BY APPOINTMENT
TO HER MAJESTY THE QUEEN
TREE SURGEONS
F.A. BARTLETT TREE EXPERTS CO. LTD.

Bartlett Consulting

TREE STRUCTURAL INTEGRITY REPORT

[redacted]

Date: 1st August 2018

CLIENT:	Daleham Gardens Housing Association
SITE ADDRESS:	Flat 26a Daleham Gardens London NW3 5DA
DATE & TIME OF VISIT:	10.00am Tuesday 31st July 2018
PEOPLE PRESENT:	Mr G Davies (Bartlett Consulting) Mr M Reed (Bartlett Consulting)
REPORT COMPLETED BY:	Mr G Davies *FdSc Arb*

Summary:

In reading and understanding the contents of this report, it should be remembered that no tree can be deemed risk free. As with all things in the natural environment, they are subject to unpredictable forces such as extreme weather, effects of disease, and man's influence upon them. In reaching a conclusion as to a level of risk the tree poses, we investigate every obvious and available facet of the structure of the tree and its surroundings.

Where applicable, these conclusions and recommendations seek to reduce the risk to a level as low as reasonably practical, given the location of the tree, the site use, the owners' acceptance of the level of risk, and the perception of the tree's value to the environment.

[redacted]

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1.0 SCOPE OF REPORT

1.1 Survey Brief

To carry out an advanced Level 3* inspection and risk assessment of the Common Ash (*Fraxinus Excelsior*) located within the rear garden of 26 Daleham Gardens London. The commissioned Level 3 inspection consisted of internal decay detection and structural integrity assessment with the use of PICUS Sonic Tomography.

To compile and collate all of the visual tree assessment survey and diagnostic information and data; to create a complete picture and understanding of the health and structural condition of the tree; to complete a qualified risk assessment and to make fully informed management recommendations, in accordance with current Arboricultural practice and tree health care techniques.

1.2 Background

The mature Common Ash was previously inspected on 9th September 2010 by J Harraway of Harraway Tree Services in which a fruiting body was observed within an a cavity at a height of 3.5m. A Picus sonic tomography test was subsequently carried out at a height of 3.25m on the main stem in order to establish the extent of internal decay.

Bartlett Consulting have been instructed by Mrs Monjardino on behalf of the Daleham Gardens Housing Association to carry out a level 3 structural integrity inspection with a Picus re-test at 3.25 m and a further test at ground level in order to establish the current structural integrity of the Common Ash.

1.3 Report References

As a progressive company, we keep abreast of research data relating to Arboriculture. All observations, recommendations and works are based on current industry standard reference material and extensive FA Bartlett research findings, derived from the company's own facilities at the University of Reading in England as well as in Charlotte, North Carolina, in the USA. A selection of pertinent items is shown in Appendix 2.

Specific tree survey methodologies and references applied by Bartlett Consulting for this project include:

- Smiley, T, Fraedrich, B & Hendrickson, N. (2011) *Tree Risk Management.* Bartlett Tree Research Laboratories. Charlotte, NC.
- Dunstar, J.A, Smiley. T, Matheny. N, Lilly. S. (2013) *Tree Risk Assessment Manual.* International Society of Arboriculture. Champaign, IL.
- Lonsdale, D. (1999) *The Principles of Tree Hazard Assessment & Management (Research for Amenity Trees No.7)* Department of the Environment. London.
- Strouts, R.G. & Winter, T.G. (1994) *Diagnosis of Ill Health in Trees (Research for Amenity Trees No.2)* Department of the Environment, London.
- Shigo, A. (1991) *Modern Arboriculture.* Shigo & Trees Associates. Durham, NH.
- Mattheck, C, Breloer, H. (1994) *The Body Language of Trees (Research for Amenity Trees)* Department of the Environment, London.
- Mattheck, C, Bethge K, Weber K. (2015) *The Body Language of Trees – Encyclopedia of Visual Tree Assessment* Karlsruhe Institute of Technology Campus North.

1.0 SCOPE OF REPORT (continued...)

1.4 Report Limitations & Methodologies

This report is restricted to the Common Ash tree detailed in the Survey Brief above. The statements, findings and recommendations made within the report do not take into account any effects of extreme climate and weather incidences, vandalism, changes in the natural and/or built environment around the trees after the date of this report, nor any damage whether physical, chemical or otherwise.

