5m width and retain the 5m offset from the centre of tree alignment. The path could then maintain its width and pass the pole at its new location on the road side.

Minimise impacts of construction.
Construction will impact TPZ of 32 trees greater than 10% incursion, the 5m offset will assist with reducing the impact to the feeder root system.

Low impact excavation methods will be required, removing the 50-75mm Organic layer only, so that the 3.5m wide path with a 5m offset could be laid without disturbing the feeder roots, where roots are disturbed, the roots will require pruning by the Arborist supervising the works.
Unlevel ground would require suitable porous inert material to be used as base material for levelling the surface.
All excavation works are to be supervised by the Arborist to ensure the impacts are minimised.

NOTE: In reference to soil disturbance, the CMP has recommended "Soil Improvements" ripping to reduce compaction under the tree and improving soil by adding lime (leaching)or gypsum.

RECOMMENDATION

1. TRC is to appoint a Project Arborist to supervise all excavation works.

2. Implement the tree maintenance program for the remedial pruning, removal, dead wood pruning shall be undertaken prior to the commencing works for the path construction. *(Refer to Conservation Management Plan Recommendation 2016 & McArdle Arboricultural Consultancy Report Resistograph Drill Test Results 20th January 2023)*

3. Reviewing all 3 concepts designs Option :1 is not acceptable design; Option 2 is the preferred option with the least impact on the trees, and Option 3 is acceptable but require minor changes to design.

4. Detailed designs to be referred to a suitably qualified Arborist for review.

5. Monitoring the quality of the contractor selected to undertake the pruning work in accordance with AS 4743-2007. (Pruning of Amenity Trees).

6. 32 x trees will have incursions greater than 10% into the TPZ of these trees the specific depth of 50-75mm to removal of the organic layer will not be exceeded, and Arborist must present during these excavations.

7. The TRC should engage an Arboriculture Industry Licensed contractor who holds minimum qualification AQF 3 Arboriculture, including Tree Amenity Insurance, workers compensation insurance consistence Safe Work NSW Engaging a Contractor.

8. Removed trees are to be replaced with the same species in accordance with the Conservation Management Plan 2016. (CMP)

9. All mulch material is to be used on the site in the new plantings where possible.
10. Review the CMP and apply the recommendation for the maintenance management of these trees.

GLOSSARY

Crown: The width of the foliage in the upper canopy of the assessed tree to the four cardinal points. Crown lifting means the removal of the lower branches of the tree.

Crown thinning means the portion of the tree consisting of branches and leaves and any part of the stem from which branches arise.

Drip line: Where the canopy releases water shed from the foliage during precipitation.

DBH/Diameter: Diameter of trunk at 1.4meters in height of assessed tree.

Dead wooding means the removal dead branches from a tree.

Dieback: Tree deterioration where the branches and leaves die.

Flush cut: A cut those damages or removes the branch collar or removes the branch and stem tissue and is inconsistent with the branch attachment as indicated by the bark branch ridge.

Genus/ Species: The Genus and species of each tree has been identified using its scientific name. Where the species name is not known the letters, species is used. The common name for trees may vary considerably in each area of geographical differences and so will not be used in the field survey.

Height: Height has been estimated to + / - 2 metres.

ISA: International Society of Arboriculture.

Maturity: Tree maturity has been assessed as over mature (last one third of life expectancy), mature (one third to two thirds life expectancy) and semi mature (less than one third life expectancy).

Remedial (restorative) pruning includes: Removing damaged, Dead wood; trimming diseased or infested branches. Trimming branches back to undamaged tissue in order to induce the production of shoots from latent or adventitious buds, from which a new crown will be established.

SRZ- Structural Root Zone: An area within the tree's root zone in which roots stabilize the tree. Roots cut in this zone can cause instability and lead to anchorage loss.

Structural Integrity: Describes the internal supporting timber. (Substantial to frail)

TULE- Tree Useful Life Expectancy: An estimation of the trees useful life expectancy using appropriate industry methods.

TPZ- Tree Protective Zone: This zone should be considered as optimal for tree growth and sustainability however the size of the zone is subjective and should be reassessed when individual design and construction methods are being discussed.

Tree Age: Trees have either been assessed as mature, immature or semi-mature.

Tree Numbering: All trees listed in the tree survey have been numbered and plotted.

Vigour: This is an indication of the tree health. Trees have either been assessed as Good Vigour, Normal Vigour or Low Vigour.

