



ARBORICULTURAL PLANNING CONSULTANTS

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January 2023

Our reference: SJA hzr 22578-01

Hazard report for a Monterey pine tree (*Pinus radiata*) at Marlhill Copse, Southampton

Instructions and context

1. SJAtrees has been instructed by Southampton International Airport Ltd. (SIAL) to undertake a hazard survey of the trees at Marlhill copse which is under its ownership. Whilst we have done that and a full tree works schedule and tree works plan is available, this report relates to a single Monterey pine growing on the top of a steep bank to the south of the permissive path running through the southern portion of the woodland.
2. The context for this report is a fungal fruiting body noticed on the east side of the tree's trunk at a height of 4m. Due to the size and location of the tree (described below) the significance of the potential risk warrants a detailed inspection and report in this instance.
3. Frank Spooner attended site on 10th January 2023. The weather was overcast with persistent but light rain. Frank Spooner is also the author of this report.
4. In preparation for the assessment of this tree and writing this report I have been provided with a copy of the previous hazard survey of the woodland. The previous work, carried out by Tree Surveys Ltd., numbered the trees and for the sake of consistency we have retained their numbering. The Monterey pine of interest is numbered 82. The previous observation was: **“swelling around basal area and girdled root to south, hanging broken branch in canopy”**. The previous recommendation was: **“tomograph decay detection within three months”**.

5. Tomograph decay detection has not been carried out because events relating to an appeal by SIAL to allow for the removal of the tree as part of a woodland management plan refused by the Local Planning Authority (Southampton City Council, hereinafter the 'LPA') took over. The background and history relating to the appeal is not relevant to this report and is not discussed here, suffice to say it was dismissed and hence there is no extant consent to remove the tree. It was at the appeal site visit that the fungal fruiting body on the Monterey pine tree was first spotted. The LPA's tree officers were present at the appeal site visit and the fungal growth was pointed out to them.

Observations

6. This pine tree is one of the largest trees in the woodland, standing approximately 26m tall, with a broadly spreading canopy and with a trunk diameter of 1790mm measured at 1.5m. It is located at the top, southern, edge of the 'hanger' woodland within 5m of the rear boundary of a property (No. 11?) on St Helena Gardens that backs onto the woodland. The size and location of the tree is significant because this places the tree at the edge of a woodland on top of a hill that is fully exposed to prevailing winds off the nearby coast.

7. The girdling wood on the south side of the tree's trunk is still present but not thought to be an issue because it has not impeded the growth or expansion of the tree's trunk. Neither is the previously observed swelling at the base of the tree's trunk significant as can be seen from the first set of resistograph readings (this is described in the discussion below).

8. However, at the base of the tree's trunk on the east side is a 'shear bomb' crack. This is where the fibres in a tree's trunk shear along a plane perpendicular to wind loading. A shear bomb starts at ground level and usually travels up a trunk for a short distance (dependant on the trunk diameter but in this instance to approximately 2m) before is arrests and goes no further. Despite the somewhat dramatic name, a shear bomb crack is not usually a significant structural defect (because sheering of the fibres in the trunk reduces the shear stress on the roots) but it is a clear indication that the tree is exposed to significant wind loading. There's also minor sap exudation associated with this crack on the east side of the trunk. The shear bomb is not obvious on the western side of the trunk.

9. At 4m on the east side of the trunk is the remnants of a small diameter (approximately 100mm) dead branch. This was clearly shed by the tree some time ago and the dead branch stub is becoming incorporated into the trunk. At this point was the decaying remnants of a fungal fruiting body. Being so decayed, the fungi was difficult to identify but being a coniferous species of tree the number of likely possibilities is limited.

10. Based on observations of the decaying fruiting body, its location, the host species and observations of other pine tree failures elsewhere in the woodland, I believe the fungus is Dyer's mazegill (*Phaeolus schweinitzii*). This fungus causes a brown rot (decay of the cellulose) and causes a reduction of tensile strength and leads to brittle fracture of the trunk.

11. Above the fruiting body the tree has a single trunk to approximately 12m where it divides into two main stems and a broadly spreading canopy formed mostly from lateral branches originating from the main stems. The canopy has an asymmetrical bias towards the west caused by competition from another tree of similar stature that was situated to the east of the tree but has been removed.

12. The canopy holds abundant cones and is sparsely foliated compared to an average specimen of the same species. The sparsity of foliage is more pronounced on the east side and associated with the competition from the now removed tree but is also above where the fungus is found. The abundance of cones may be associated with a natural response to a decline in vitality which causes a tree to use energy stores for reproduction whilst it still can.

Survey methodology

13. Whilst tomograph decay detection was previously recommended for this tree, its use was discounted here because I do not consider it necessary. This is mainly due to the innate difficulties in interpreting the data from a tomograph, especially when there are cracks in tree's trunk. Because SJA trees has a resistograph and I am trained to use it, I place greater faith in its results than a tomograph. If the results from a resistograph test are inconclusive, this is the only time when I have, in my experience, found the use of a tomograph to be helpful.