Bartlett Consulting and Bartlett Tree Experts cannot accept any liability in connection with the above factors nor where recommended tree management is not carried out in accordance with modern tree health care techniques, within the timelines proposed and specification provided.

1.5 Assessment of Ecological Status of Tree & Potential Constraints

The Wildlife and Countryside Act 1981, as amended by the Countryside and Rights of Way Act 2000, provides statutory protection to birds, bats, insects and other species that inhabit trees, hedgerows, or other associated vegetation. It is the recommendation of Bartlett Consulting that professional, detailed, advice from an ecologist is sought (if not done-so already) to confirm the consideration of Bartlett Consulting and to check if any such constraints apply to this site and its development proposals.

All trees must be thoroughly and properly assessed for nesting birds prior to the commencement of any recommended tree works.

*** Levels of Tree Assessment**

Level 1 Limited Visual Assessment: A visual assessment of an individual tree or a population of trees near a specified target, conducted from a specific perspective, in order to identify certain obvious defects or specified conditions. Observations are made from ground level and the tree is not climbed.

Level 2 Basic Assessment: A detailed visual inspection and assessment of a tree and the surrounding site. The basic assessment requires the tree risk assessor to walk completely around the tree. Tree dimensions are recorded using hand tools such as a diameter tape, laser range finder and measuring tape. Further information is gathered using a "sounding hammer", binoculars and other tools such as a depth probe.

Level 3 Advanced Assessment: An advanced assessment is performed to provide detailed information about specific tree parts, defects, targets, or site conditions. Methods of advanced assessment can include climbing inspections, decay detection, root excavations, lean monitoring and pull tests.

It is important to understand that as trees are living and dynamic organisms, it is not possible to maintain them free of risk. Some level of risk must be accepted in order to experience the full range of benefits that trees provide. As such, we reference the recently published document by the National Tree Safety Group (NTSG), Common Sense Risk Management of Trees (Forestry Commission 2011). This document provides guidance on trees and public safety in the UK for owners', managers and advisors.

2.0 TREE PRESERVATION ORDER & CONSERVATION AREA PROTECTION STATUS

The Town & Country Planning Act (Tree Preservation) (England) Regulations 2012 and the Town & Country Planning Act 1990 (as amended) provides legislative protection for trees within England.

An enquiry was conducted by Bartlett Consulting on 2nd August 2018 through the London Borough of Camden interactive mapping website: http://gis.camden.gov.uk/geoserver/ConservationArea.html

2.1 Tree Preservation Order (TPO) Status

The Common Ash is covered by: TPO24H-T20

2.2 Conservation Area (CA) Status

Fitzjohns Netherhall Conservation Area – Designation Date 01/06/1985

2.3 Tree Management Implications

The Common Ash subject to this Tree Survey is currently subject to statutory protection, all works as prescribed within the corresponding tables (Tables 1 section 8), which can only be implemented with the formal consent of London Borough of Camden.

This report can be submitted with the TPO 1APP as a supporting document. Bartlett would be happy to submit the TPO 1APP on your behalf, should you wish to proceed with any works arising from this report.

Please note that the removal of dead trees and the pruning of deadwood from living trees are permitted and "exempted" works under the 2012 Regulation listed above. These works can be undertaken only after 5 working days' notice has been given to the local planning authority.

