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SURVEYS, INSPECTIONS, REPORTS



**OAK TREE
28 RHODFA GANOL
NANT PARC
JOHNSTON
WREXHAM
LL14 1PW**

**ADVANCED TREE INSPECTION UTILISING THE PICUS
SONIC AND PICUS TREE TRONIC DECAY DETECTION
EQUIPMENT**

Report by:

Stephen Cutmore BSc (Hons), MICFor, MArborA
Chartered Arboriculturist

Client	David Lewis
Planning Authority	Wrexham County Borough Council
Grid Reference	SJ30314641
Date of Survey	11 September 2020
Reference	092020/ATI/DL



PRO3755



UK/I 0343A

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1.0 SUMMARY

The subject tree was identified as a Common Oak (*Quercus robur*). The tree is located on the East boundary of the rear garden [OS Grid Ref SJ30314641]. The tree location is shown on the site plan, attached as *Appendix 1*.

A Visual Tree Assessment of the tree was carried out, followed by an advanced inspection, utilising specialist decay detection equipment. Fungal fruiting bodies of Lacquered Bracket (*Ganoderma resinaceum*) were observed on the Northwest side of the trunk at approx. 50cm above ground and on the East side of the trunk at approx. 30cm above ground.

The SoT tomograph indicates a small area of early-stage decay (green colours) at the centre of the trunk and the EIT tomograph indicates a disruption to the inner red ring in the Northwest of the trunk, which is typical of an active fungal decay. Analysing both SoT and EIT tomographs indicates that the area of active decay is predominantly at the centre of the trunk.

Lacquered Bracket (*Ganoderma resinaceum*) causes a white rot, where the fungus preferentially decays the lignin within the wood, leaving the cellulose relatively intact. The fungus targets the roots and stem base. White rot causes wood softening and can result in a ductile fracture of the trunk, or windthrow as a result of root fracture.

As the Lacquered Bracket fungus attacks the roots and stem base, the tree would be most likely to fail in high-wind conditions. As the garden of the client and the garden of the adjacent neighbour to the East are only used occasionally during the day, (so a fairly low occupation rate), the likelihood of the tree failing and impacting someone in the gardens is unlikely, with a Tree Risk Rating for the tree being determined as low. Another factor in reducing the risk is that the people are less likely to be using the garden areas during stormy conditions, when the tree is more likely to fail.

The conclusion is the tree currently poses a low risk and could be retained at this time.

The recommendation is to crown reduce tree volume by up to 20% to include a height reduction of circa 2m and reduction in length of some of the long branches of circa 1.5m, to leave a well-balanced natural crown shape, with crown dimensions of circa 11m high x 12m spread. This work would reduce the weight and 'sail' area of the crown and lower the centre of gravity, which would help reduce the risk of the tree failing.

The tree should be crown cleaned, to remove any large deadwood (>35mm diam.), broken/hanging branches and damaged branches.

The tree is subject to a Tree Preservation Order (Ref WCBC TPO No. 258/2016), therefore written permission will need to be obtained from the Local Planning Authority, before any work to remove live growth is carried out (removing dead branches is classed as an exemption, so no formal application is required for crown cleaning).

Other Plant Health Care recommendations could be considered, to boost the health of the tree.



2.0 INTRODUCTION

2.1 Brief

Stephen Cutmore BSc (Hons), MICFor, MArborA, was instructed by Mr David Lewis, to carry out an advanced inspection of a mature Oak tree, located in the rear garden of 28 Rhodfa Ganol, Nant Parc, Johnston, Wrexham, LL14 1PW [OS Grid Ref SJ30314641].

The definition of the assignment was to:

1. Carry out an Advanced Tree Inspection of the Oak tree, utilising hi-tech decay detection tools.
2. Assess the condition of the tree.
3. Provide a report with management options.

2.2 Purpose of this report

The purpose of this report is to advise you of the results of the parts 1 and 2 of the assignment. These results are set forth in the *Conclusions* section, following. This report describes the field conditions as found and interpreted.

2.3 Scope of report

Date of consultation.

The field examination was made on 11 September 2020, and observations and conclusions are as of that date.

Limit of scope.

