Picus Tomography and Arboricultural Report

The Green, Main Rd/chapel Lane, Old Dalby, LE14 3LR

Project no. J190637

Tree Ref - T1 - Turkey Oak

Parish council of Broughton and Old Dalby

July 2019

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Project Title	Picus Tomography and Arboricultural Report
Property Name	The Green, Main Rd/chapel Lane, Old Dalby, LE14 3LR
Our Reference	J190637
Client	Parish council of Broughton and Old Dalby
Revision	None
Report Date	18/03/2019
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Contents

1.00 **Instruction**

1.10 **Site**

1.20 The Green, Main Rd/chapel Lane, Old Dalby, LE14 3LR

1.30 Client representative
Lucy Flavin

Fee Proposal reference number E19-1620

1.40 With regard to the above fee proposal reference number, I was instructed by the person above by email to undertake detailed diagnostic decay testing and prepare an Arboricultural Report including tree and risk assessment, report findings and mitigation recommendations if necessary, at the above named site.

1.50 Species Turkey oak – *Quercus cerris*

1.60 Reference number T1

1.70 The purpose of the report is to assess the risk of the tree listed above, as per agreement. In addition, mitigation recommendations will be included to reduce risk if necessary. This report is valid for no more than 12 months.

2.00 **Limitations**

2.10 Tomography is typically only appropriate between ground level and where the operator can reach and as such, cannot show any decay or issues within the root system. Any tests, interpretation and recommendations are based on test levels between aforementioned points and observable factors on the day.

3.00 **Introduction**

3.10 Inspector Alan Richardson *Dip Arb L4 (ABC)Tech.Arbor.A*

3.20 My qualifications, professional membership and relevant training include the following;

- ABC Diploma Level 4, Arboriculture
- Lantra Professional Tree Inspector
- Tech.Arbor.A
- Advanced Picus use

3.30 I visited the site on - 16/07/2019

3.40 Concern
The concern raised by previous inspections is the extensive decay caused by *Ganoderma australe.*

4.00 Methodology

4.0.1 As part of the methodology, the following procedure for preparing the report has been undertaken;

1. Understand the situational background
2. Undertake VTA/tomography of the subject tree(s) on site.
3. Interpret tomography, other observable issues and any other implications.
4. Tree risk Assessment
5. Recommend any mitigation measures/ actions if deemed necessary.

4.10 Visual Tree Assessment (VTA) Methodology **Appendix – C**
4.20 Risk Assessment Methodology **Appendix – D**
4.30 Picus Tomography Methodology **Appendix - E**

4.40 The Site

The tree is on the south western edge of the main green within Old Dalby and is within target distance of both Main Rd and Chapel Lane. Furthermore, public events are held periodically on the green.

4.50 Background History

Previous inspections in 2003 and a report based on a resistogragh test in May 2019 recommended the tree's removal. After offering advice that previous reports had clear and compelling recommendations, the local residents are evidently very passionate towards this tree and asked for a 2nd opinion.

4.5.1 Subsequently Ground Control was asked to carry out tomography.

4.60 Scope

Inspection Standards	Decay Testing and Visual Tree Assessment
Inspection Methodology	Visual Assessment from Ground level A climbing Inspection has not been undertaken.
Specialist Inspection Equipment (other than tape/camera/plans)	Tablet Computer
	Laser measuring device
	Inclinometer
	Picus Calliper
	Picus arbosonic (Tree Decay Investigation) (Picus 3)

5.00 Findings

5.10 Visual Tree Assessment

Tree Ref	Species	Scientific name	Remarks Tag no.	Ownership	Height (m)	Circumference cm	DBH (mm)	Crown Spread (M)	Age Class
T1	Turkey Oak	*Quercus cerris*	n/a	Client	23	386	1230	25	Mature

Target 1	Target 2	Target 3	Condition	Decay opening width (cm)	Observation Physical Remarks 1	Observation Physical Remarks 2	Observation Physical Remarks 3	Observation - Disease 1	Observation - Disease 2
Road	Public Open Space		Fair	25	Cavity			Ganoderma australe (Southern Bracket)	

5.2 Inspection Remarks

Mature Ganoderma australe bracket at base on western side. Open cavities x2 on eastern side and x1 to the south at base between buttressing. Cavities are at least 1m deep into centre of trunk. Sound buttressing to the north, south east, south and south west. No buttressing on western side where ganoderma is situated. Sound testing with hammer reveals hollow sounding predominantly on western side up to 1.5m. Further hollowing on eastern and southern sides.