14. As most detectable fungal activity leading to trunk or stem failure is found at the base of a tree's trunk it was logical to undertake a series of resistograph tests at the base of this tree's trunk. However, because of the location of the fungal fruiting body at 4m it was also deemed necessary to undertake a series of tests at this height as well.

15. The resistograph is a machine that drills a 40cm long 1.5mm wide drill bit into the trunk of tree and measured the resistance to torque. The machine then records the resistance and presents a graph that can be accurate enough to determine the depth of individual growth rings. However, it can also clearly show the difference between sound wood and decayed wood and the depth at which the decayed wood can be found.

16. At the base of the tree's trunk, approximately 250mm above ground level, I drilled into the trunk from the north, east, south and west. The readings from these tests can be found at **Appendix 1** to this report, numbered 1-4. The results are commented on in the bottom left and right hand corners of each reading. Only the reading taken on the south side showed any sign of decay or dysfunction. However, based on the orientation of the test, it aligns with the shear bomb crack described above.

17. I undertook a similar task at 4m, the height of the location of the fungal fruiting body. The readings from these tests can be found at **Appendix 2**. As the height of the second set of tests was done at 4m I used a ladder to carry out the work. The location of the tree on a steep woody bank meant it was not safe to undertake tests uniformly at the four cardinal points and hence they were done from the north, south, west and north-west. The west test clearly shows decay from a depth of 28 cm; this was orientated directly towards the location of the fungal fruiting body. The north-western test also shows decay from a depth of 32cm. Both the north and south tests do not show clear evidence of decay, but the peaks and troughs are less pronounced the deeper the drill goes.

18. It should be noted that with a trunk diameter of 179cm (radius of 89.5cm) the drill bit can only extend less than halfway into the trunk. It should also be noted that the trees are thought to be 110-120 years old making them contemporaneous with the construction of the track through the woodland leading to the nearby manor house.

This is corroborated by the counting of tree rings on other similar trees felled in recent years. It is illogical therefore to count each peak and trough on the resistograph readings as annual growth rings. Instead, each growth ring probably accounts for two or three peaks, with extra resistance when the drill breaks through either side of a ring and sometimes something in-between.

Discussion

19. Trees are dynamic self-optimising structures. They respond to external forces such as wind and gravity and can usually detect when one part of their structure is weak and respond by producing additional wood to compensate. This is usually most obvious at the base of a tree's trunk in its buttresses, which is also where most of the more significant decay fungi are found. But adaptive growth can also be seen throughout a tree and with experience one can learn to read the 'body language' of a tree.

20. In this instance there is no external evidence of substantial decay in the tree's trunk, other than the presence of the fungal fruiting body. Whilst the buttresses of a tree are the most obvious place where adaptive growth can and does take place, it is also where adaptive growth presents the greatest defence against decay. At four metres up the trunk, decay is present in a place where there is less potential for significant adaptive growth.

21. It is not without good reason that Mattheck (the author of 'The Body Language of Trees') has identified the trunk of a tree between about 2.5m and the crown break as being the most hazardous zone for a tree to develop decay. Hollowing of the trunk above the buttresses presents a hollow tube without the additional supports of the buttresses. This can lead to a range of failure types associated with hosepipe kinking stresses. Assuming the decay fungus found on this tree is indeed Dyer's maze-gill then the type of decay is brown rot, which typically reduces tensile strength and retains compressive strength. This type of decay does not usually elicit adaptive growth and hence none is apparent on the trunk and the potential for failure can be even greater.

22. Whilst I do not ascribe to Mattheck's formula for assessing the significance of a trunk hollowing¹ (there is too much contrary literature to take the formula as given), it does give a foundation in the understanding of how and when trunk hollowing may be significant.

23. In this instance, the west and north-west sides of the tree's trunk at 4m are substantially decayed, with only about 30% residual sound wood. The south and north sides have at least 35cm of sound wood but the wood appears to be weakening at greater depths. On the east side I could not take a reading but this is where the fungal fruiting body was found. Whilst criticisms of Mattheck's work would suggest 30% residual sound wood should be fine, the fact that the location of the decay does not benefit from support by the buttresses; the brown rot does not elicit significant adaptive growth; the sheer size of the tree's canopy coupled with its location and wind exposure; further influenced by the tree's declining physiological condition; all lead me to the conclusion that this decay is significant.

24. Therefore, I think there is a good chance this tree could fail at about 4m from ground level. There is evidence that a comparable failure has taken place in a very similar tree just a short distance to the west.

25. Whilst the likelihood of the tree hitting anything significant if it were to fail is comparatively low and one might assess the risk of harm to be correspondingly low, the consequences of the failure of a tree of this size are so great that even a low level of risk needs to be taken very seriously.