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Section II APPENDIX A TULE

TULE –TREE USEFUL LIFE EXPECTANCY

	1 Long TULE	2 Medium TULE	3 Short TULE	4 Remove	5.No Potential for Retention REMOVE IMMEDIATELY	6 Small, Young or Regularly clipped
	Trees that appeared to be retainable at the time of assessment for more than 40 years with low level of risk	**Trees that appeared to be retainable at the time of assessment for 15 to 40 years with and with low to medium level risk**	**Trees that appeared to be retainable at the time of assessment for 5 to 15 years with medium to high level of risk**	**Trees that should be removed within the next 5 years High to Very high level of risk**	**Trees that must be removed immediately. Very high to Extreme level of risk**	**Trees that can be easily transplanted or replaced.**
A	Structurally sound trees located in positions that can accommodate future growth	Trees that may only live for between 15 and 40 more years	Trees that may only live for between 5 and 15 more years	Dead, dying, suppressed or declining trees through disease or inhospitable conditions.	Dead, dying or declining trees diseased or inhospitable conditions.	Small trees less than 5 meters in height
B	Trees that could be made suitable for retention in the long term by Intervention Works.	Trees that may live for more than 40 years, but would need to be removed for safety or Nuisance reasons	Trees that may live for more than 15 years, but would need to be removed for safety or nuisance reasons	Dangerous trees through instability or recent loss of adjacent trees	Dangerous trees through instability or recent loss of adjacent trees	Young trees less than 15 years old but over 5 meters in height
C	Trees of special significance for historical, commemorative or rarity reasons that would warrant extraordinary efforts to secure their long term retention	Trees that may live for more than 40 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	Trees that may live for more than 15 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form	Dangerous trees through structural defects including cavities, decay, included bark, wounds or poor form	Trees that have been regularly pruned to artificially control growth
D		Trees that could be made suitable for retention in the medium term by Intervention Works.	Trees that require substantial Intervention Works, and are only suitable for retention in the short term	Damaged trees that are clearly not safe to retain	Damaged trees that are clearly not safe to retain and must be removed immediately	
E				Trees that may live for more than 5 years, but should be removed to prevent interference with more suitable individuals or to provide space for new planting	High Toxicity Allegan trees, asthmatic and poisonous trees and must be removed immediately.	
F				Trees that may cause damage to existing structures within 5 years	OTHER with legitimate explanation to be removed immediately	
G				Trees that will become dangerous after removal of other trees for reasons given in 1A-1F		
INSPECTION FREQUENCY	Inspection frequency 1-5 Years by competent inspector unless event monitored.	Inspection frequency 1-5 Years by competent inspector unless event monitored.	Inspection frequency 1-3 years by competent inspector unless event monitored.	Inspection frequency to 1 year by competent inspector unless event monitored.	1-7 days by competent inspector and event monitored	Inspection frequency Biannually by competent inspector

Tree Contractors Association of Australia

Health & Structural Condition of Tree
1. *J- Juvenile; im- Immature; SM-Semi- Mature; M-Mature*
2. Excellent Condition
3. Good Condition but Poor Development / Habit
4. Dieback is more than 20%. 4b Epicormics
5. Sparse Foliage Crown 5b Unbalanced Canopy
6. Physical Damage
7. Cavity
8. Lean
9. Heavily Pruned
10. Inclusions
11. Damage to roots
12. Insect Damage 12b Borers
13. Termite Damage
14. Fungal Attack
15. Parasitic Vine Present
16. Damage by Climbing Plant
17. Habitat Tree

Developed by Claus Mattheck in: *The Body Language of Trees (*1994) which have adapted versions from Hornsby Shire Council.

APPENDIX C TREE HAZARD & SITE ASSESSMENT for Preserved trees -

McArdle and Sons Arboricultural Services Pty Ltd

Adapted from ISA Hazard Checklist

SIGNED: 	**SITE:** **King George V Avenue NSW**	**DATE:** ***12/11/22***

1. SITE
Underground service, Overhead power lines, High / low voltage, winds direction, Building within 3m, Uneven terrain, Electrical lines to property, Telephone and cable lines, Streetlights, Vehicle & Pedestrian traffic.
2. ROOT ZONE
Compaction, Damaged Roots, Exposed Roots, Girdling, Close to kerb, Soil Level Raised/ Lowered, In Garden Bed /Mulched Paving/ Concrete/ Bitumen, Roots Pruned, Fungal Growths At Base
3. TRUNK
○ Dead ○ Severe decline(<20% Dead wood) ○ Declining (20-60% twig & branch dieback) ○ Average/ low vigour (60-90% twig dieback) ○ Good (90-100% little or no dieback or visual defects)
4. BRANCH
Lean, Cavities / cracks, Splits / cracks, Physical damage, Insects/ parasites/ borers / termites, Hangers, Condition of bark, Disease, Decay, Previous failures, Inclusion.
5. BRANCH UNIONS
Dead branches, Branch clusters, Pockets of decay, Leaves colour
6. VIGOUR & VITALITY - Crown
Branch unions, Storm damage, heavily pruned

APPENDIX D DISCLAIMER

McArdle & Sons Pro Tree Service

McArdle and Sons Arboricultural Services Pty Ltd does not assume responsibility for liability associated with the tree on or adjacent to this project site, their future demise and/or any damage, which may result therefrom.