This is solely an *Arboricultural Report* and cannot comment on topics outside this discipline. If additional advice is required, it is strongly recommended that other professionals are consulted e.g. Structural Engineers or Surveyors.

Unless stated otherwise:

- 1) Information contained in this report covers only those trees that were examined and reflects the condition of those trees at the time of the inspection.
- 2) The inspection is limited to visual examination of the subject tree from ground level and an advanced inspection, utilising decay detection equipment, to assess the internal condition of the trunk.
- 3) There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the subject trees may not arise in the future.
- 4) This report has been prepared for the sole use and benefit of the client. Any liability of Stephen Cutmore Arboricultural & Ecological Services shall not be extended to any third party.



2.0 INTRODUCTION (continued)

2.4 Relevant background information

The property owner noticed a fungal bracket developing at the base of Oak several years ago and had a visual tree survey carried out. The report recommended that the tree be pruned, which was subsequently carried out. When a second fungal bracket was observed developing at base of the trunk this year, the Wrexham Council Tree Officer, John Brewin, advised that an advanced inspection be carried out, to assess the internal condition of the trunk.

2.5 Tree identification and location

The subject tree was identified as a Common Oak (*Quercus robur*). The tree is located on the East boundary of the rear garden [OS Grid Ref SJ30314641]. The tree location is shown on the site plan, attached as *Appendix 1*.

2.6 Qualifications

Stephen Cutmore is a Chartered Arboriculturist (Institute of Chartered Foresters), with over thirty years' experience in the arboricultural and forestry industry as a contractor and over twenty years' experience as an arboricultural consultant. Full details of my qualifications and experience entitling me to give expert opinion evidence are in *Appendix 6*.

2.7 Copyright

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3.0 DATA COLLECTION

3.1 Site visit

A site visit was made on 11 September 2020. The weather was dry and sunny. There were no limiting factors to the inspection.



3.0 DATA COLLECTION (continued)

3.2 Methodology

A Visual Tree Assessment of the Oak tree was carried out, followed by an advanced inspection, utilising specialist decay detection equipment.

Picus Sonic Tomograph

The Oak tree was tested with the Picus Sonic Tomograph (non-invasive technique) to assess the internal condition of the trunk. The Picus Sonic Tomograph works on the basis that solid wood is a better sound transmitter than decayed wood. Sonic sensors were strategically spaced around the circumference of the trees, to detect stress-waves induced by manual impact and propagated through the wood. Electronic callipers were used to accurately plot the positions of the sensors. Picus Expert (Q73Exp) software was used to generate a two-dimensional colour sonic tomograph (SoT) of the cross-section, detailing areas of solid wood, decay and cavities within the tree. On the tomograph, brown colours indicate solid, healthy wood. The colours green, violet and blue indicate increasing degrees of decay. One test was carried out at 45cm above ground level. The SoT tomograph is included as *Figure 4* and also as *Appendix 2*.

Picus TreeTronic

The Oak was further assessed at the same test position, with the Picus TreeTronic, which uses electric current/voltage to examine the tree. The resulting measurements are displayed in a two dimensional map showing the apparent electrical impedance of the wood, called an Electrical Impedance Tomogram (EIT). The electric impedance - or resistance - of the wood (i.e. the ability of the wood to transmit an electric current) is influenced most of all by the water content, cell structure and chemical elements which change if decay is present in the tree. The TreeTronic can detect such changes by measuring how the heterogeneous wood “bends” the electrical field.

By analysing both the Sonic (SoT) and Electrical Impedance (EIT) tomograms together, detailed information about the position, extent and - in some cases - the kind of decay can be determined. The EIT is also able to clearly identify areas of entrapped bark, resin etc. that could be mistaken for decay, so it is often possible to distinguish between cracks, cavities and ‘wet’ diseased wood.

EIT can detect very early stages of decay and also get information about areas above or below the measuring point, so helps identify root decay problems. On the EIT tomograph, blue colours indicate areas of low resistance (high water content), red colours indicate high resistance (low water content). One EIT test was carried out at 45cm height. The EIT tomograph is included as *Figure 5* and as *Appendix 3*.