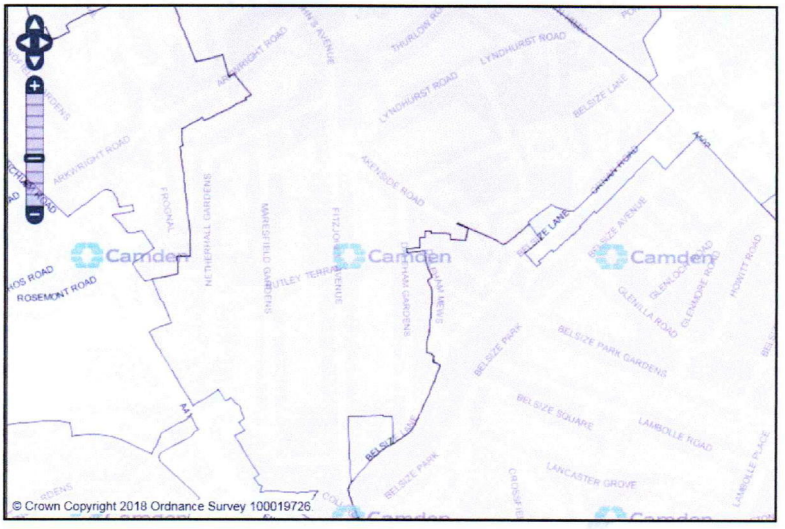


Figure 1: Screen-shot From the London Borough of Camden Interactive Mapping Service

3.0 TREE & SITE DETAILS

Species	Common Ash (*Fraxinus excelsior*)
Stem Diameter at 1.5m	1020 millimetres
Age	Classification (140 years ±10 years)
Tree Height	24.0 metres
Crown Spread	7.0(N) / 7.0(E) / 8.0(S) / 6.2.(W)
Vitality	Classification: ≤5% deadwood throughout crown at 20 millimetres diameter
Location	Located within the south eastern corner of the private residential garden
Targets	1 – Public highway of Daleham Mews running north to south adjacent to and east of the main stem within the crown spread (constant) 2 – Cars parked under eastern crown along Daleham Mews road (frequent) 3 – Pedestrians walking under eastern crown (Occasional / frequent) 4 – Private residential property 8.0m east, 4.0m south & 11.0m north-west of main stem (constant) 5 – Residential garden of 26 Daleham Gardens west & 2A Daleham Mews south of main stem within crown spread (constant)
Rooting Environment	1 –Maintained lawn area to the west of the main stem covering approximately 40% of rooting zone 2 – Hard standing impervious surface of the public highway and residential properties within proximity, east and south of main stem covering approximately 60% of rooting zone 3 –Retaining wall immediately adjacent to the east of the main stem, no current sign of damage to wall.
Buttress / Lateral Roots	1 –Suspected historic level change resulting in raised soils of approximately500mm and partially buried rooting collar
Main Steam	1 –Large historic wounding within western quadrant from ground level up to to 1.0m, vertically probed to 300mm solid beyond with good structural adaptive growth. 2 –Desiccated remains of fungal bracket at base of wound suspected to be *Innonotus hispidus* 3 –Trifurcation of the main stem at 4.0m with further multiple unions forming throughout the crown as a result of historic pollarding.
Crown	1 –Historic pollard at 6.0m and high pollard at 12.0m resulting in multiple co-dominant leaders 2 –Further more recent crown reduction works carried out resulting in approximately 4.0m regrowth 3 –Fully and partially occluding wounds throughout crown resulting from previous pruning 4 –Minor epicormic regrowth on main stem and scaffold limbs 5 –Southern crown significantly overhanging neighbouring property (house and garden).
Detailed Assessment	1 – PiCUS Sonic Tomograph re-test at 3.25 metres height on main stem. 2 – PiCUS Sonic Tomograph at 1.5 metres height on main stem.

4.0 FUNGAL, DISEASE OR INSECT PATHOGEN

4.1 Common Name (*LATIN NAME*)

The presence of a desiccated fungal fruiting body suspected to be Shaggy Polypore *(Inonotus hispidus)* was found in a desiccated state at the base of the Common Ash.

This fungus develops an annual fleshy bracket, orangey-brown when fresh, quickly degrading as it reaches maturity, developing a black spongy bracket before detaching.

The fungal fruiting body appears annually, usually forming in summer or early autumn. Dead, blackened brackets can sometimes remain attached for a few months before falling to the ground.

The type of decay is also classed as a simultaneous 'white rot' attacking both cellulous and lignin at a similar rate.

The pathogen enters the tree through wounds on the branches or the main stem and decomposes the heartwood. It can cause bark death, and causes the timber to become brittle. This can lead to fractures of the affected branches and stems.