5.30 Photos

5.40 Picus tomography

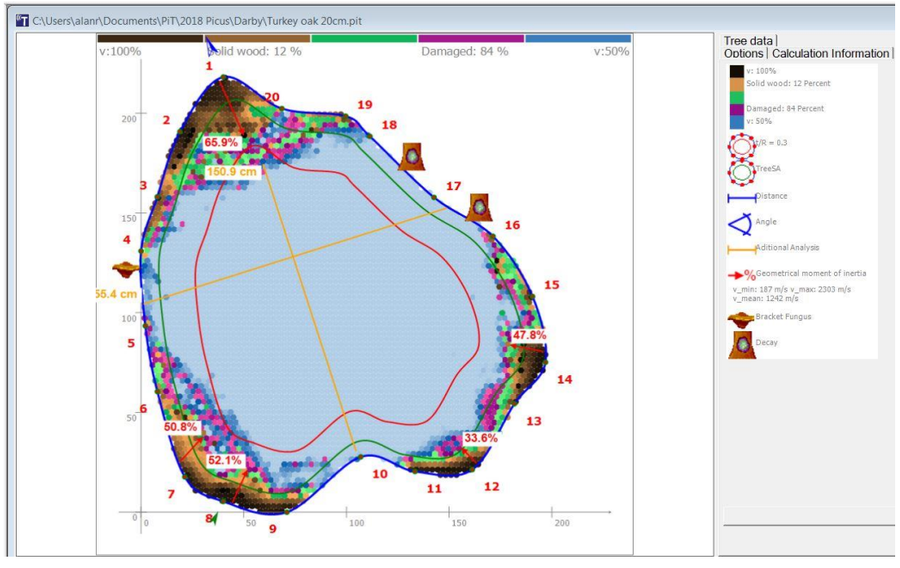
5.4.1 The resulting images from the tomography can be seen on the following pages. In short, they appear to collaborate with the initial observations made with a sounding hammer.

5.3.2 Tests were carried out at the heights below. North is a point 1.

x 5	1st	20	cm
	2nd	50	cm
	3rd	112	cm
	4th	160	cm
	5th	200	cm

5.4.2 20 cm Test

		Wood Type	Colour		Velocity
12	%	Solid	Brown		High
84	%	Damage	Blue	Purple	Low
4	%	Transitional	Green		Unclassified

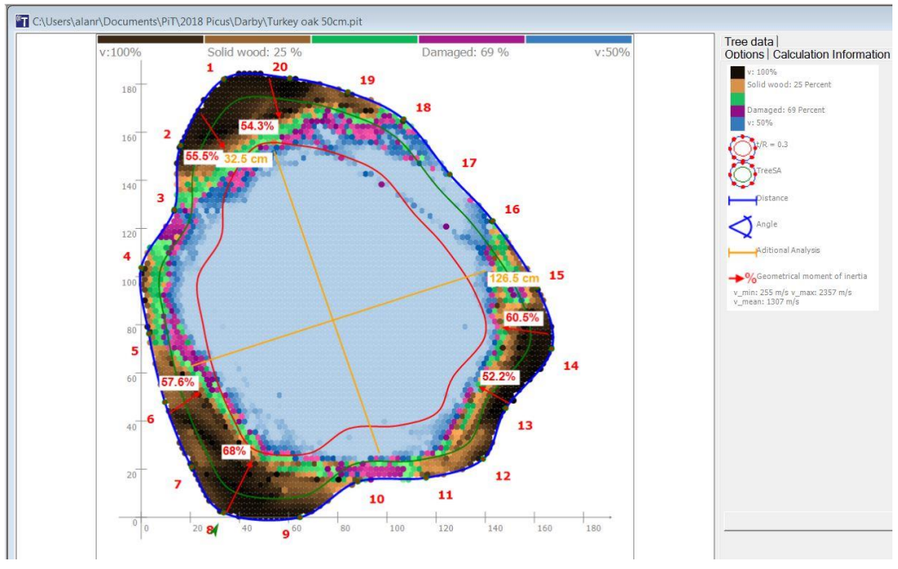


The superimposed red line indicates the 1/3 radius safety margin. t/R ratio

The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line.

50 cm Test

		Wood Type	Colour		Velocity
25	%	Solid	Brown		High
69	%	Damage	Blue	Purple	Low
6	%	Transitional	Green		Unclassified



The superimposed red line indicates the 1/3 radius safety margin. t/R ratio

The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line.

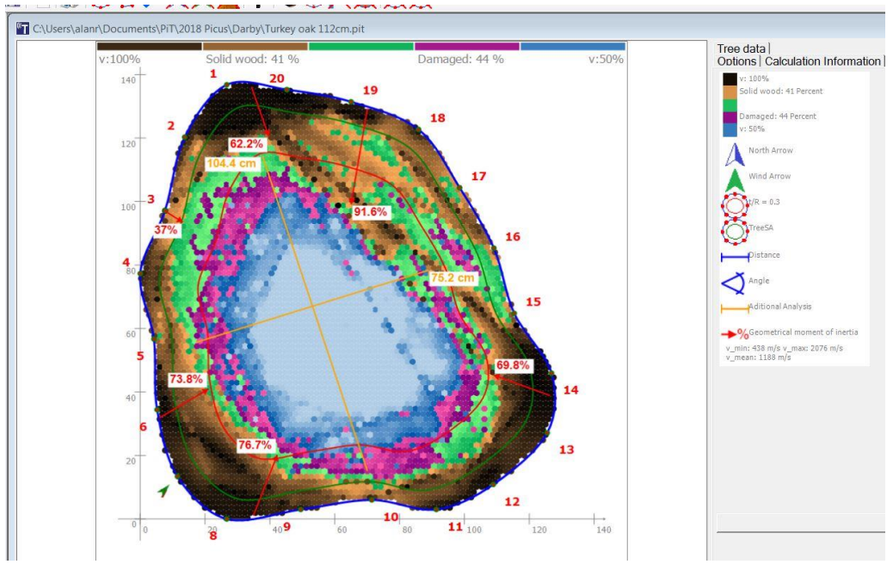
Picus tomography

5.4.3 112 cm Test

		Wood Type	Colour		Velocity
41	%	Solid	Brown		High
44	%	Damage	Blue	Purple	Low
15	%	Transitional	Green		Unclassified

The superimposed red line indicates the 1/3 radius safety margin. t/R ratio

The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line.