3.0 DATA COLLECTION (continued)

3.2 Methodology

Picus Treeetric

Unlike SoT, which is a relative measurement and thus independent of tree species, EIT is to some extent species dependent, with tree species having their own EIT ‘fingerprint’. Most European tree species are Type 1 (e.g. Beech, Birch, Lime, Pine, Poplar and many more). Type 1 trees show **higher conductivity** (low resistance – blue colours) **on the outside** and **high resistance** (low conductivity – red colours) towards the **inside** of the tree.

Coast Redwoods are Type 2 showing **high resistance** on the **outside** and **high conductivity** on the **inside**.

Oaks are Type 3 showing a ring-like distribution, with **higher conductivity** on the **outside** (sapwood), an **inner ring of high resistance** and **high conductivity** in the **centre** (due to high concentration of certain ions).

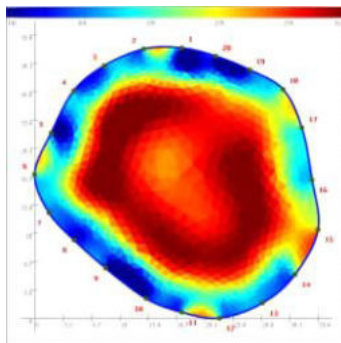


Figure 1: Healthy EIT Type 1.

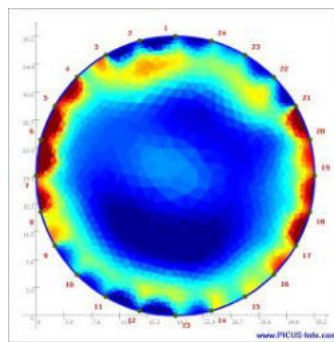


Figure 2: Healthy EIT Type 2.

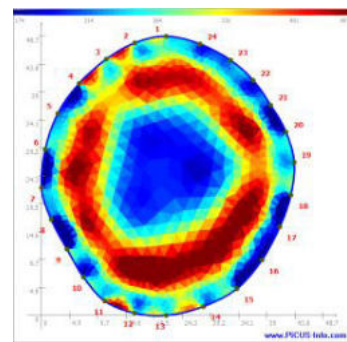


Figure 3: Healthy EIT Type 3.

3.3 Observations

The height of the mature Oak is approx. 13m and crown spread is approx. 15m. The crown appeared in fair health, with good foliar density, size and colour. A number of dead branches and stubs were observed in the crown. The tree is developing large buttresses at the base of the trunk. Fungal fruiting bodies of Lacquered Bracket (*Ganoderma resinaceum*) were observed on the Northwest side of the trunk at approx. 50cm above ground and on the East side of the trunk at approx. 30cm above ground.



3.0 DATA COLLECTION (continued)

3.4 Results

Picus Sonic Tomograph

SoT test at 45cm above ground level.

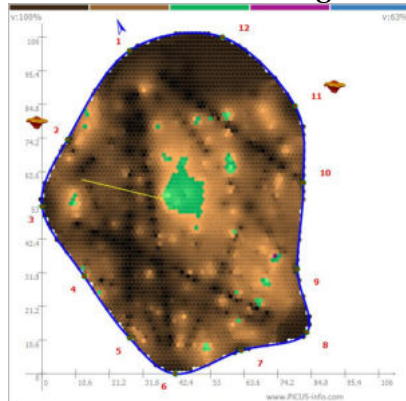


Figure 4: SoT of Oak at 45cm height.

The sonic tomograph (SoT) in *Fig.4* indicates a small area of early-stage decay (green colours) at the centre of the trunk. The light brown colours indicate a slight reduction in velocity of the sonic waves, where a fungus has inoculated the wood and is just beginning to affect the structure of the wood cells. A possible crack/bark inclusion in the Northwest of the trunk is indicated by the superimposed yellow line, that the Picus Q73 Expert software has detected. The symbols indicate the locations of the fungal fruiting brackets.

Picus Treetric

EIT test at 45cm above ground level.