Any legal description provided to McArdle and Sons Arboricultural Services Pty Ltd is assumed to be correct. Any titles and ownerships to any property are assumed to be good and sound. McArdle and Sons Arboricultural Services Pty Ltd takes care to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.

McArdle and Sons Arboricultural Services Pty Ltd reports and recommendations shall not be viewed by others or for any other reason outside its intended target, either partially or whole, without the prior written consent of the consultant. Unauthorised alteration or separate use of any section of the report invalidates the whole report. McArdle and Sons Arboricultural Services Pty Ltd cannot be held responsible for any consequences because of work carried out outside specifications, not in compliance with Australian Standards or by inappropriately qualified staff.

Sketches, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale. All recommendations contained within this report represent the current industry best practice methods of inspection. McArdle and Sons Arboricultural Services Pty Ltd 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.

LIMITS OF OBSERVATION

McArdle and Sons Arboricultural Services Pty Ltd makes every effort to accurately identify current tree health and safety issues. Results may or may not correlate to actual tree structural integrity. There are many factors that may contribute to limb or total tree failure. Not all these symptoms are visible. There can be hidden defects that may result in a failure even though other, more obvious defects would be the likely cause of failure.

All standing trees have an element of unpredictable risk. McArdle and Sons Arboricultural Services Pty Ltd endeavours to identify the risk that the tree represents; however, a level of risk associated with every tree will remain. McArdle and Sons Arboricultural Services Pty Ltd does not provide any warranty or guarantee that problems, deficiencies or failures with regard to the plant/s, property or building/s will not arise in the future.

Ongoing monitoring may foresee deterioration of a tree and allow remedial action to be taken to prevent injury or damage. The timing for re-inspection on individual trees is subjective and will vary however an annual inspection is advisable for trees in subsequent years.

FURTHER RESEARCH The report does not cover threatened, heritage or existing trees in relation to remnant forest. Further reporting may be considered as part of the relevant RISK ASSESSMENT.

LIMIT OF OBSERVATIONS BY RODNEY M. PAGE

“There are many factors that may contribute to limb or total tree failure. Factors include, decay (in the trunk, crown or branch junctions), external damage to branches leading to decay, poor branch taper, included bark, root rot/ decay. Not all these symptoms are visible i.e. internal decay; of these some external symptoms may indicate the presence of Dead wood but not the extent of decay. The most solid looking piece of timber may be riddled with breaks in continuity of growth caused by insect damage or poor pruning practices, or other physical damage caused many years previous. Trees don’t heal; they simply box in the damaged area ((CODIT) Compartmentalization of Decay In Trees.) and continue to expand in girth, completely disguising the fact that the branch or trunk has a hollow or decayed section. Having said this, not all areas, of decay past or present suggest a point of failure.”

In addition to this information, other variables that can contribute to limb or total tree failure are tree species, wood densities, weight, age, location, exposure to the elements, soil types, disease and pests, birds using trees as habitat and food sources, termites causing structural problems and human influences such as, altered drainage, compaction or leaching of minerals.

APPENDIX E McArdle Arboricultural Consultants Report Resistograph drill test.

APPENDIX D

REPORT: **Resistograph Drill Test**

REPORT COMMISSIONED FOR:

Dan McArdle
McArdle & Sons Arboricultural Services

King George V Avenue
Tamworth NSW 2340

0418 165 650

16th of January, 2023

MCARDLE
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Tree Contractors Association Australia Inc. T C A A

MEMBER ISA

QTRA

Plate 1: *Tree 4, Quercus robur (English Oak).*

	Sound Wood	Cavities & Decay
North	66.07%	26.79%
South	75.00%	17.86%
East	75.00%	21.43%
West	41.07%	55.36%
Mean	**64.29%**	**30.36%**