Recommendations

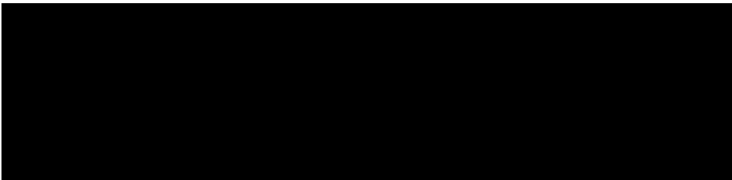
26. In light of the above discussion I conclude that the best course of action is to fell the tree now rather than wait to clear up what destruction arises as the consequence of failure. I do not think there is a suitable alternative that can be achieved through pruning the tree instead, although it might be appropriate to retain a standing hulk of deadwood habitat.

¹ The t/R ratio would suggest anything less than 30% of a trunk's radius being sound wood would be hazardous.

27. As the tree is within an area covered by a woodland tree preservation order (TPO), one must apply to the LPA before the tree can be removed. I am satisfied that the tree is not imminently dangerous and hence an application can be allowed to run its normal course. This report is written with a view to it being capable of being submitted with a TPO application without need for editing. Nevertheless, please let me know if you would like SJA to submit the application on your behalf.

28. I trust the above will be clear but if you require further advice or clarification, please do let me know.

Signed,



SJAtrees

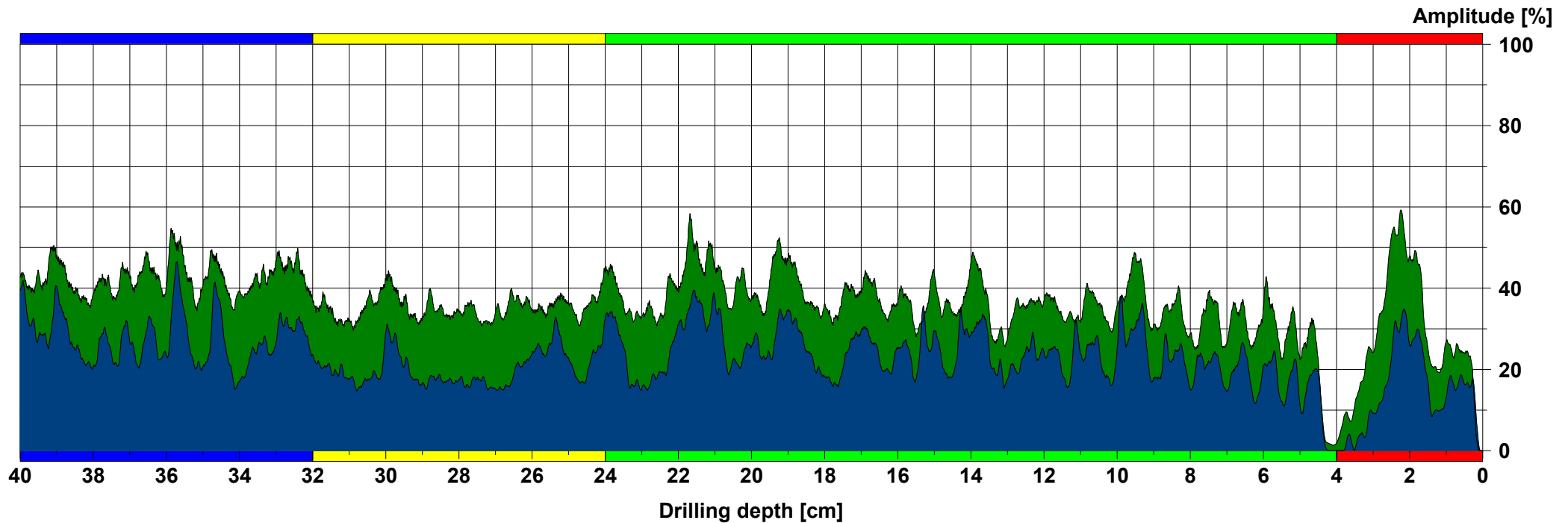
Senior Consultant and Operations Director

APPENDIX 1

Resistograph readings at ground level, nos. 1-4

Measuring / object data

Measurement no. :	1	Needle speed :	1750 r/min	Diameter :	129,0 cm
ID number :	MARLHILL 82 GL N	Needle state :	---	Level :	25,0 cm
Drilling depth :	40,06 cm	Tilt :	---	Direction :	North
Date :	10.01.2023	Offset :	146/256	Species :	Monterey pine
Time :	12:09:22	Avg. curve :	off	Location :	
Feed speed :	150 cm/min	Name :			