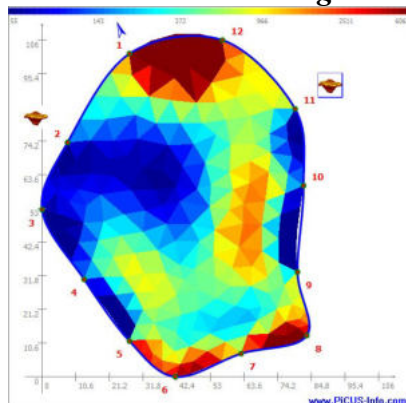


Figure 5: EIT of Oak at 45cm height.

The electrical impedance tomograph (EIT) in *Fig.5* indicates a typical EIT Type 3 ring-like distribution, with higher conductivity (blue colours) on the outside (sapwood), an inner ring of high resistance (red/yellow colours) and high conductivity towards the centre, across the South of the trunk. The disruption of the inner ring across the North of the trunk is typical of an active fungal decay.



4.0 APPRAISAL

4.1 Analysis of Picus SoT and EIT tomographs

By analysing both the SoT and EIT tomographs, a better understanding of the condition of the wood can be obtained (see Table 1).

Tests at 45cm

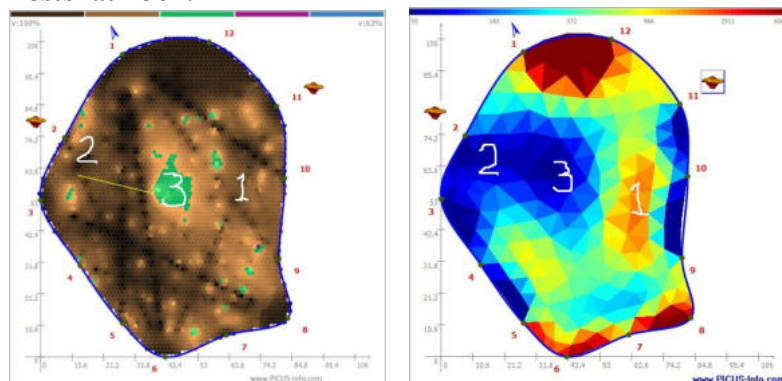


Figure 14: Analysis of SoT and EIT of Oak at 45cm height.

The tomographs show a combination of high velocity SoT (brown) and high resistance EIT (red/yellow) indicating healthy wood, at the Southeast (MP9-10) of the inner trunk [labelled 1], where the inner red ring remains intact. The disruption to the inner red ring (EIT) in the Northwest (MP1-3) of the trunk, due to an increase in conductivity in the wood, is an indication of a defect [labelled 2]. The TreeTronic generates an electric field above and below the test position, whereas the Sonic Tomograph only measures in a horizontal plane across the trunk. When a fungus inoculates the wood and begins to start attacking the cells, it releases enzymes to digest the wood, which increases the moisture content. This increase in conductivity indicates that there may be fungal activity in the walls of the wood cells, in the lower trunk/base below the test position. The green colours on the SoT in the centre of the trunk indicate a decrease in velocity of the sonic waves, indicating early-stage fungal decay. The combination of decreasing velocity SoT (green) and high conductivity EIT (blue), in the centre, indicates an area of active fungal decay [labelled 3].



4.0 APPRAISAL (continued)

4.3 Tree Risk Assessment

By using a process of rating the likelihood of tree failure and the consequences of the event (International Society of Arboriculture Tree Risk Assessment methodology), a risk level was determined for the next **2 years** for Oak tree. The main targets identified are pedestrians (people using the gardens) and the neighbour's extension. There are **five** steps in determining the Tree Risk Rating.

Step 1: Likelihood of Failure

The likelihood of failure in the next year can be categorised using the following guidelines:

Improbable – the tree or tree part is not likely to fail during normal weather conditions and may not fail in many severe weather conditions within the specified time period.

Possible – failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified time period.

Probable – failure may be expected under normal weather conditions within the specified time period.

Imminent – failure has started or is most likely to occur in the near future, even if there is no significant wind or increased load.

The Oak was assessed as having a **Possible** Likelihood of Failure.

Step 2: Likelihood of Impacting a Target

To estimate this likelihood, the occupancy rate of any targets within the target zone and any factors that could affect the failed tree as it falls towards the target are determined. The likelihood of impacting a target can be categorised using the following guidelines:

Very Low – the chance of a failed tree or tree part impacting the specified target is remote. This is the case for a rarely used site that is fully exposed to the assessed tree, or an occasionally used area that has some protection against being struck by the tree failure due to the presence of other trees between the tree being assessed and the targets.