Figure 2: Image of western base of Common Ash with desiccated Fungal Fruiting Bodies

Green. T & Watson. G. (2011)
Fungi on Trees - An Arborists Field Guide.
Arboricultural Association, Stonehouse

5.0 TESTING USING A SONIC TOMOGRAPH (PiCUS)

PiCUS testing (Sonic Tomography) enables almost non-injurious testing of decay in trees. Sensor units are attached to adjustable webbing and small nails are driven into the bark to contact the sapwood tissue beneath. Each of the nails is then struck with a test hammer, sending soundwaves through the tree stem, with the soundwave being picked up by the sensor array around the tree stem. When travelling through solid wood, the soundwaves are uninterrupted and travel quickly; in damaged wood the soundwave will be slowed or forced to travel around features such as an internal cavity.

The relative speeds of reception are uploaded onto a data file and processed into a visual image of the interior of the tree stem, using the software provided with the Sonic Tomograph. This image displays the different conductivity of the wood in the tree stem, with areas of high velocity and solid wood indicated by brown colours; areas of low velocity and distorted sound waves in violet or blue colours; and areas of unclassified sound waves in green.

This information and representative image is interpreted by Bartlett Consulting based on the visual tree assessment, knowledge of the interaction between the tree species and fungal pathogen, and references cited in Section 1.3 above to create an understanding of the internal structure of the tree stem.

Following the VTA and Level 2 assessment, a total of 2 tests were conducted on the Common Ash including a re-test at 3.25metres and additional test at 1.3 metres both on the main stem.

5.1 Common Ash Test 01

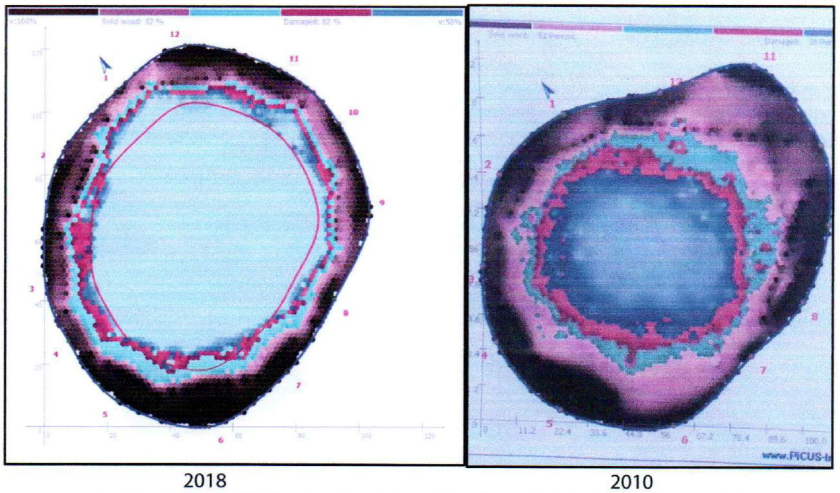
3,25m

The first test was carried out at a height of 3,250 millimetres above ground level. Sensor 1 was positioned on the northern side of the main stem; and the subsequent 11 sensors were spaced at regular intervals at the same height to create a level test plane. Please see Figure 3 below.

Figure 3: Image Showing PiCUS Test Plane on the western Aspect of the Common Ash at 3.25m

5.0 TESTING USING A SONIC TOMOGRAPH (PiCUS) (continued...)

5.2 Results of Sonic Tomograph (PiCUS) Test 01



2018 2010

Figure 2: Image of PICUS Sonic Tomograph-test at 3250 Millimetres Height on the Common Ash

The Tomogram re-test (Test 1) carried out 2018, depicts that at 3,250 millimetres above ground level approximately 62% of the wood has been decayed as indicated by the blue / pink colours, with 32% as solid wood as shown in brown colours. The remaining 6% is considered incipient decay and partially damaged wood as indicated by the green coloured areas of the image.

The blue and pink coloured zones are areas of the stem where the soundwaves have encountered woody material; however, this is in such a state of advanced decay that there is little structural property remaining.

The surrounding belt of green depicted on the image between the damaged wood (blue and pink) and the solid wood (brown) indicate areas of the stem where we believe there is incipient and early-stage decay. The small width of the green zone suggests relatively good defence capabilities and compartmentalisation of the decay.

