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Arboricultural Report:
**Mature small leaved lime tree within the churchyard of St Wystan's Church,
Repton**

Prepared for:
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Willington Road
Repton
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Document reference: 382-19, Revision 0

1. Introduction and background

- 1.1 I received instruction from Simon Mann on behalf of St Wystan's Church on 28 June 2019. Located within the closed churchyard to the north west of St Wystan's Church close to the boundary of the churchyard itself is a large fully mature small leaved lime. Located beyond the bounds of the churchyard and at a lower level is Repton School's School House with the housemaster's accommodation being closest to the report tree.
- 1.2 I understand that the tree had been inspected by Martin Buckley, Arboricultural Officer of South Derbyshire District Council, in 2014. At that stage it had been noted that the lower primary branches were subsiding and a more thorough inspection of this region of the tree was recommended to help advise upon a strategy for maintaining the tree and maximising its longevity.
- 1.3 It is understood that the tree is protected by virtue of a Tree Preservation Order administered by South Derbyshire District Council and, on this basis, ahead of undertaking any pruning to the tree, the Council's consent is required and any pursuant conditions must be complied with.
- 1.4 I inspected the tree on the afternoon of Friday 26 July 2019 during dry and bright weather conditions. Photographs reproduced within this document were taken during this assessment and, where appropriate, the resistograph read-out graphs have been reproduced at Appendix 1.

2. Report tree

Photograph 1: Report tree as viewed from the west.



Photograph 2: Report tree as viewed from the south.



Photograph 3: Report tree as viewed from the east within the grounds of School House.



- 2.1 The report tree is a fully mature small leaved lime (*Tilia cordata*). Its estimated height is in the region of 25m and, at around 1.5m above ground level, the trunk has a measured diameter of 1,170mm.
- 2.2 To the north and east, the crown overhangs beyond the boundaries of the churchyard but it is estimated to be 13m and 11m respectively, whilst to the south the crown spread measures 4m and 13m to the west.
- 2.3 The tree stands to one side of an internal path running the length of the churchyard with graves beneath the entirety of its crown spread. The marker stone for the grave of Robert George Measham lists to the north somewhat, having been lifted by roots at the base of the trunk.
- 2.4 The main path is surfaced in tarmac. However, it is clearly disrupted by near-to-surface roots thought to belong to the lime tree extending as far as 9–10m back towards the church (level with the grave of Thomas Whawell).
- 2.5 Around the base of the trunk, at three locations, there are small clusters of toadstools which, although immature, are thought to be those of the fungus *Pholiota squarrosa*, commonly known as the shaggy scalycap. This fungus is understood to be moderately parasitic and potentially may cause an intense white rot, however typically with a selective white rot in earlier phases. Due to this observation, the base of the trunk was tested with a resistograph decay detecting drill.

Photograph 4: Shaggy scalycap toadstools around the base of the report tree.