Low – there is a slight chance that the failed tree or tree part will impact the target. This is the case for an occasionally used area that is fully exposed to the assessed tree, a frequently used area that is partially exposed to the assessed tree, or a constant target that is well protected from the assessed tree.

Medium – the failed tree or tree part could impact the target, but is not expected to do so. This is the case for a frequently used area that is fully exposed on one side to the assessed tree, or a constantly occupied area that is partially protected from the assessed tree.

High – the failed tree or tree part is likely to impact the target. This is the case when a fixed static target is fully exposed to the assessed tree or near a high-use road or walkway with an adjacent street tree.

The Oak was assessed as having a **Low** Likelihood of Impacting people using the gardens.

The Oak was assessed as having a **High** Likelihood of Impacting the neighbour's extension.



4.0 APPRAISAL (continued)

4.3 Tree Risk Assessment

Step 3: Categorising Likelihood of a Tree Failure Impacting a Target

After determining the likelihood of failure and the likelihood of impacting a target, the combined likelihood of a failure impacting a target can be categorised using the following table.

Table 2: Likelihood of failure and likelihood of impacting a target

Likelihood of Failure	Likelihood of Impacting a Target			
	Very Low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

The Oak was assessed as having an **Unlikely** value of failure impacting people using the gardens and a **Somewhat likely** value of impacting the neighbour's extension.

Step 4: Categorising Consequences of Failure

Consequences are estimated based on the value of the target and the harm that may be done to it. Consequences of failure may be categorised using the following guidelines:

Negligent – consequences are those that involve no personal injury, low-value property damage or disruptions that can be replaced or repaired.

Minor – consequences are those involving minor personal injury, low to moderate-value property damage, or small disruption of activities.

Significant – consequences are those that involve substantial personal injury, moderate to high-value property damage or considerable disruption of activities.

Severe – consequences are those that could involve serious personal injury or death, high-value property damage, or major disruption of important activities.

The Consequences of Failure for the Oak was assessed as **Severe**.



4.0 APPRAISAL (continued)

4.3 Tree Risk Assessment

Step 5: Tree Risk Rating

Having determined the combined likelihood of a tree failure impacting the target and categorising the severity of the associated consequences, the tree risk rating can be determined using the following table.

Table 3: Tree Risk Rating

Likelihood of Failure and Impact	Consequences			
	Negligible	Minor	Significant	Severe
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

The **Tree Risk Rating** for the next 2 years for the Oak is determined as **Low** with regards to people using the gardens and **Moderate** with regards to the neighbour's extension.

5.0 CONCLUSIONS

The SoT tomograph indicates a small area of early-stage decay (green colours) at the centre of the trunk and the EIT tomograph indicates a disruption to the inner red ring in the Northwest of the trunk, which is typical of an active fungal decay. Analysing both SoT and EIT tomographs indicates that the area of active decay is predominantly at the centre of the trunk.

Lacquered Bracket (*Ganoderma resinaceum*) causes a white rot, where the fungus preferentially decays the lignin within the wood, leaving the cellulose relatively intact. The fungus targets the roots and stem base. White rot causes wood softening and can result in a ductile fracture of the trunk, or windthrow as a result of root fracture.

Trees defend themselves against fungal attack by depositing chemicals in the wood (polyphenols) to form barriers which have antifungal properties. Oaks as a species usually form strong defensive barriers, so the decay process can often be quite slow.

As the Lacquered Bracket fungus attacks the roots and stem base, the tree would be most likely to fail in high-wind conditions. As the garden of the client and the garden of the adjacent neighbour to the East are only used occasionally during the day, (so a fairly low occupation rate), the likelihood of the tree failing and impacting someone in the gardens is unlikely, with a Tree Risk Rating for the tree being determined as low. With regards to the neighbour's extension the Tree Risk Rating is determined as Moderate. Another factor in reducing the risk is that the people are less likely to be using the garden areas during stormy conditions, when the tree is more likely to fail, although that does not reduce the risk posed to the neighbour's extension.