Assessment

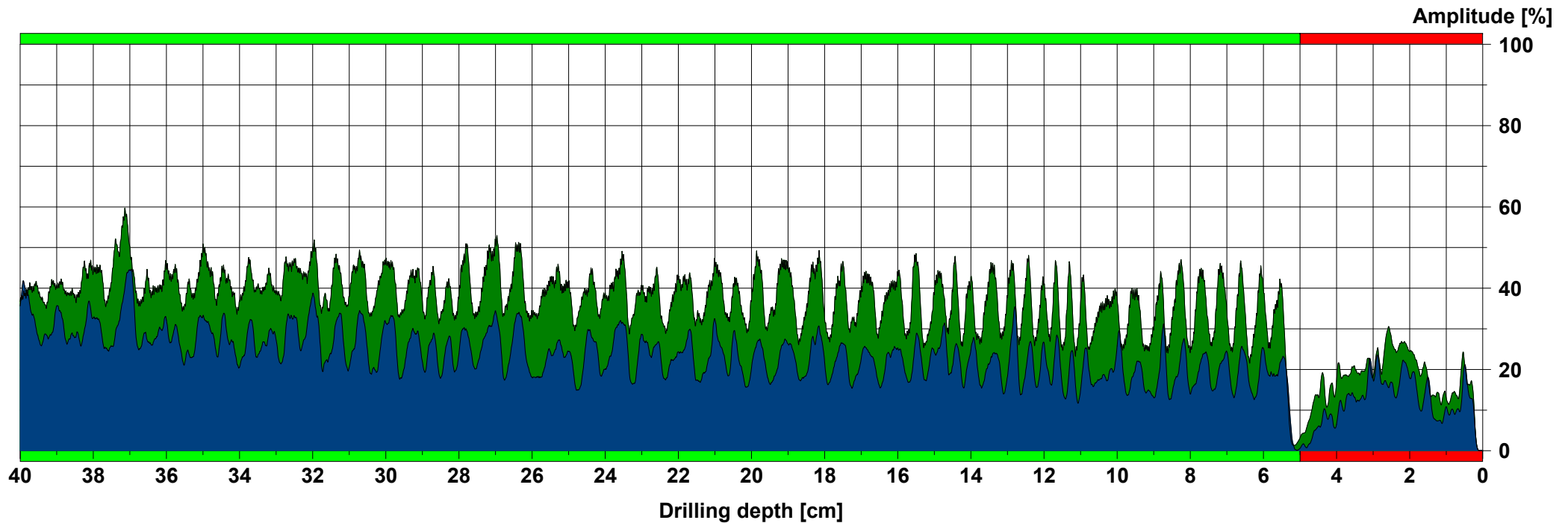
■	From	0,0 cm	to	4,0 cm	:	Bark
■	From	4,0 cm	to	24,0 cm	:	Sound wood
■	From	24,0 cm	to	32,0 cm	:	Slight degradation
■	From	32,0 cm	to	40,0 cm	:	Sound wood
□	From	0,0 cm	to	0,0 cm	:	
□	From	0,0 cm	to	0,0 cm	:	

Comment

No cause for concern

Measuring / object data

Measurement no. : 2	Needle speed : 1750 r/min	Diameter : 129,0 cm
ID number : MARLHILL 82 GL E	Needle state : ---	Level : 25,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : East
Date : 10.01.2023	Offset : 130/245	Species : Monterey pine
Time : 12:10:57	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

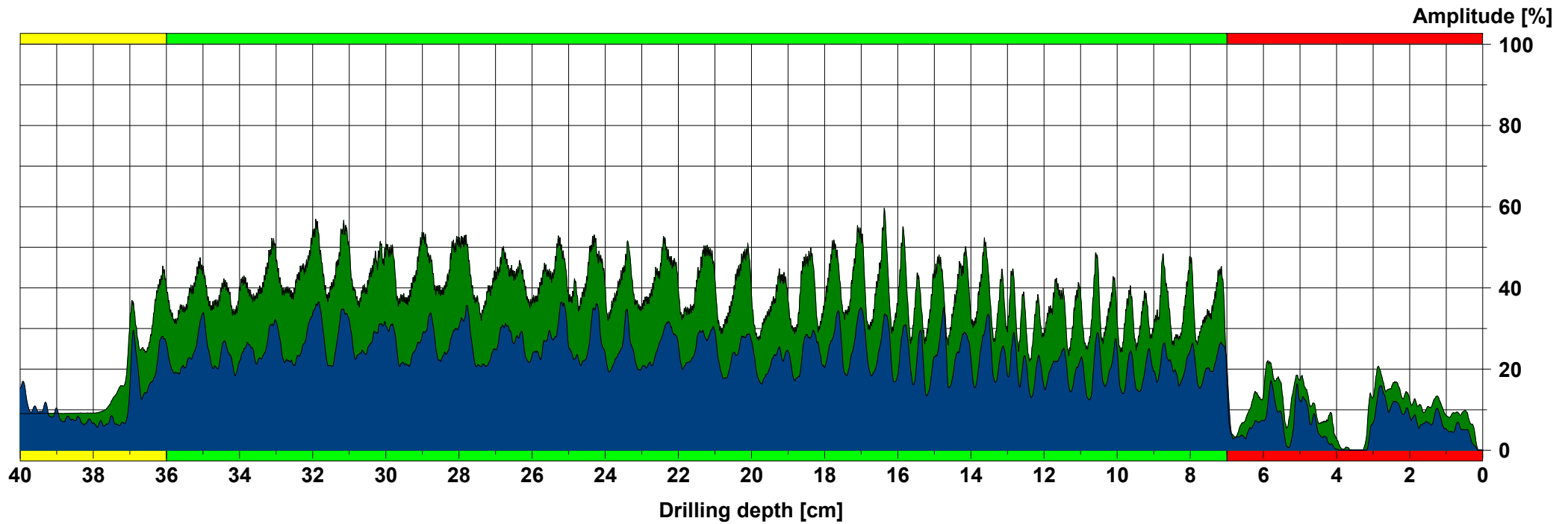
■	From 0,0 cm to 5,0 cm : Bark
■	From 5,0 cm to 40,0 cm : Sound wood
□	From 0,0 cm to 0,0 cm :
□	From 0,0 cm to 0,0 cm :
□	From 0,0 cm to 0,0 cm :
□	From 0,0 cm to 0,0 cm :