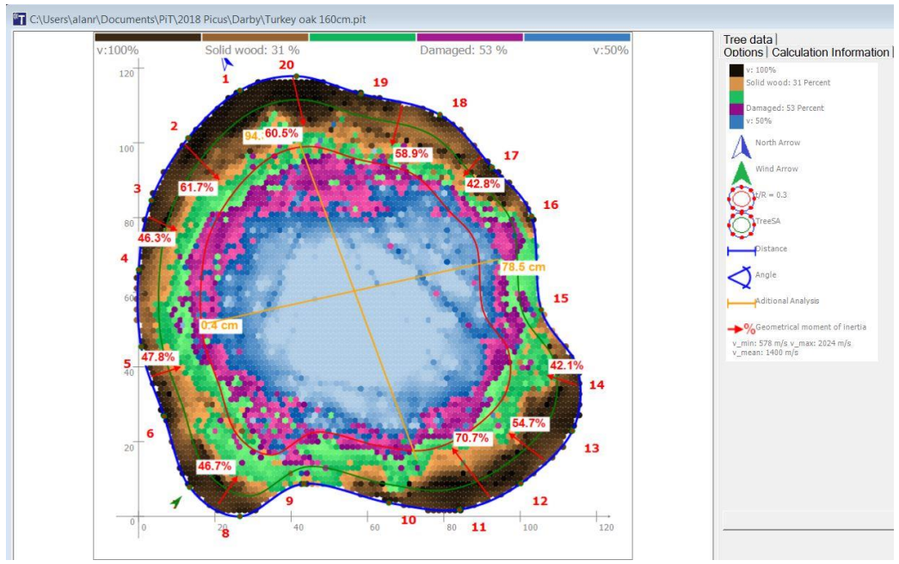


160 cm Test

		Wood Type	Colour		Velocity
31	%	Solid	Brown		High
53	%	Damage	Blue	Purple	Low
16	%	Transitional	Green		Unclassified

The superimposed red line indicates the 1/3 radius safety margin. t/R ratio

The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line.



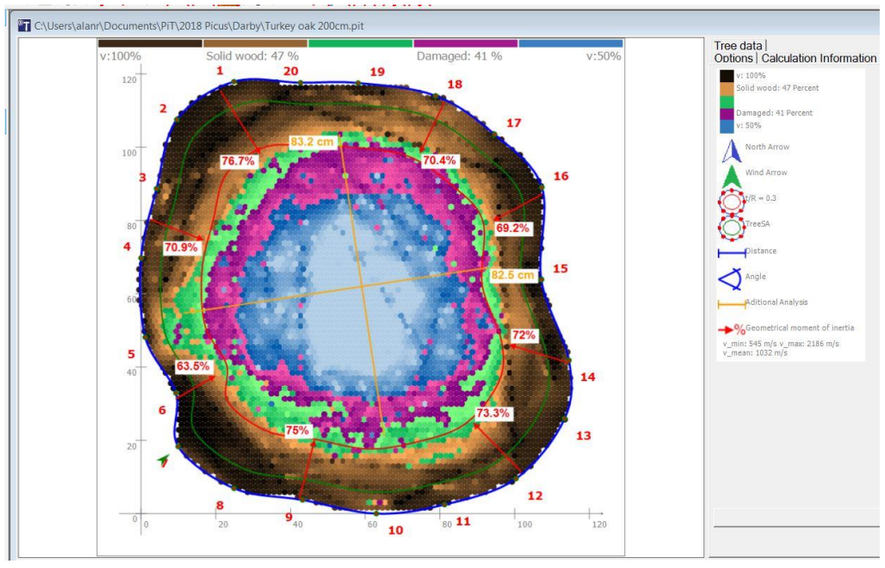
Picus tomography

5.4.3 200 cm Test

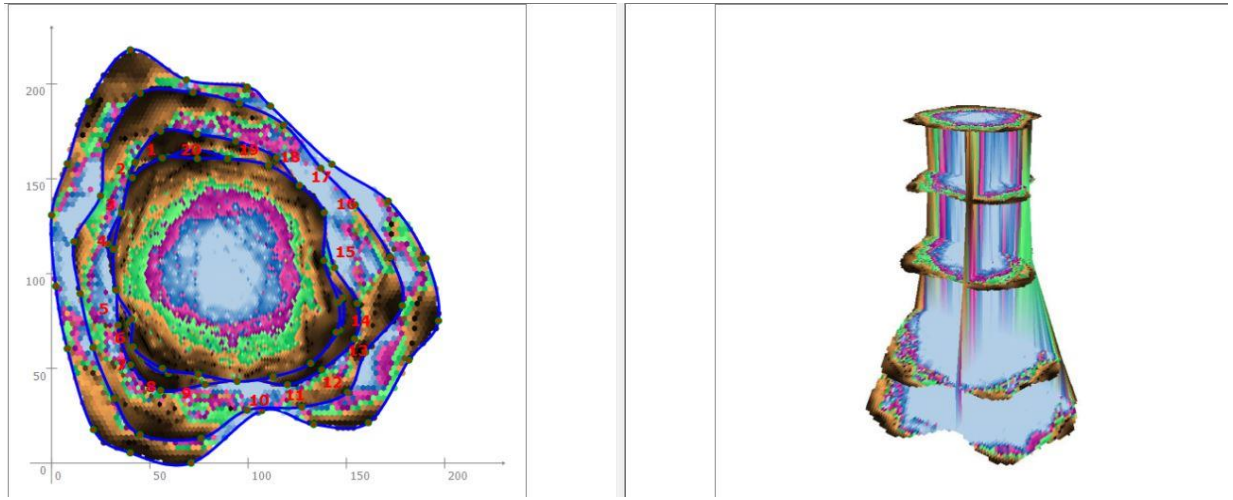
		Wood Type	Colour		Velocity
47	%	Solid	Brown		High
41	%	Damage	Blue	Purple	Low
12	%	Transitional	Green		Unclassified