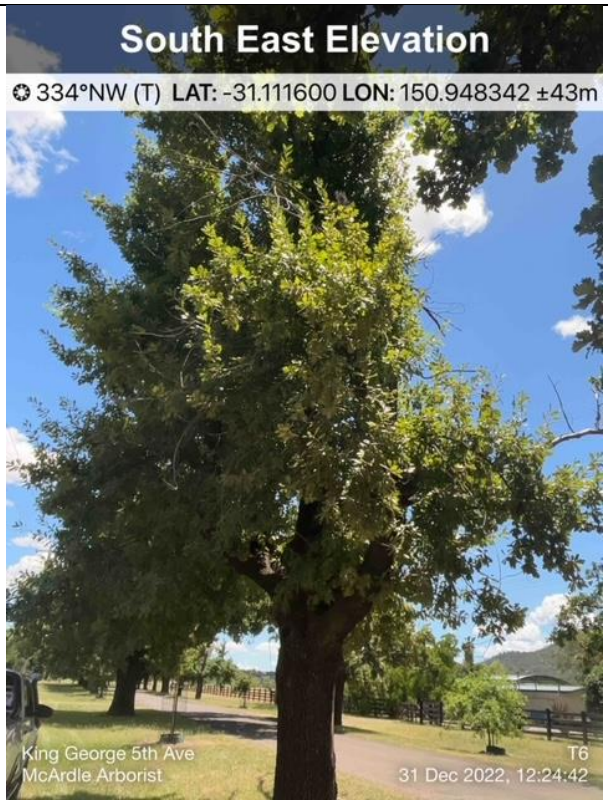

Plate 2: *Tree 6, Quercus robur (English Oak).*

	Sound Wood	Cavities & Decay
North	35.71%	57.14%
South	44.64%	50.01%
East	44.64%	49.11%
West	66.07%	32.14%
Mean	**47.77%**	**47.10%**

Plate 3: Tree 8, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	41.79%	57.14%
South	60.36%	37.50%
East	68.75%	30.36%
West	56.26%	42.85%
Mean	**56.79%**	**41.96%**

Plate 4: Tree 18, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	-	-
South	28.57%	57.13%
East	-	-
West	42.86%	50.00%
Mean	**35.72%**	**53.57%**

Plate 5: Tree 31, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	-	-
South	51.79%	44.64%
East	44.65%	51.78%
West	64.29%	35.71%
Mean	**53.58%**	**44.04%**

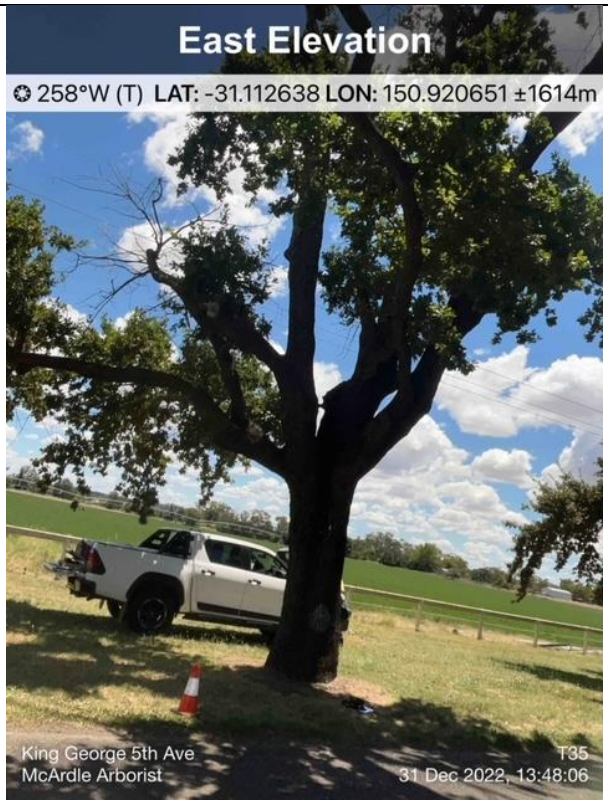

Plate 6: Tree 35, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	73.21%	24.11%
South	58.04%	36.60%
East	90.18%	3.57%
West	36.61%	58.93%
Mean	**64.51%**	**30.80%**