Comment

No cause for concern

Measuring / object data

Measurement no. : 3	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 GL S	Needle state : ---	Level : 25,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : South
Date : 10.01.2023	Offset : 124/244	Species : Monterey pine
Time : 12:12:04	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

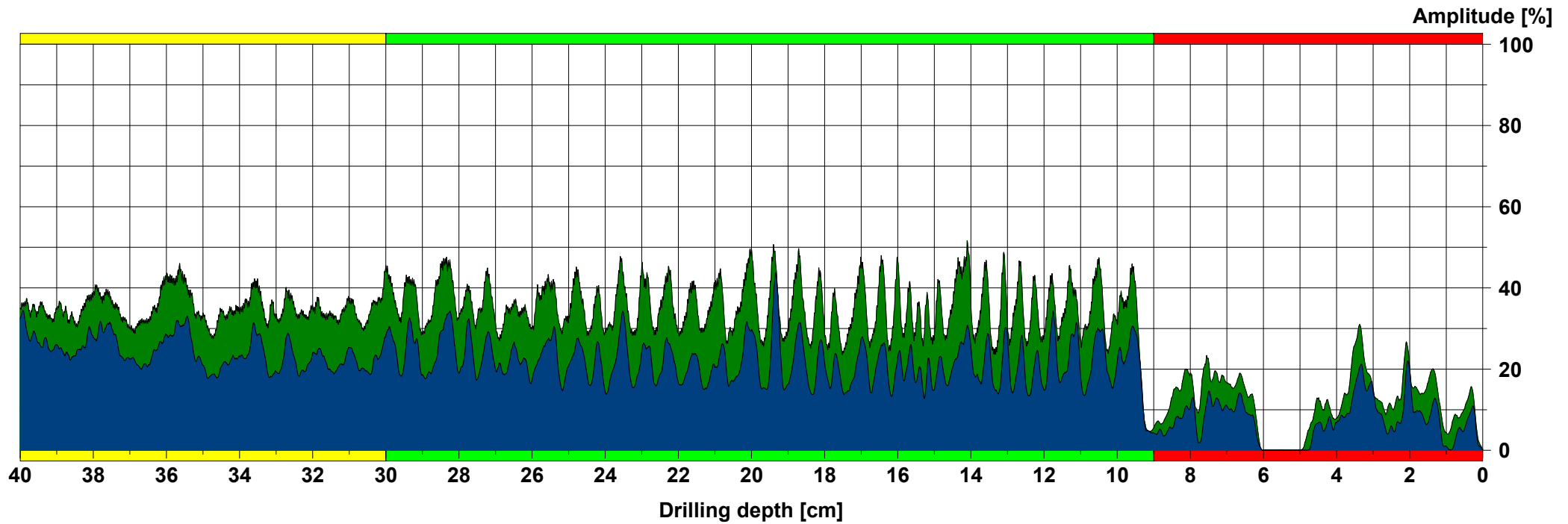
■	From	0,0 cm	to	7,0 cm	:	Bark
■	From	7,0 cm	to	36,0 cm	:	Sound wood
■	From	36,0 cm	to	40,0 cm	:	Decay or cavity
□	From	0,0 cm	to	0,0 cm	:	
□	From	0,0 cm	to	0,0 cm	:	
□	From	0,0 cm	to	0,0 cm	:	

Comment

Deep decay or cavity, no cause for concern in isolation but aligns with sheerbomb crack observed on E side fo trunk.