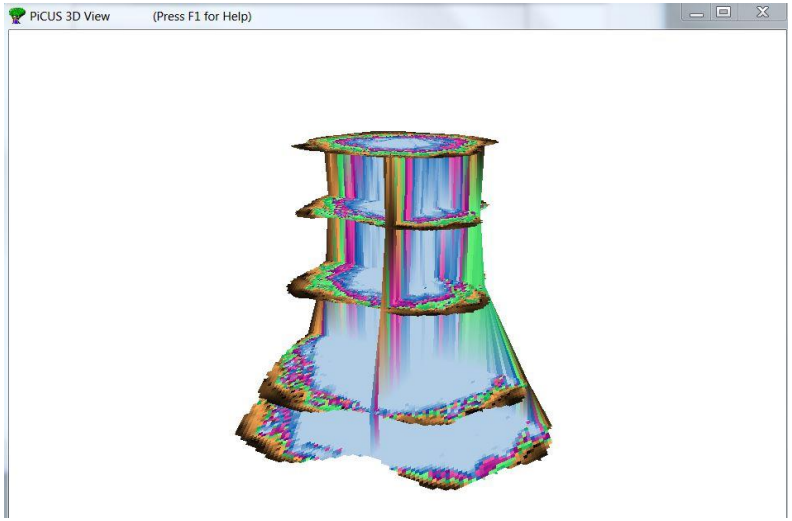
The superimposed red line indicates the 1/3 radius safety margin.
t/R ratio

The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line.



5.4.4 3D Tomography Image





5.5 Interpretation

5.5.1 The Picus tomograph images show an area of hollowing throughout the main stem which although gradually decreases in size, also extends up into the trunk to at least 200cm above ground level. Maximum amount of damaged wood is 84%. Although the tree has tried to compensate with large buttress roots the area around the ganoderma is a flattened section with no compensatory growth. Ganoderma austale causes a white rot by selective delignification especially within the rays leaving a white spongy fibrous mass. This can cause radial cracking, cross sectional flattening of the hollow trunk or failure of buttress roots.

5.5.2 Ganoderma spp
Can be seen on the tomogram at the points below

Point	Tomogram
4-5	1st

5.5.3 Mattheck, C and H. Breloer. 1994. The t/R ratio was developed by scientist Claus Mattheck as a means of determining whether a tree with a hollow (or decayed) stem is safe to be retained. The research, which is generally accepted in the arboricultural industry, states that if the residual wall (t) of sound wood is greater than one third the radius (R) of the stem, the tree is safe to be retained. It should be noted however that other factors are very often involved, and the rule should be considered as a guide only, not as a ruling principle.
Calculate the following: t/R where t= (sound wood excluding bark) and R = Trunk Radius (minus bark)
Note; **Only applies to trees 900mm in diameter or under**. Only applies to trees with a full crown and does not take into account that a crown can be reduced which may replace the need to remove the tree under the same ratio.
When t ÷ R < 0.3 the tree requires removal or reduction in crown size.

t/R ratio applies to subject tree. No

Diameter from Circumference = d=c/3.14

Circumference	631		
Diameter	200.9554		
Minus bark	3		197.955414
Trunk radius	98.97771		
equals in cm	167		

Cavity (damaged wood from tomography)

Sound Wood (t)	equals in cm	28
t/R=		0.282892

5.5.4 Where appropriate a loss of strength calculation has been carried out using the Smiley and Fraedrich method (1990).

$$\frac{\text{(Diameter of Decayed Wood)3 + R x (Diam. trunk wood3-Diameter of decayed wood3) x 100}}{\text{(Trunk Diameter)3}}$$

Trunk Circumference	631		
Trunk Diameter	200.955414		
Note: Reduce trunk diameter by thickness of the bark	3	197.9554	
Diameter of decayed Wood	167		
Cavity Opening	25		
R= Cavity opening/Trunk wood circumference	0.039619651		
Diameter of decayed wood 3	4657463		
Diam. trunk wood 3	8115198.243		
Minus diameter of decayed wood 3	3457735.243		
R x (Diam. trunk wood3-Diameter of decayed wood3	136994.2648		
(Diameter of Decayed Wood)3 + R x (Diam. trunk wood3-Diameter of decayed wood3	4794457.265	x100	479445726.5
Divded by (Trunk Diameter)3	59.07997711		
Stength loss =	59%		