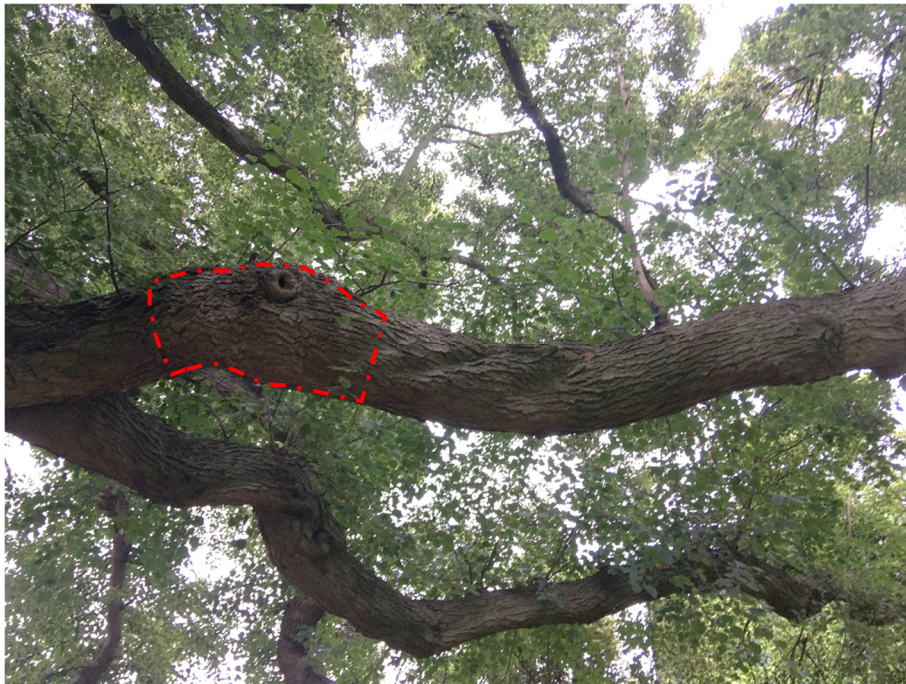


Photograph 5: Close up view of a toadstool together with a cross-section view.



- 2.6 The lowest branches emerge from the trunk at around 4m and have been subsiding for some years, such that when the crown is viewed from a distance, gaps are opening up within the foliage line with a few lower branches potentially becoming individually loaded during future inclement weather.
- 2.7 On the western side, the lowest branch that extends over the grave of Mary Thorp has a small opening that has been hollowed out by mammals. Upon close inspection, this was becoming hollow in cross-section and, again, carries considerable end weight.

Photograph 6: Showing the subsiding lower limb of the report tree with the hollow section highlighted by the red dashed line.



- 2.8 Overall, the crown vigour is good given the tree's life phase. Periodically throughout the crown, there are a number of dead smaller secondary branches; the largest of which is around 150mm in diameter by 6–7m in length. As the deadwood from the species is not at all durable, it is often shed from the crown during inclement weather. Some of it is big enough to damage gravestones beneath as well as potentially posing a hazard to people visiting or tending graves.
- 2.9 I undertook a careful close quarters inspection of the attachment points of the primary branches to the lower trunk. However, I found no abnormal unions or those of particularly weak structural configuration. There is, however, a clear trend for the subsidence of the lower limbs and it was noticeable that their cross-sections have become heavily elliptical due to progressive reaction wood formation.
- 2.10 Above around 5m, the main trunk has a strong bias to the north east, perhaps in lieu of wind from the south west. Although as mentioned, overall vigour is generally good, the upper crown is slightly receding as would be expected given the tree's advanced years.
- 2.11 At a lower level, branches hang down to within 1.5m of ground level with minimal clearance to the gravestones.

3. Structural appraisal

- 3.1 Resistograph test drillings 1 to 3 were made at the junction of the lower primary branches to the main trunk but revealed no abnormalities.
- 3.2 Test drillings 4 to 8 inclusive were made around the base of the trunk at between 100mm and 200mm above ground level (see Appendix 1). At around this horizon, the lower trunk was measured and had a diameter of 1.4m.
- 3.3 Drilling 4 was made at a bearing of 170° into the root buttress adjacent to fungal toadstools; drilling 5 was made at a bearing of 200° again into a root buttress to the opposite side to a cluster of fruiting bodies; drilling 6 was made at a bearing of 270° into a sunken seam between two root buttresses; drilling 7 was made at a bearing of 100° near another cluster of toadstools, whilst drilling 8 was made at around 60° into a further sunken seam between two pronounced buttress roots.
- 3.4 Some seams of decay were noted in drillings 4 and 5. A more significant zone of deeper decay was noted in drilling 8.
- 3.5 A method for assessing stem failure criteria is the ratio between the sound wood and decayed wood/cavity (Mattheck C, Bethge K and Erb D *Failure Criteria for Trees*). The threshold for this ratio is 0.3. If a lower result is recorded, a tree would normally be recommended for removal or substantial crown reduction.
- 3.6 The calculation for this is t/R where t is the thickness of the sound wood and R is the predicted residual stem radius at the height of testing. In this instance R = approximately 70cm. At the point of drilling 8 a ratio of 0.4 was recorded.