The circumferential red line within the Tomograph is a notional representation of Mattheck's "t/R ratio". The theory proposed by Mattheck & Breloer (1994) argues that when the remaining solid wood within the main stem of a tree, with a full crown, falls below a ratio of 0.3 then the tree is liable to increased risk of failure. From the above image it can be seen that the residual solid wood at this level falls just shy of the circumferential red line and highlighting a t/R ratio of 0.32.

When comparing the results against the 2010 image it is clear to see that decay is progressing at a faster rate than annual tree growth resulting in a 20% solid wood loss within the last eight years. It must be noted there is a slight variation in profile between 2010 test and the 2018 re-test. This variation in profile within the 2010 test has resulted in an over estimation of reaming solid wood percentage.

5.0 TESTING USING A SONIC TOMOGRAPH (PiCUS) (continued...)

5.3 Common Ash Test 02

The second test was carried out at a height of 1,300 millimetres above ground level. Due to the proximity of the retaining brick wall to the east 1.3 metres was the lowest point on the main stem in which sufficient access could be achieved in order to carry out the required testing. Sensor 1 was positioned on the northern side of the main stem; and the subsequent 11 sensors were spaced at regular intervals at the same height to create a level test plane. Please see Figure 6 below.

Figure 6: Image Showing PiCUS Test Plane on the north-western Aspect of the Common Ash at 1.3m

5.0 TESTING USING A SONIC TOMOGRAPH (PiCUS) (continued...)

5.4 Results of Sonic Tomograph (PiCUS) Test 02

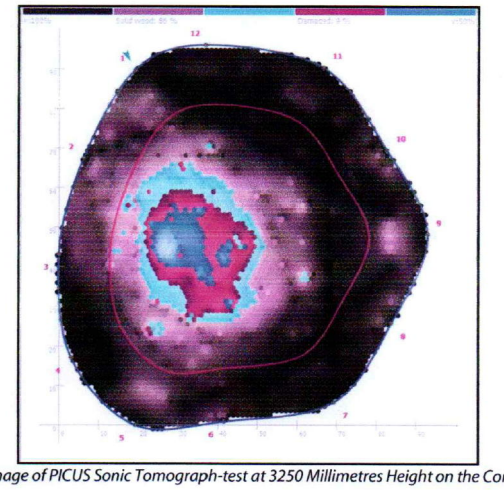


Figure 7: Image of PICUS Sonic Tomograph-test at 3250 Millimetres Height on the Common Ash

The Tomogram test (Test 2) carried out 2018, depicts that at 1,300 millimetres above ground level approximately 9% of the wood has been decayed as indicated by the blue / pink colours, with 86% as solid wood as shown in brown colours. The remaining 5% is considered incipient decay and partially damaged wood as indicated by the green coloured areas of the image.

The blue and pink coloured zones are areas of the stem where the soundwaves have encountered woody material; however, this is in such a state of advanced decay that there is little structural property remaining.

The surrounding belt of green depicted on the image between the damaged wood (blue and pink) and the solid wood (brown) indicate areas of the stem where we believe there is incipient and early-stage decay. The width of the green zone suggests moderate defence capabilities and compartmentalisation of the decay.

From the above image it can be seen that the residual solid wood at this level is well within the circumferential red line and highlighting a t/R ratio of 0.86.

The decay at this level is slightly asymmetrical to the west indicative of the open wound and decay within the western quadrant running from ground level to a height of 1.0 metre.