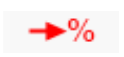
5.5 Interpretation

5.5.5 Estimate of the bending resistance using the geometrical moment of inertia

The second moment of area, also known as moment of inertia of plane area, area moment of inertia (MOI), or second area moment, is a geometrical property of an area which reflects how its points are distributed with regard to an arbitrary axis. In the field of structural engineering, the second moment of area of the cross-section of a beam is an important property used in the calculation of the beam's deflection and the calculation of stress caused by a moment applied to the beam.2

The MOI of a circular ring is being calculated according to this formula:

$$I = \pi * (R4 - r4)$$

Shown as the following on tomograph 

% of bending resistance left (in relation to a circular body with no defect).

5.5.6 "TreeSA" means "Tree Stability Assessment". These TreeSA calculations are based on the publications by Dr. Wessolly, Günther Sinn and Martin Erb in the book "Handbuch der Baumstatik" (published by Patzerverlag). Because the shape and number of crowns to work with have been expanded in the TreeSA program, there are some minimal differences to the SIA method of Dr. Wessolly.
Both the SIA and TreeSA methods attempt to estimate the minimal residual wall thickness needed to prevent the tree trunk from breaking. The methods incorporate the tree species, tree size, wind load, and the environmental conditions.

Required residual bearing Capacity

5.5.7 "Required residual bearing capacity": The bearing capacity of the trunk can be reduced by that value in relation to the non-damaged trunk. In other words:
The bending strength of the trunk must be like this or higher (in relation to the non-damaged trunk) in order to meet the safety factor chosen.

0%

5.5.8 The maximum size of a possible cavity that coincides with the remaining stability calculated is shown by a green line. 

5.5.9 A loss of strength calculation has been carried out using the Smiley and Fraedrich method (1990). It suggests a 59% loss of strength in the tree as a result of the internal hollowing. The t/R ratio is less than one third. This is not a definitive or conclusive factor but a useful reference when taken into consideration with other aggravating conditions that may affect its interpretation.

There are many factors taken into consideration when undertaking tomography and tree assessment. Most elements within the interpretation are often either inappropraite or contributary towards the final decision making rather than a singulary overiding factor.

The parts of the tree most likely to fail (in order to severity of consequence) are the main trunk and then the buttress roots

6.00 Risk evaluation

6.10 **ARB Risk Assessment, Hazards and Mitigation**

6.20 Results of Risk Assessment

6.30 The overall risk rating for this tree is considered Severe

6.40 **Mitigation priority - Arrange for work to be completed** 1 Week

6.50 Summary

Tree Part	Defect	Target	Likelihood of failure	Likelihood of Impacting Target	Consequences of Tree Failure	Occupancy of Target	Risk Rating
Main trunk	Cavity	Road	Imminent	High	Severe	Numerous	Severe

6.60 Risk Summary and recommendations are based upon Tomography interpretation, other factors and Risk Matrix as follows;

Matrix 1

Likelihood of failure	Likelihood of Hitting Target			
	Very Low	Low	Medium	High
Imminent	None	Mindful	Likely	Very Likely
Probable	None	Unlikely	Mindful	Likely
Possible	None	Unlikely	Unlikely	Mindful
Improbable	None	Unlikely	Unlikely	Unlikely

Matrix 2

Likelihood of failure & Impact	Consequences of Tree Failure			
	Negligible	Minor	Significant	Severe
Very Likely	Low	Moderate	High	Severe
Likely	Low	Moderate	High	High
Mindful	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Mitigation Priority

Occupancy of Target	Liklihood of failure, hitting target and consequences				
	Very Low	Low	Moderate	High	Severe
Continuous	Re-inspect within 2 yrs	Within 6 Months	Within 3 Months	Within 1 Week	Immediate
Numerous	Re-inspect within 2 yrs	Within 12-18 months	Within 6 Months	Within 1Month	Within 1 Week
Infrequent	None	Within 2 Years	Within 12-18 months	Within 3 Months	Within 1Month
Uncommon	None	Re-inspect Within 3 Years	Within 2 Years	Within 6 Months	Within 3 Months

7.00 Conclusion

7.10 The tree currently provides considerable amenity value as it can be seen from all directions and is a focal point.

7.20 Based on the following; VTA, Interpretation and risk assessment

7.30 It is my considered opinion that given the condition of the tree and its proximity to; Road

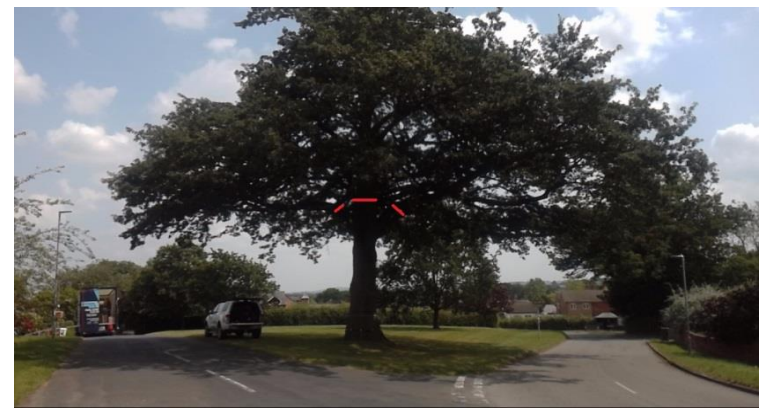
and its following amenity contribution to the landscape Considerable