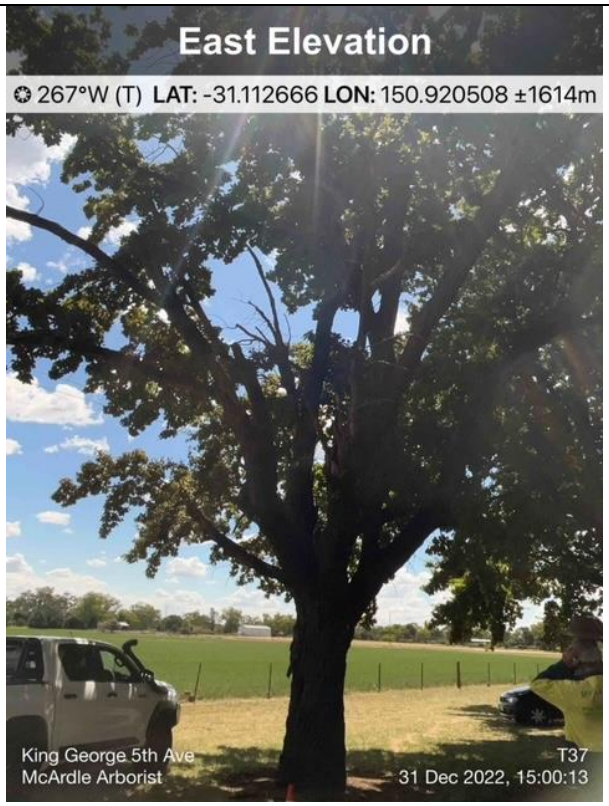

Plate 7: Tree 37, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	67.85%	26.79%
South	60.72%	35.71%
East	42.86%	55.35%
West	59.43%	37.00%
Mean	**57.72%**	**38.71%**

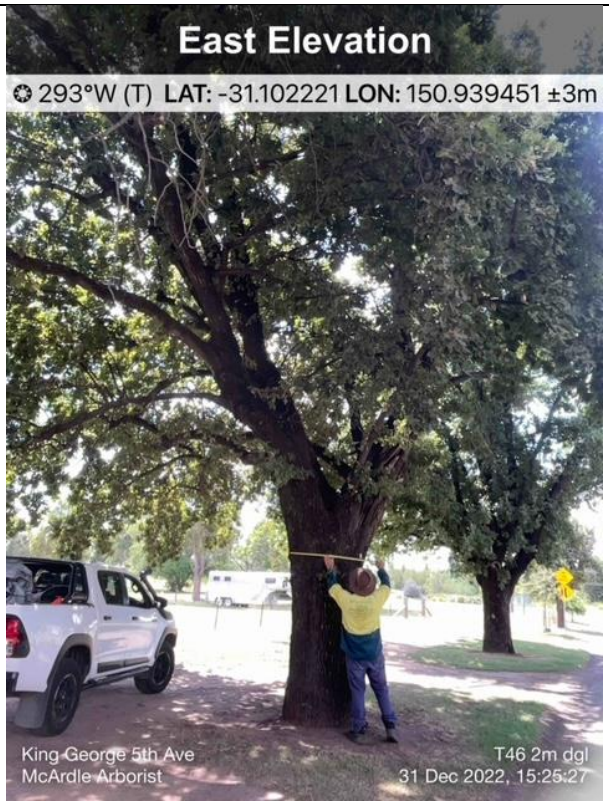

Plate 8: Tree 46, Quercus robur (English Oak).

	Sound Wood	Cavities & Decay
North	41.96%	51.79%
South	40.18%	58.04%
East	79.46%	17.86%
West	70.54%	27.68%
Mean	**58.04%**	**38.89%**

Disclaimer

McArdle Arboricultural Consultancy Pty Ltd does not assume responsibility for liability associated with the tree on/or adjacent to this project site, the future demise and/or any damage which may result therefrom. They take care to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant can neither guarantee nor be responsible for the accuracy of information provided by others.

McArdle Arboricultural Consultancy Pty Ltd cannot be held responsible for any consequences as result of work carried out outside specifications, not in compliance with Australian Standard® or by inappropriately qualified staff. If further investigations such as, aerial, drill and root test are recommended, the report shall not be considered final until all investigations have been completed, as further defects may be found.

STATEMENT OF LIMITATIONS

McArdle Arboricultural Consultancy Pty Ltd makes every effort to accurately identify current tree health and hazards. Results may or may not correlate to actual tree structural integrity. There are many factors that may contribute to limb or total tree failure. Not all these symptoms are visible. There can be hidden defects that may result in a failure even though it would seem that other, more obvious defects would be the likely cause of failure. All standing trees have an element of unpredictable risk.

The inspection was limited to a visual ground examination of the tree, without aerial inspections and below ground excavations. The assessments are limited and do not include specialised analysis. No internal diagnostics, aerial inspection and pathology test were conducted. Sketches, diagrams, graphs, and photographs in this report, being intended as visual aids, are not necessarily to scale.

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