4. Conclusions and recommendations

- 4.1 The tree was found to be in good physiological condition and overall is considered to be in fair structural condition.
- 4.2 I had no significant concerns regarding the attachment points of the lower branches. However, basal decay was observed but, from the testing undertaken, the tree retains sufficient residual wall thickness.
- 4.3 The lofty crown architecture, along with the subsiding lower limbs, is resulting in increased localised exposure to oncoming winds meaning that there is a heightened risk of branch failure which would be potentially very damaging within the churchyard.
- 4.4 Intrinsically, the tree still has considerable longevity and this is aided by good current physiological condition. However, it would be necessary to monitor the extent of progressive basal decay.

4.5 I recommend that the following works are undertaken:

- Selectively shorten the branches within the lowest two thirds of the crown height, typically reducing their outer length by around 4–5m, ensuring they are reduced back to appropriate growth points.
- Following the above, the upper crown should be reduced itself in order to reduce the overall height of the tree and ensure as balanced and cohesive a crown shape as is practicable. Internal growth is to remain.
- The majority of lower pendulous growth will be removed by the already recommended branch shortening. However, any remaining such growth may be lifted to clear graves etc and aid mowing/maintenance.
- Any remaining dead branches should be removed from the crown of the tree.

4.6 Wherever applicable, the works should be carried out in accordance with BS3998:2010 *Tree work – Recommendations*.

4.7 It would be appropriate to monitor the tree and it is recommended to take place on a two to three year cycle. However, ad hoc inspections should be undertaken should any significant change in the tree's condition or wind damage occur.

4.8 Future inspections must take account of the potential for decay developing in the lower trunk, in particular on the south western side where the lower trunk is loaded under tension due to its overall growth list in the opposite direction.

4.9 It would be necessary to submit this report along with an application for the recommended works to South Derbyshire District Council to seek consent. Due to the high potential for nesting bird activity including in the many hollows and openings, such work should be undertaken outside of the closed bird nesting season.

Signed:



Ben Bennett BSc (Hons) For, Cert Arb (RFS), MArborA
Director, BB Trees Ltd

Appendix 1: Resistograph decay detection methodology and read-out graphs

Methodology

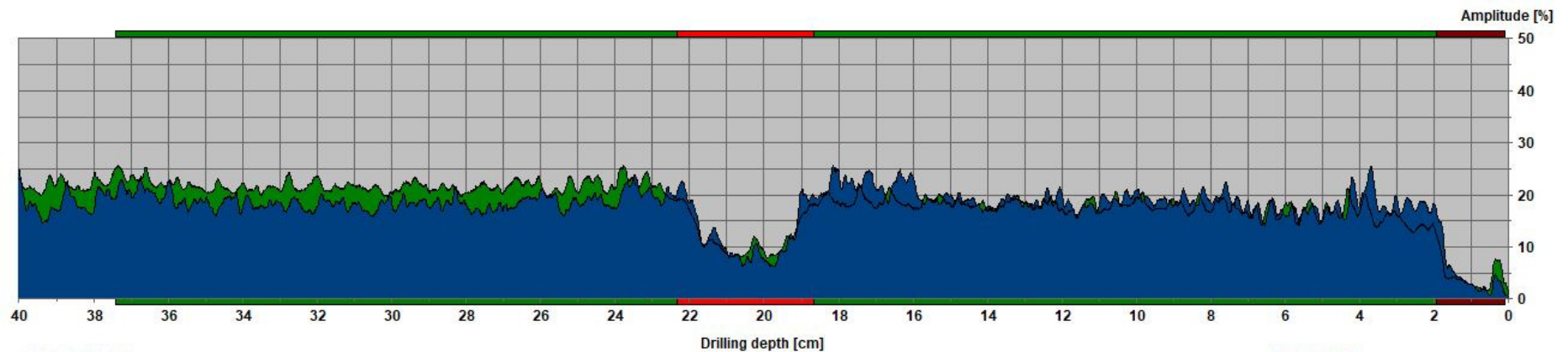
- A1.1 Throughout the course of my experience as an arboriculturist, I have gained a sound understanding of tree biomechanics and the nature of decay caused by principal decay organisms. I have employed the Visual Tree Assessment methodology during my assessment. I have received intensive training in this methodology and its application and have been assessed at Elite Practitioner status.
- A1.2 Invasive investigations have been undertaken using an IML PD400 Resistograph, in this instance, to assess the potential extent of internal decay within the lower trunk and attachment points of the lower branches.
- A1.3 The Resistograph measures the relative density of wood by drilling into the tree with a flexible 3mm diameter drill of 400mm in length. The model of Resistograph used is the latest incarnation of well-proven technology and is capable of measuring wood quality and the presence of internal defects such as included bark or decay-altered wood. In simple terms, the higher the quality of the wood encountered, the greater the resistance offered to the drilling force and a higher output is recorded on the graph.
- A1.4 The read-out graph identifies the depth of penetration for the testing (read right to left) along the horizontal (Z) axis. The vertical (Y) axis records the amplitude which is a relative measurement as to the density of the encountered wood.
- A1.5 The read-out graph consists of two independently recorded, overlaid measurements. The green graph is the resistance measured at the tip of the drill and is equal to the torque force required to drill into the wood. The blue graph relates to the feed rate i.e. the force required to drill through the wood at a predetermined rate.
- A1.6 Although a highly accurate precision tool, the Resistograph is only capable of interpreting the quality of wood within a very small area subject to the drilling. Whilst this is important in reducing the damage to the assessed tree, this tool does not measure wood quality beyond the area of testing. However, multiple testing points can be made in order to map potential defects.

Resistograph read-out graphs

Test drilling 4

Measuring / object data

Measurement no. :	4	Needle speed :	2500 r/min	Diameter :	
ID number :	LIME	Needle state :	---	Level :	
Drilling depth :	40,08 cm	Tilt :	---	Direction :	
Date :	26.07.2019	Offset :	57/252	Species :	
Time :	13:10:22	Avg. curve :	off	Location :	
Feed speed :	100 cm/min	Name :			



Assessment

■	From 0,1 cm to 1,9 cm :	Bark/Cambial Zone
■	From 1,9 cm to 18,7 cm :	Sound Wood
■	From 18,7 cm to 22,4 cm :	Decay/Cavity
■	From 22,4 cm to 37,4 cm :	Sound Wood
□	From 0,0 cm to 0,0 cm :	
□	From 0,0 cm to 0,0 cm :	

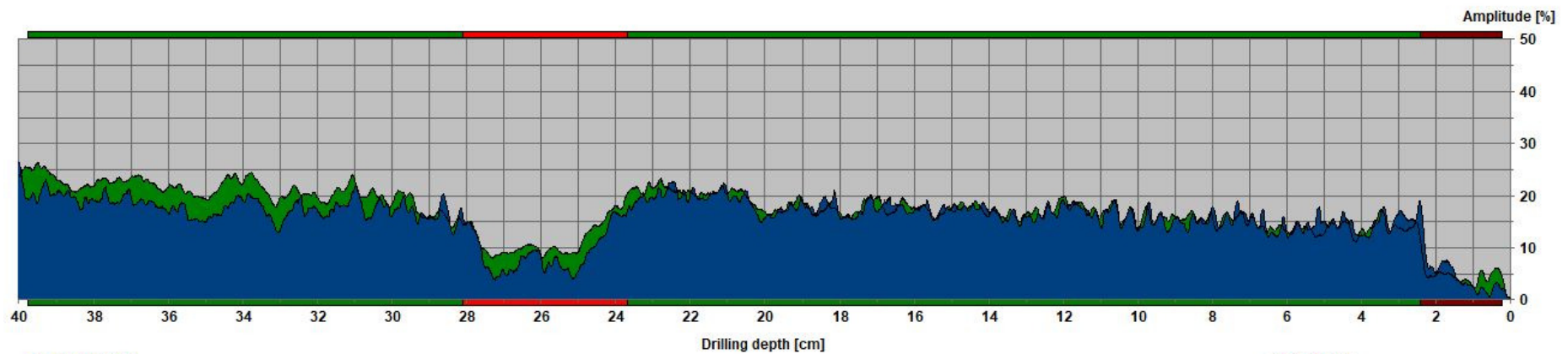
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Drilling 4.