the following recommendation applies; Monolith to specified height

8.00 Recommendations

8.10 Option 1: Monolith at 7m, leaving lowest structural branches at approx 1.5m from trunk on southern side and shape remainder. This will considerably foreshorten tree to target and all but eliminate any wind sail. Considering the current crown vitality of the tree, it will soon develop significant epicormic growth which it is hoped will retain a “vestige” of a much loved tree. Future management will require cyclic pruning of any re-growth and it is recommended that a pull test is carried out periodically to confirm stability.
Option 2: Alternatively, the tree could be removed with the trunk carved into a seat or bench along with a suitable replacement, planted slightly to the north.

8.40 **Mitigation priority - Arrange for work to be completed** 1 Week



9.00 Notes

9.10 Statutory Tree Protection/Designations

9.20 If trees are subject to a Tree Preservation Order, consent will be required from the Local Planning Authority which can take can take up to 8 weeks to process.

9.30 If trees are situated within a Conservation Area, notification to the Local Planning Authority will be required before works can commence. Please note this should be possible without the usuall 6 weeks to process. A 5 day felling notice can be applied for.

9.40 All the work as specified in the Tree Table of this report should be carried out by suitably skilled and qualified arboricultural contractors in accordance with BS 3998 (2010) or to specification.

10.00 Document Control

10.10 Tree inspection, report prepared, authorised and signed by;

Alan Richardson *Dip Arb L4 (ABC)Tech.Arbor.A*
Senior Arboriculturist

18/07/2019

If you have any queries or wish to discuss further, please do not hesitate to call.

Best Regards

Best Regards,

Alan Richardson *Dip Arb L4 (ABC)Tech.Arbor.A*
Senior Arboriculturist

Arboricultural ASSOCIATION Technician Member

ARB Approved CONTRACTOR

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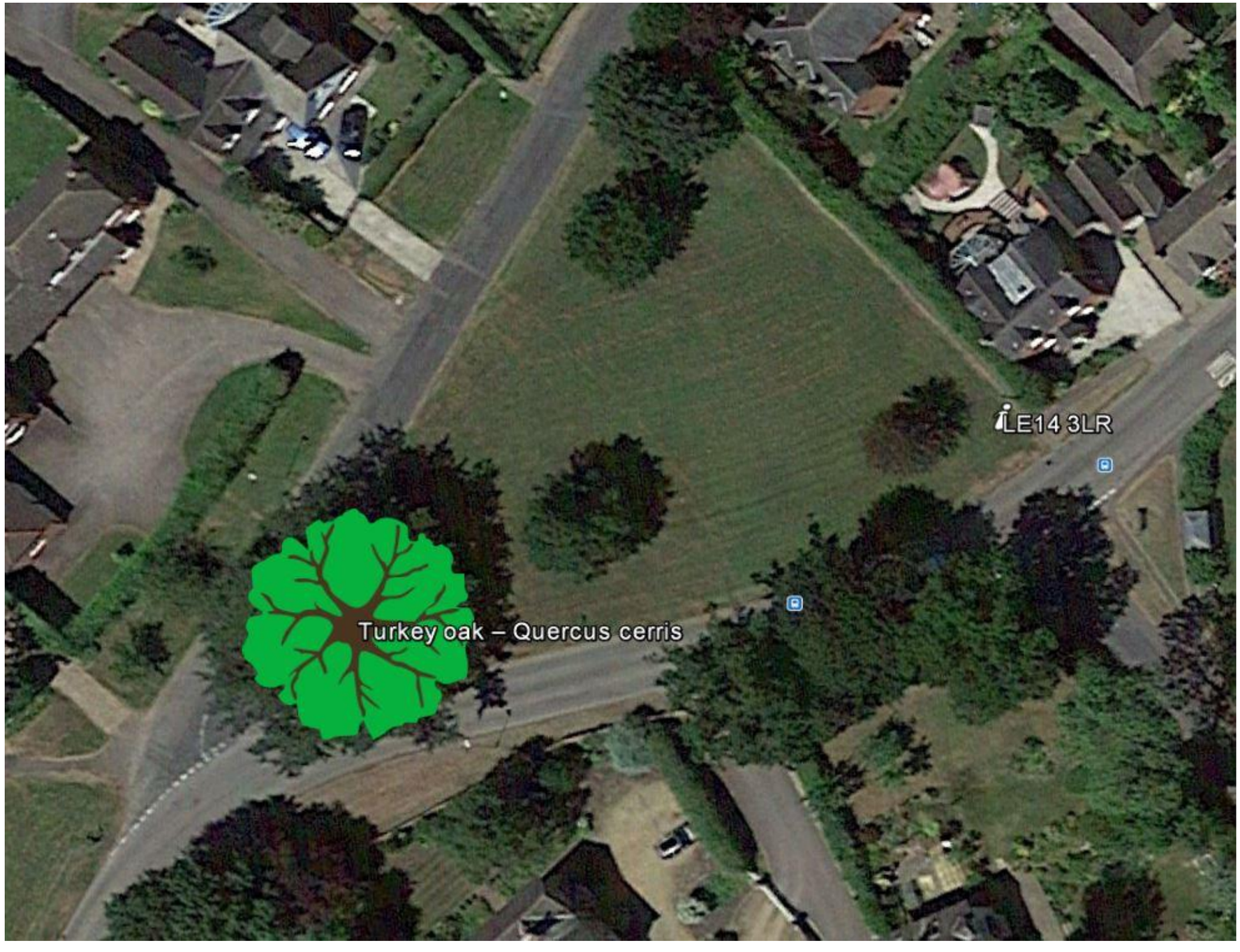
Annex A Plan