Measuring / object data

Measurement no. : 4	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 GL W	Needle state : ---	Level : 25,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : West
Date : 10.01.2023	Offset : 121/236	Species : Monterey pine
Time : 12:13:41	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

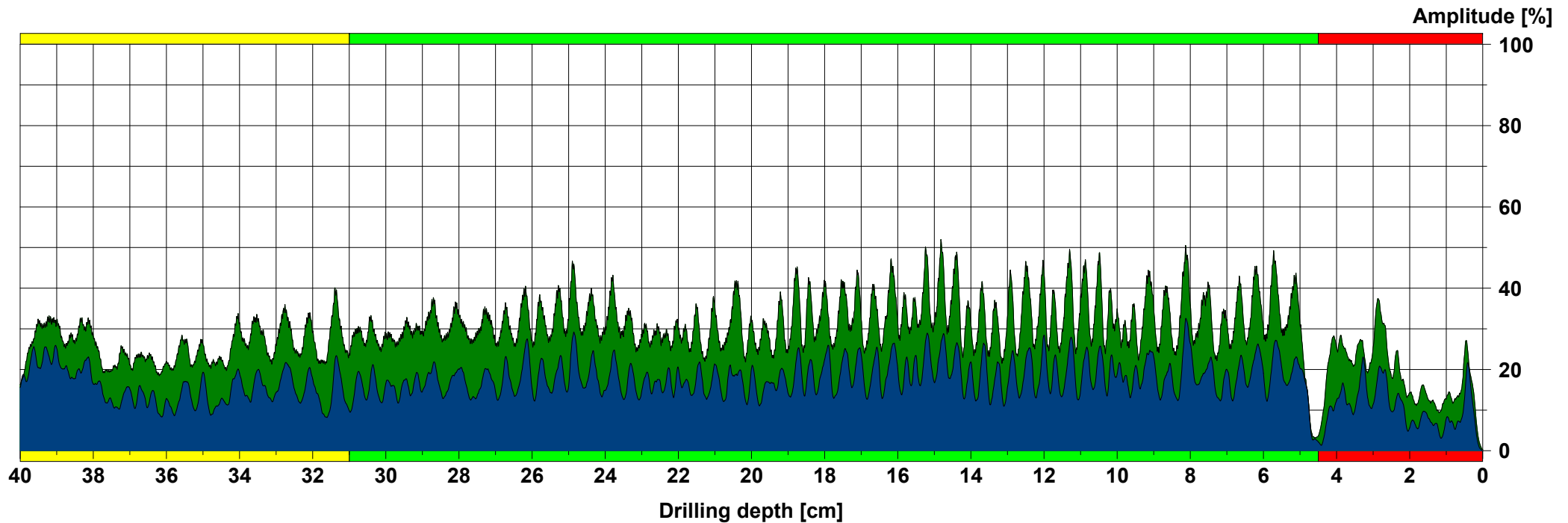
■	From	0,0 cm	to	9,0 cm	:	Bark
■	From	9,0 cm	to	30,0 cm	:	Sound wood
■	From	30,0 cm	to	40,0 cm	:	Slight degradation
■	From	0,0 cm	to	0,0 cm	:	
■	From	0,0 cm	to	0,0 cm	:	
■	From	0,0 cm	to	0,0 cm	:	

Comment

APPENDIX 2
Resistograph readings at 4m, nos. 5-8

Measuring / object data

Measurement no. : 5	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 4M S	Needle state : ---	Level : 400,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : S
Date : 10.01.2023	Offset : 124/244	Species : Monterey pine
Time : 12:19:56	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