Test drilling 6

Measuring / object data

Measurement no. :	12	Needle speed :	2500 r/min	Diameter :	
ID number :	LIME	Needle state :	---	Level :	
Drilling depth :	40,08 cm	Tilt :	---	Direction :	
Date :	26.07.2019	Offset :	58/251	Species :	
Time :	13:13:32	Avg. curve :	off	Location :	
Feed speed :	100 cm/min			Name :	



Assessment

From 0,2 cm to 2,4 cm :	Bark/Cambial Zone
From 2,4 cm to 23,7 cm :	Sound Wood
From 23,7 cm to 28,1 cm :	Decay/Cavity
From 28,1 cm to 39,7 cm :	Sound Wood
From 0,0 cm to 0,0 cm :	
From 0,0 cm to 0,0 cm :	

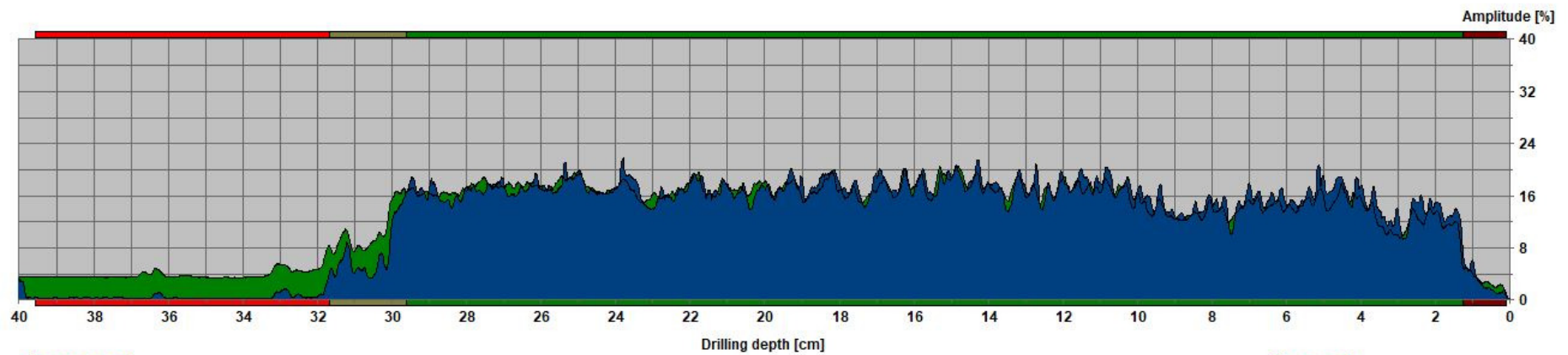
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Drilling 6.

Test drilling 8

Measuring / object data

Measurement no. :	14	Needle speed :	2500 r/min	Diameter :	
ID number :	LIME	Needle state :	---	Level :	
Drilling depth :	40,08 cm	Tilt :	---	Direction :	
Date :	26.07.2019	Offset :	59/252	Species :	
Time :	13:17:06	Avg. curve :	off	Location :	
Feed speed :	100 cm/min	Name :			



Assessment

From	0,1 cm	to	1,3 cm	:	Bark/Cambial Zone
From	1,3 cm	to	29,6 cm	:	Sound Wood
From	29,6 cm	to	31,7 cm	:	Incipient Decay
From	31,7 cm	to	39,6 cm	:	Decay/Cavity
From	0,0 cm	to	0,0 cm	:	
From	0,0 cm	to	0,0 cm	:	

Comment

Drilling 8.