5.0 CONCLUSIONS (continued)

The tree is a prominent feature in the locality, with high amenity value and is subject to a Tree Preservation Order (Ref WCBC TPO No. 258/2016). The conclusion is the tree currently poses a low-moderate risk and could be retained at this time. It would be sensible to carry out remedial pruning works to remove dead branches for safety reasons and to carry out crown reduction pruning, to reduce the size of the crown.

6.0 RECOMMENDATIONS

The recommendation is to crown reduce tree volume by up to 25% to include a height reduction of circa 3m and reduction in length of some of the long branches of circa 2m, to leave a well-balanced natural crown shape, with crown dimensions of circa 10m high x 11m spread. This work would reduce the weight and 'sail' area of the crown and lower the centre of gravity, which would help reduce the risk of the tree failing.

The tree should be crown cleaned, to remove any large deadwood (>35mm diam.), broken/hanging branches and damaged branches.

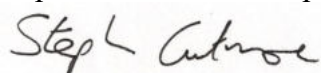
The tree work should be carried out by a suitably qualified and experienced arborist, and the work should conform to B.S.3998 'Recommendations for Tree Work', (2010).

The tree is subject to a Tree Preservation Order (Ref WCBC TPO No. 258/2016), therefore written permission will need to be obtained from the Local Planning Authority, before any work to remove live growth is carried out (removing dead branches is classed as an exemption, so no formal application is required for crown cleaning).

Another option to consider is to apply Avengelus [improved Basic granule formula] as a surface dressing under the crown area and apply Avengelus gel to the fungal brackets. Avengelus contains *Trichoderma atrobrunneum*, a naturally occurring environmentally-friendly organism that fights many of the common wood decay fungi (*Kretzschmaria deusta*, *Armillaria mellea*, *Meripilus giganteus*, *Ganoderma adpersum*, *Laetiporus sulphureus*, *Inonotus hispidus*, *Phaeolus schweinitzii*). As a population of *Trichoderma* develops in the soil (and on the fungal brackets), it grows specifically towards the hyphae of the host fungus, attaches on and penetrates the cell wall of the decay fungal hyphae, feeds on the cell contents, thus destroying the fungus.

To boost the tree health and vitality, consider injecting Enerbrite into the trunk, by means of the TreeBite system. Enerbrite is a liquid potassium phosphite fertilizer, which is applied via a small lenticular shaded perforated blade and absorbed into the xylem tissues by infusion. The fertilizer will boost the energy levels in the tree, to help it recover from the stresses that the pruning work will cause and help the trees' defence against the fungus.

Report written and compiled by



Stephen Cutmore BSc (Hons), MICFor, MArborA,
Chartered Arboriculturist



APPENDIX 1 – Site plan



Tree location plan.

Client: David Lewis
Ref: 092020/ATI/DL

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APPENDIX 2 – Picus Sonic Tomograph