Annex B - Survey Data Collection Key and Remedial Work Actions

Ref No:	*Assigned tree number. Corresponds to supporting plans. Trees have been categorised as one of the following: Tree (T)*
Tag No:	*Tree tag reference number*
Species:	*The common name of the tree*
Height (m):	*In line with National Housing Federation height banding to include:0-5, 5-10m, 10-15m, 15-20m and 20+M*
Crown Spread (m):	*Canopy spread of the tree*
Stem Diameter (mm):	*The diameter of the trunk measured in millimetres taken with a DBH Tape at a height 1.5m above ground. In line with National Housing Federation DBH banding to include:0-150mm, 150-300mm, 300-450mm, 450-600mm, 600-1000mm and >1000mm.*
Age Class:	*Recorded as:* ***Y (Young)*** *= Staked tree or tree with high growth potential (in 1st 3rd of life expectancy).* ***MA (Middle Age)*** *= Tree nearing full height but not full spread or stem diameter (Tree in 2nd 3rd of life expectancy).* ***EM (Early Maure) M (Mature) OM (Over Mature)*** *= A mature specimen with limited potential for any significant increase in size but with a reasonable safe life expectancy (in its last 3rd of life expectancy).* ***V (Veteran)*** *= A mature specimen in decline with significant dead wood and cavities which are adventageous to wildlife.*
Condition:	*Categorised as either: Good, Fair, Poor or Dead*
Observation Physical Remarks	*Observations made on the trees structural condition, wounds and defects*
Observation - Disease	*Observations made on the trees physilogical condition including fungal bodies.*
Tree Part	*Part of tree most likely to fail*
Defect	*A defect in the context of the growing environment of a tree is a structural, health or environmental condition that could predispose a tree to failure".*
Likelihood of failure	*Imminent, Probable, Possible or Improbable*
Likelihood of impact	*High, Medium, Low or Very Low*
Likelihood of failure & impact	*Very likely, Likely, Mindful or unlikely*
Consequenses of Tree Failure	*Severe, Significant, Minor or Negligable*
Occupancy of Target	*Continuous, Numerous, Infrequent or Uncommon*
Long Term Value	*Limited, Moderate, Significant, Considerable*
Action	*Remedial work specification*
Works Priority	*Recommended tree works action categorised under Immediate, within 1 week, within 1,3,6,12 months, within 2,3,5,7 years*

Appendix C Visual Tree Assessment Methodology (VTA)

All survey works have been undertaken by appropriately qualified and experienced arboricultural surveyors & consultants with a minimum of LANTRA qualified professional tree inspection.

The trees have been assessed from ground level only using the Visual Tree Assessment methodology and assessed with regards to:

- Structural Condition
- Current H&S Implications
- Recommendations for Remedial Works
- Priority for Works & Cost Implications

VTA is undertaken according to industry best practice and guidence. This includes some of the following;

Matheny and Clark (1994) Tree Risk Assessment
Qualitative Tree Risk Assessment Matheny and Clark (2016)
ISA Basic Tree Risk Assessment (2017)
T H R E A T S; Tree Hazard: Risk Evaluation and Treatment System - Julian Forbes-Laird 2008
Body Language of Trees Mattheck, C and H. Breloer
Principles of Tree Hazard Assessment and Management D Lonsdale 1999

Appendix D Risk Assessment Methodology

Risk Assessment – uses risk categorisation methodologies which tie the data collected to the risk categorisation process. This allows the inspector to record the target and occupancy and carry out a risk assessment.

Tree risk ratings are derived from a combination of three factors: the likelyhood of failure, the likelihood of the failed tree part hitting a target, and the consequences of the target being hit.

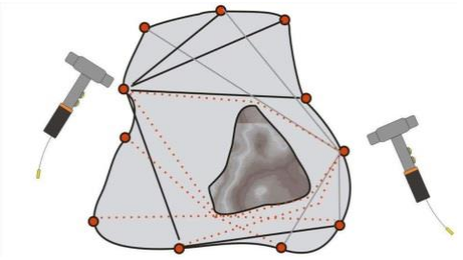
The guidelines used to classify each of these factors are adapted from the International Society of Arboriculture's (ISA's) Best Management Practices (BMP) for Tree Risk Assessment. These factors are then used to categorise tree risk as Severe, High, Medium, Low or None. The factors used to define the risk rating are identified in this report.

Mitigation; Remedial Action required –Full specification and options are given in 6.0-7.0-8.0
The residual risk is the level of risk to the target; the tree should pose after the recommended mitigation. This can be none, low, medium, high or very high with further notes as applicable.