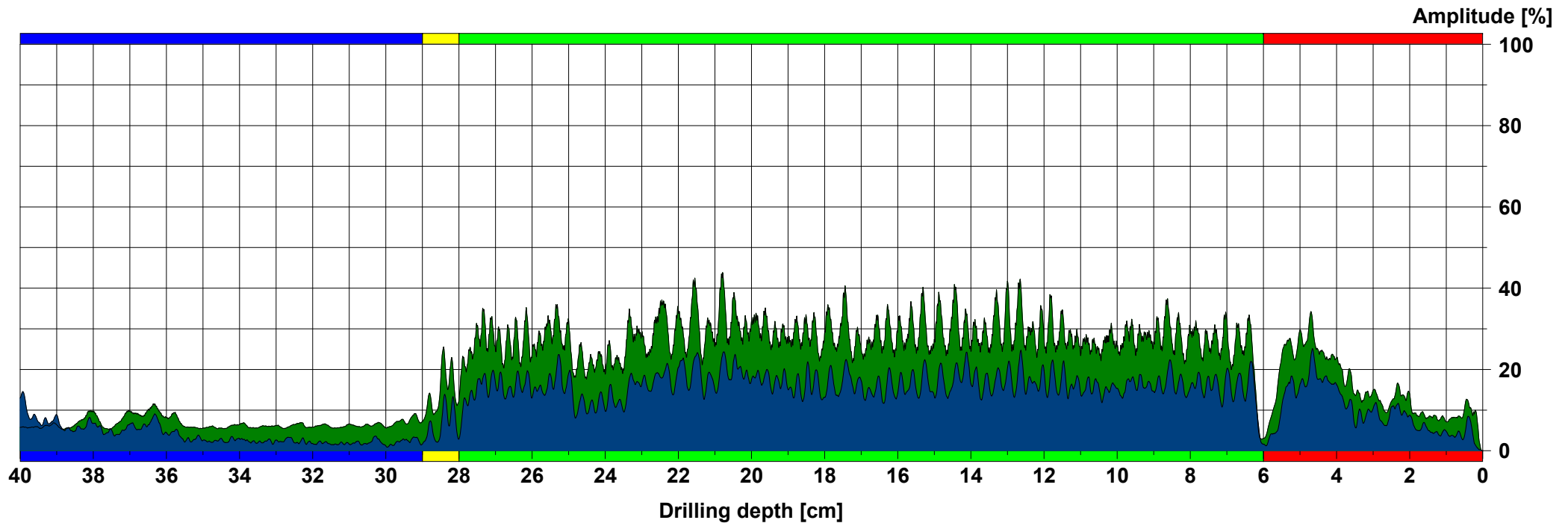
■	From 0,0 cm to 4,5 cm : Bark
■	From 4,5 cm to 31,0 cm : Sound wood
■	From 31,0 cm to 40,0 cm : Slige degradation
■	From 0,0 cm to 0,0 cm :
■	From 0,0 cm to 0,0 cm :
■	From 0,0 cm to 0,0 cm :

Comment

No cause for concern in isolation

Measuring / object data

Measurement no. : 6	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 4M W	Needle state : ---	Level : 400,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : West
Date : 10.01.2023	Offset : 119/236	Species : Monterey pine
Time : 12:21:27	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

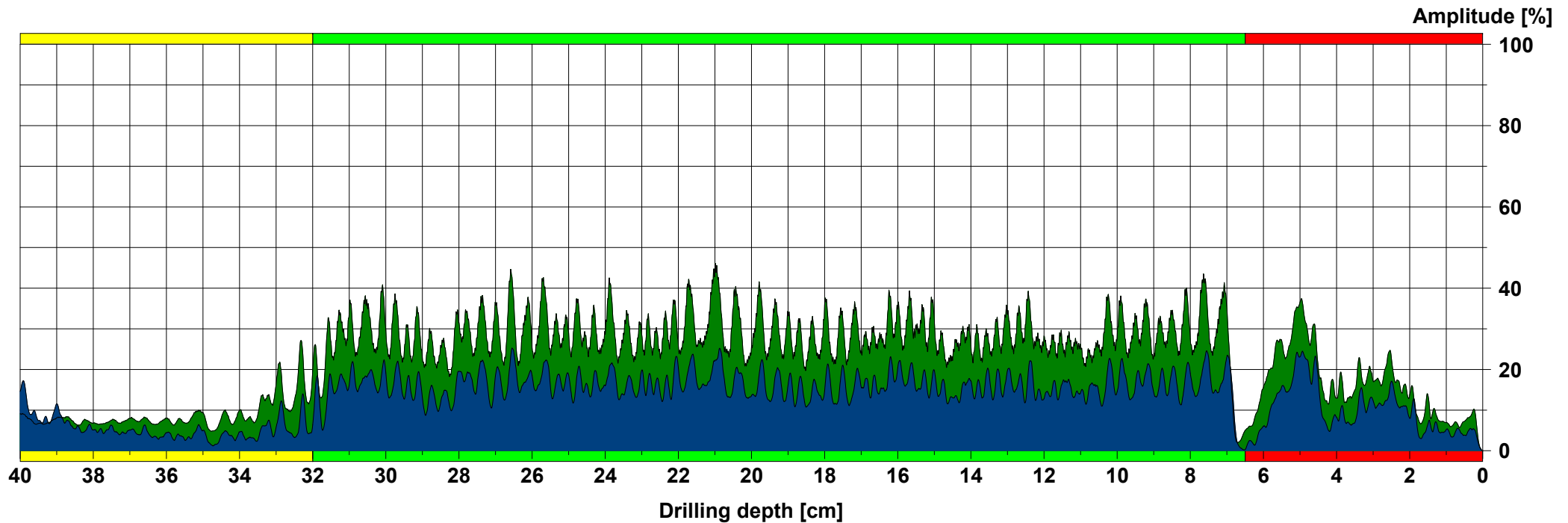
■	From	0,0 cm	to	6,0 cm	:	Bark
■	From	6,0 cm	to	28,0 cm	:	Sound wood
■	From	28,0 cm	to	29,0 cm	:	Transition zone
■	From	29,0 cm	to	40,0 cm	:	Decay
■	From	0,0 cm	to	0,0 cm	:	
■	From	0,0 cm	to	0,0 cm	:	

Comment

Trunk radius is 83.5cm (not including bark).
 sound wood is 22cm thick meaning decay is
 61.5cm deep.