6.0 PHOTOGRAPHIC OVERVIEW

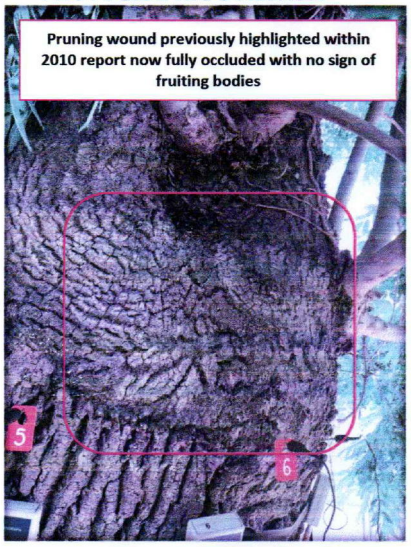


Image 8: Pruning wound at 3.5m, to southern quadrant of main stem

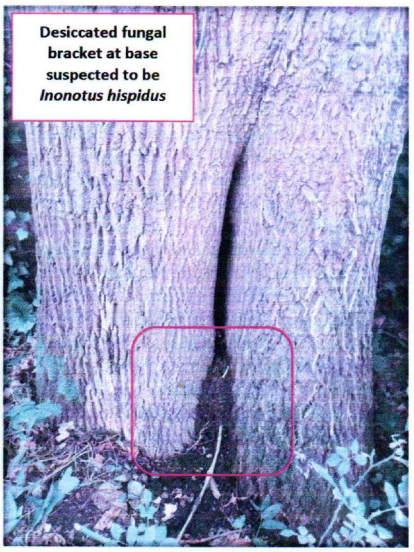


Image 9: Old stem wound within western quadrant from ground level up height of 1.0m

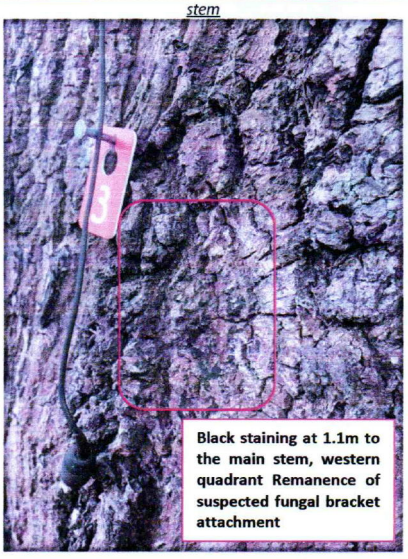


Image 10: 1.1m on western quadrant of main stem above old stem wound

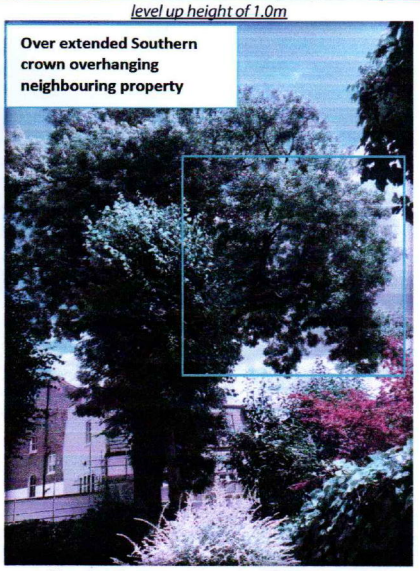


Image 1: Showing Common Ash as viewed from a western aspect

8.0 RISK ASSESSMENT

Bartlett Consulting uses the International Society of Arboriculture's (ISA) Tree Risk Assessment methodology, referred to as TRAQ. This is a 'qualitative' system which uses a matrix-based combination of ratings, to reach a conclusion of associated risk. The standard Bartlett Consulting time-line within the TRAQ system is three (03) years, unless otherwise stated within the report.

Risk is the combination of the 'likelihood' of an event: in this case the failure of a tree or part of a tree, and the severity of the potential consequences. A hazard is the likely source of harm. The two tables below define both the likelihood and risk levels as per the TRAQ system.

Table 02: Likelihood of Failure

Classification	**Description of Likelihood** (As per Dunster, Smiley, Matheny, Lilly 2013)
Improbable	Failure is not likely during normal weather conditions and may not fail during severe weather conditions, within the specified time frame of three years.
Possible	Failure could occur but is unlikely during normal weather conditions, within the specified time frame of three years.
Probable	Failure may be expected under normal weather conditions, within the specified time frame.
Imminent	Failure has started or is most likely to occur in the near future, even if there is no significant wind, weather, or increased load.

Table 03: Risk Rating

Risk Level	**Description of Risk** (As per Dunster, Smiley, Matheny, Lilly 2013)
Extreme Risk	Failure is imminent, with a high likelihood if impact on people and/or property, with severe consequences.
High Risk	Failure likely to very likely with significant consequences; or failure likely with severe consequences – to impact on people and/or property.
Moderate Risk	Failure likely to very likely with minor consequences; or failure somewhat likely with significant to severe consequences – to impact on people and/or property.
Low Risk	Failure unlikely with negligible consequences; or failure somewhat likely with minor consequences – to impact on people and/or property.
Tree Removal and Tree Surgery	Weakened crown anchor points or root system possible requiring full risk assessment by Arborist and Climber prior to tree works to determine appropriate working methods.