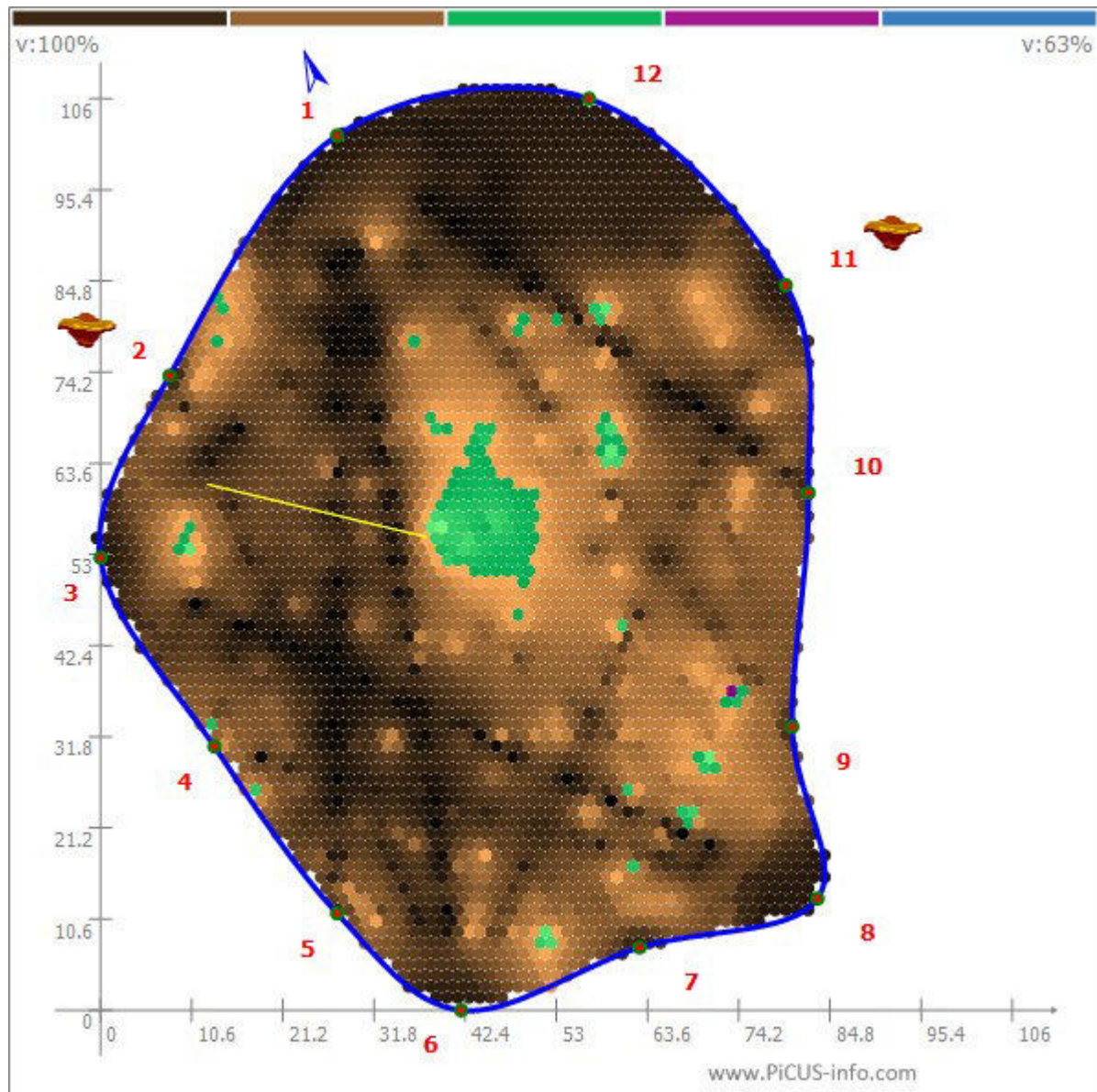


Plate 1: SoT of Oak at 45cm height.

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APPENDIX 3 – Picus Treeetric Tomograph