Measuring / object data

Measurement no. : 7	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 4M NW	Needle state : ---	Level : 400,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : North-west
Date : 10.01.2023	Offset : 121/235	Species : Monterey pine
Time : 12:24:14	Avg. curve : off	Location :
Feed speed : 150 cm/min		Name :



Assessment

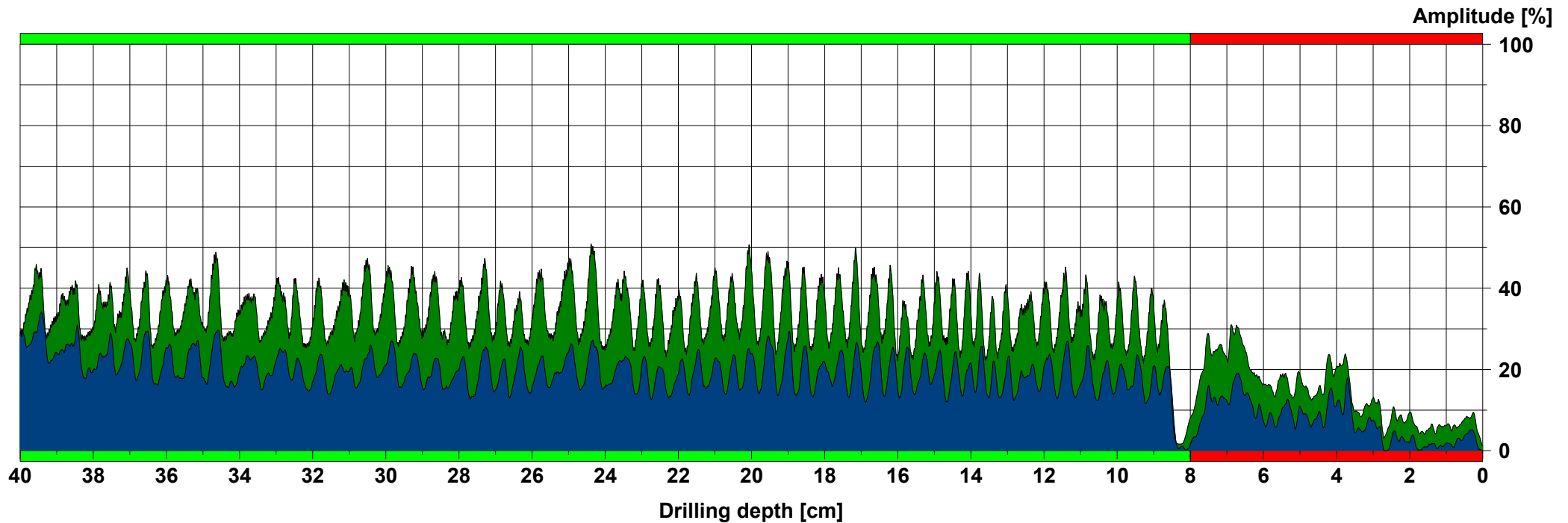
■	From	0,0 cm	to	6,5 cm	:	Bark
■	From	6,5 cm	to	32,0 cm	:	Sound wood
■	From	32,0 cm	to	40,0 cm	:	Decay
■	From	0,0 cm	to	0,0 cm	:	
■	From	0,0 cm	to	0,0 cm	:	
■	From	0,0 cm	to	0,0 cm	:	

Comment

Trunk radius of 83cm (not including bark. Sound wood is 25.5cm thick and decay is 57.5cm deep.

Measuring / object data

Measurement no. : 8	Needle speed : 1750 r/min	Diameter : 179,0 cm
ID number : MARLHILL 82 4M N	Needle state : ---	Level : 400,0 cm
Drilling depth : 40,06 cm	Tilt : ---	Direction : North
Date : 10.01.2023	Offset : 124/257	Species : Monterey pine
Time : 12:27:45	Avg. curve : off	Location :
Feed speed : 150 cm/min	Name :	



Assessment

■	From 0,0 cm to 8,0 cm : Bark
■	From 8,0 cm to 40,0 cm : Sound wood
	From 0,0 cm to 0,0 cm :
	From 0,0 cm to 0,0 cm :
	From 0,0 cm to 0,0 cm :
	From 0,0 cm to 0,0 cm :

Comment

No cause for concern in isolation, soundness of wood seems to be reducing at greater depth.