NOTE: Customer Must Make Tree Workers Aware of this Statement

CAUTION: Trees with structurally weak root systems, main stems or branches may not have sufficient structural strength to withstand dismantling works. The weight of people climbing the tree or using the tree branches as load carrying points may increase the load to the point of tree or branch failure. Persons engaged on such works must undertake a thorough risk assessment of the structure of the tree before finalising a working method. Alternative work methods to consider may include the use of crane or mobile elevated platform.

7.0 DISCUSSIONS & RECOMMENDATIONS

The Common Ash has undergone a number of historic pollarding works resulting in multiple included unions and regrowth on weak points of attachment that have now lapsed creating an un natural and structurally compromised form.

The Common Ash is located within a high target area and concern must be given to the proximity of residential developments within the crown spread.

At the conclusion of the PiCUS Sonic Tomograph assessment, we have confirmed the presence of internal decay at both 1.3m and 3.25m.

The suspected desiccated remains of *Inonotus hispidus* identified within the base of the old stem wound to the western quadrant is attributed to the decay highlighted within Test 02 at 1.3 metres although currently is not of significant concern.

When comparing the results of the Picus Tomography at 3.25m from 2010 against the current 2018 T01 re-test it is clear that the main stem has been severely compromised by the fungal activity *Polyporus squamosus* (identified within the 2010 report) and its persistent action has degraded the wood by approximately 20% in less than 8 years.

In conclusion, I would advise that the tree structure has been considerably de-graded by the internal decay identified at 3.25m to such an extent that significant remedial works must now be recommended in order to reduce weight on the compromised structure.

Remedial tree works identified with Table 1 below will reduce risk of tree failure similar to that of neighbouring trees although will not remove the risk completely.

The tree will require re-inspection and a re-evaluation in two years

Upon completion of the risk assessment, following the Level 3 investigations, the likelihood of stem failure at 3.25metres has been categorised as 'Possible', whilst the likelihood of impacting the target is 'High'. The consequences of failure have been categorised as 'Severe' with the identified targets being residential properties, parked cars and pedestrians.

The final risk rating is classified as 'Moderate'.

Table 01: Schedule of Tree Works

Tree Reference	Specification of Works
Common Ash	• Carry out a high pollard back to previous points reducing height to 12.0m a lateral growth accordingly • Crown raise to 6.0m • Remove epicormic growth from main stem and scaffold limbs • Carry out root collar excavation to reduce build-up of soil • Apply Phosphite drench at base

After recommended remedial works have been carried out the Residual Risk rating will be classified as LOW

7.0 RECOMMENDATIONS (continued...)

7.1 Specification of Tree Works

Re-Pollarding: The removal of regrowth back to the bole.

Pruning Cuts: All cuts will be made to significant lateral growth, and not back to a bud so that only a stubbed branch end remains – in accordance with Figure 02 of British Standard 3998:2010.

Root Invigoration™: The aim of Bartlett's patented Root Invigoration™ Program is to improve soil conditions and the growing environment by promoting efficient root growth and tree vitality. The process includes performing a root collar excavation, "air-tilling" a portion of the root zone to find fine roots, incorporating organic matter and soil amendments (listed below) and applying mulch.

For the Root Invigoration™ Program to be successful, the tree must be watered regularly after the treatment.

Potassium Phosphite: An essential component for tree health and growth, it stimulates vitality leading to root development and development of new tissue. These later aspects "switch on" the tree's defence systems improving the tree's resistance to disease and increasing defence responses and capabilities to fungal pathogens and hyphal spread.

This is applied simply as a soil drench around the base of the tree stem.

We trust that the contents and recommendations contained within this report were informative, easy to understand and helpful to you, with regards to managing your tree. Should you have any further questions or concerns, please do not hesitate to contact us again.

REPORT CLASSIFICATION: Tree Structural Integrity Report

REPORT STATUS: Final

REPORT COMPLETED BY: Mr G Davies *FdSc Arb*
Arboricultural Consultant

SIGNATURE: 

DATE: 01/08/2018

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