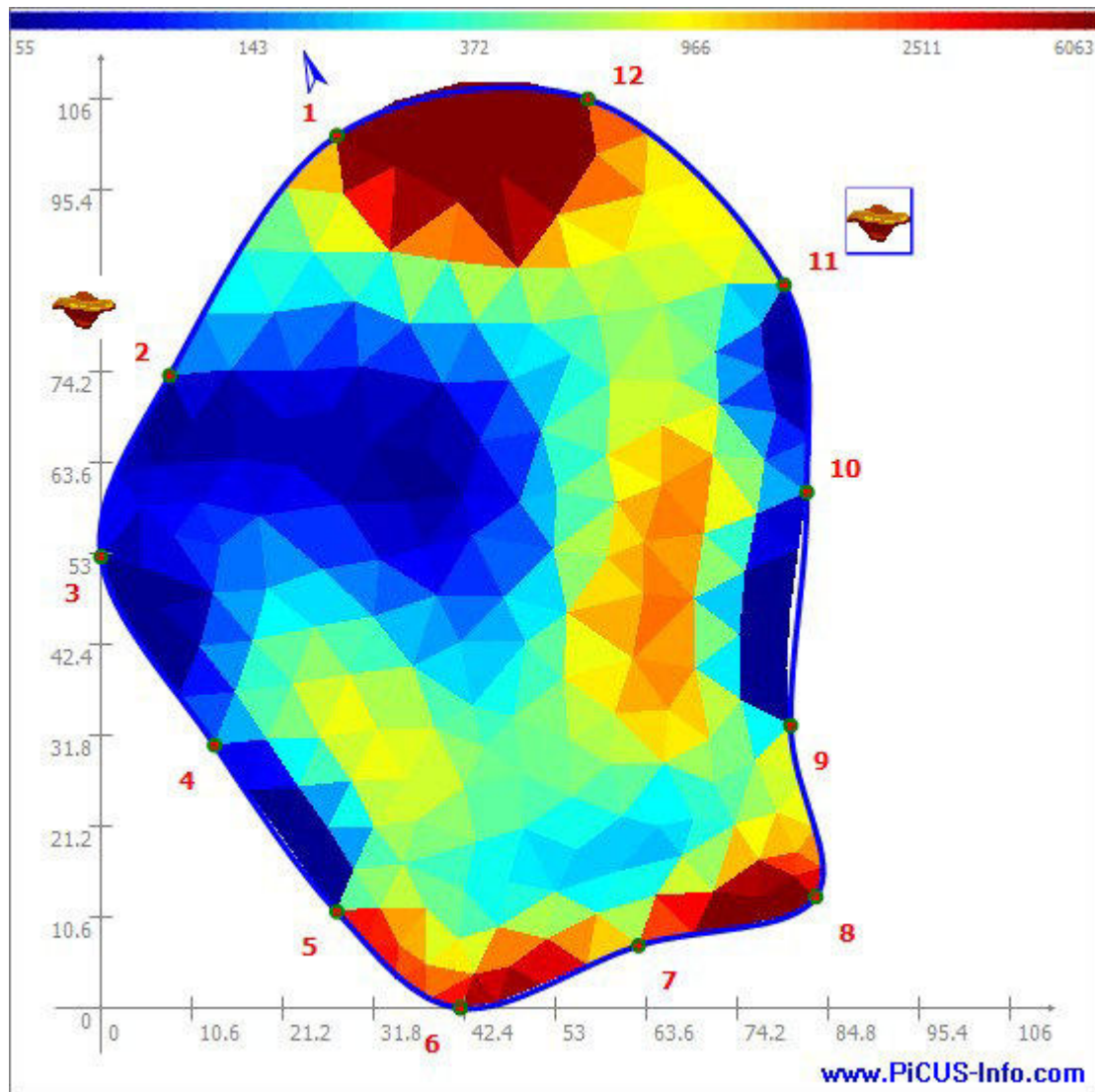


Plate 3: EIT of Oak at 45cm height.

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APPENDIX 4 – Photographs



Photo 1: Lacquered Bracket (*Ganoderma resinaceum*) at Northwest of the trunk base.



Photo 2: Lacquered Bracket (*Ganoderma resinaceum*) at East of the trunk base.

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APPENDIX 4 – Photographs



Photo 3: There are a number of dead branches within the crown.



Photo 4: Suggested crown reduction pruning to reduce size of crown 'sail' area.
[Red line = approx. 20%, Amber line = approx. 25%]

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APPENDIX 5 – Bibliography

The following publications were referred to in preparing this report.

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APPENDIX 6 – Consultant Profile



Stephen Cutmore

BSc (Hons) Arboriculture & Urban Forestry

Chartered Arboriculturist

Member of the Institute of Chartered Foresters (Professional 772508)

Institute of Chartered Foresters Registered Consultant

Member of the Arboricultural Association (Professional 3755)

Member of the International Society of Arboriculture (Professional 84047)

International Society of Arboriculture Certified Arborist (UK/I -0343A)

Stephen Cutmore has over thirty years' experience in the arboricultural and forestry industry as a contractor and during this period over twenty years' experience as an arboricultural consultant.

He has specialist knowledge in advanced inspections of hazard trees, utilising hi-tech specialist equipment (Picus Sonic Tomograph, Picus TreeTronic, IML Resistograph PD400 microdrill, IML Fractometer).

Stephen has attended three Masterclasses for the Picus and one Masterclass for the Resistograph, run by the UK distributors, Sorbus International.

He is also Tree Risk Assessment Qualified [TRAQ] (International Society of Arboriculture).



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