Appendix E Tomography Methodology

Decay in trees is of major concern in relation to human safety and damage to property. Significant decay can eventually weaken stems, branches or roots enough to increase the chance of mechanical failure. Decay is a natural process and commonly occurs in trees without causing structural weakness.
It is therefore inappropriate to regard a tree as hazardous merely because decay has been identified. It is therefore important to be able to evaluate the tree to determine the extent of the decay so that informed management decisions can be made. This will ensure that hazardous trees are correctly identified and relatively safe trees are not removed or unsuitably pruned.

Picus tomography is based on the fact that sound wood is a better sound wave conductor than wood damaged by decay. The device uses a series of sonic sensors which detect sound waves induced and propagated through the wood. It is an instrument to detect decay and cavities in standing trees non-invasively. Sensors are strategically placed and software will generate a two/three dimensional colour tomogram of the tree stem at the chosen test level(s) to demonstrate the internal structure with a diagrammatic representation. Through training, experience and interpretation, the operator can draw conclusions and recommendations where necessary.



Analysing the Picus® Report
Please read the following points to help you understand the Picus Sonic Tomograph Report.
1. Sensor 1, unless otherwise stated, is located on the northern side of the tree.
2. The test height is always measured at sensor 1.
3. Depending on some species of fungi, the active fungus that has colonized cells will not be visible to the human eye.
4. In most cases the altering wood from the fungus cannot be seen by the human eye.
5. The circumference measurement of the Tomogram is created from the location of the tips of the pins.
6. With some readings the ‘Sound wood’ and ‘Unsound wood’ quantities will not total 100%. The unspecified quantity is wood density that cannot be measured. That means that it may be sound or it may not. It is considered to be altering or transitional wood.
The Tomogram produced by the Picus® Sonic Tomograph may at times vary to what will visually be observed when the test area is revealed. It is important that only trained professionals make comments and recommendations regarding any test results.

Appendix F **Legislation and Duty of Care**

'Under both the civil law and criminal law, an owner of land on which a tree stands has responsibilities for the health and safety of those on or near the land and has potential liabilities arising from the falling of a tree or branch. The civil law gives rise to duties and potential liabilities to pay damages in the event of a breach of those duties. The criminal law gives rise to the risk of prosecution in the event of an infringement of the criminal law.

The owner of the land on which a tree stands, together with any party who has control over the tree's management, owes a duty of care at common law to all people who might be injured by the tree. The duty of care is to take reasonable care to avoid acts or omissions that cause a reasonably foreseeable risk of injury to persons or property. If a person is injured by a falling/fallen tree or branch, potential causes of action arise against the tree owner in negligence for a breach of the duty of care, in the tort of nuisance and, where the injured person was on the land of the tree owner at the time of the injury, under the occupiers' Liability acts of 1957 or 1984 (oLa 1957, oLa 1984)'

It is the duty holder's fundamental responsibility, in taking reasonable care as a reasonable and prudent landowner, to consider the risks posed by their trees. The level of knowledge and the standard of inspection that must be applied to the inspection of trees are of critical importance….the courts have not defined the standard of inspection more precisely than the standard of "the reasonable and prudent landowner". Generally, the courts appear to indicate that the standard of inspection is proportional to the size of and resources available (in terms of expertise) to the landowner. It is of note that the Hse states in the Hse sector information minute Management of the risk from falling trees (Hse 2007), that: "for trees in a frequently visited zone, a system for periodic, proactive checks is appropriate. This should involve a quick visual check for obvious signs that a tree is likely to be unstable and be carried out by a person with a working knowledge of trees and their defects'.

(National Tree Safety Group Common Sense risk management of trees, 2011)

Appendix G

Disclaimer

The recommendations contained in this Report represent Alan Richardson professional opinions, in exercising the duty of care required of an experienced Arboriculturist. The information contained has been prepared and given in accordance with the author's professional institution's Code of Professional Conduct and the opinions expressed within are true professional opinions.

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It is important for the tree owner or manager to know and understand that all trees pose some degree of risk from failure or other conditions. The information and recommendations within this report have been derived from the level of tree risk assessment identified in this report, using the information and practices based on the International Society of Arboriculture's Best Management Practices for Tree Risk Assessment, as well as the information available at the time of the inspection. However, the overall risk rating, the mitigation recommendations, or any other conclusions do not preclude the possibility of failure from undetected conditions, weather events, or other acts of man or nature. Trees can unpredictably fail even if no defects or other conditions are present. Tree failure can cause adjacent trees to fail resulting in a "domino effect" that impacts targets outside the foreseeable target zone of this tree. It is the responsibility of the tree owner or manager to schedule repeat or advanced assessments, determine actions, and implement follow up recommendations, monitoring and/or mitigation.
Ground Control can make no warranty or guarantee whatsoever regarding the safety of any tree, trees, or parts of trees, regardless of the level of tree risk assessment provided, the risk rating, or the residual risk rating after mitigation. The information in this report should not be considered as making safety, legal, architectural, engineering, landscape architectural and land surveying advice or other professional advice. This information is solely for the use of the tree owner and manager to assist in the decision making process regarding the management of their tree or trees. Tree risk assessments are simply tools which should be used in conjunction with the owner or tree manager's knowledge, other information and observations related to the specific tree or trees discussed, and sound decision making.

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