Franklin Square Park

Level 3 Advanced Assessments Report

PREPARED FOR:

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BARTLETT TREE EXPERTS
SCIENTIFIC TREE CARE SINCE 1907

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Tree Risk Assessment Report

Franklin Square Park
130 E West Street
Southport, NC 28461
February 2, 2024

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Summary

In November 2023 Southport City Manager Bonnie Therrien agreed to the recommendation of completing a *Level 3 advanced assessment* on 22 live oaks (*Quercus virginiana*) located in the Franklin Square Park in Southport, North Carolina. to assess the decay in the trees and determine their risk to people using the property. The result of the project would be a written report describing our observations, findings, and recommendations. Ms Therrien initial concern was the possible failure of a tree or tree parts that could impact a target.
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We visited the property to assess the trees on January 2-5, 2024. ArborSonic 3D™ tomograms and IML PD400 resistance drill readings indicated the presence of a range of negligible to severe loss of structural integrity at multiple sensor planes for all 22 trees. The loss of structural integrity appeared asymmetrical and consistent with external defects observed. Using the methods outlined in this report and the results of the assessments of these trees, it is my professional judgment that live oaks #8 and #45 are *moderate* for trunk failure, and the other 20 live oaks are *low* risk for trunk failure within the next three years.

Options to mitigate the risk associated with the 22 live oaks are listed below.

- Option One:
  I recommend removing live oaks #3, #24, and #25 entirely to remove the risk of root, root collar, trunk, crown, and branch failure. Grind the resulting stumps and back fill the holes. There will be no residual risk for these four trunks, crowns, or branches, but there may be a tripping hazard with the remaining roots, stump, or grindings that you will need to address for all four trees.

  I recommend the remaining 18 trees be pruned to remove dead branches 2 inches and larger in diameter, reduce the spread and weight of their crowns, and thinned so that winds easily move through their canopies, reducing the likelihood of branch, stem, or root failure. Completing the pruning would resulting maintaining the low overall risk rating and reducing the likelihood of failure.

  I recommend installing cables in the live oaks #35, #43, #44, #45,and #46 to provide support to co-dominant stems. Completing the installation of cables would aid in maintaining an overall risk rating and likelihood of failure.

  I recommend installing lightning protection systems in live oak #5, #8, #16, #22, #35, #43, #44, #45, and #46 to reduce the likelihood of these trees being damaged by lightning strikes.

  I recommend for the 18 live oaks not proposed for removal implement a soil management program based on soil testing to correct nutrient deficiencies and/or toxicities that may be detrimental to plant health.

- Option Two:
  If you elect to not remove the trees, the risk of trunk failure will remain low for live oaks #3, #24, and #25. Pruning to reduce the relative size of the crown on each tree may result in an estimated residual risk of ***low*** for branch or crown failure. These four trees should have root collar excavations performed if they are to remain on site.

- Option Three:
  If you elect not to remove the trees, or prune to remove dead branches and reduce the relative size of the crowns, the risk of trunk failure will remain *moderate* for live oak #8

and #45 and low for stem failure for the other 20 live oaks. Each tree's risk may increase in the future as a result of not performing mitigation.

For all live oaks that remain, I recommend an inspection interval of every 12 months and after major storm events.

All recommended work should be performed by qualified arborists and in accordance with industry accepted standards and best management practices set forth by the *American National Standards Institute* and the *International Society of Arboriculture*.

Introduction

Franklin Square Park was located in the coastal city of Southport, NC, FL. City Manager Bonnie Therrien agreed to performing Level 3 Advanced Assessments on 22 live oaks that were identified in the November 2023 City of Southport- Franklin Square Park Tree Inventory and Management Plan as requiring additional data to help determine future management. The result of the project would be a written report describing our observations, findings, and recommendations. Consulting Arborist John Colavecchio and Bartlett team members Zachary LeBlanc and Bo Baker were assigned to conduct the advanced assessments.

After discussing of the recommendations from the November 2023 City of Southport- Franklin Square Park Tree Inventory and Management Plan report, Bonnie Therrien and Everett Jones agreed that my assignment was to:

1. Perform a Level 3 advanced assessment to provide additional information for the risk assessments for live oaks #1, #3, #5, #8, #10, #14, #15, #16, #18, #22, #24, #25, #29, #35, #39, #40, #43, #44, #45, #46, #49, and #50. This assessment would include the use of sonic tomography and resistance drilling to analyze areas of wood to help identify the potential loss of structural integrity within the crown, lower trunks, root collars of the trees. Climbing gear and /or an aerial lift was used to assess the crown of live oak #5, #8, #10, #24, #40, #43, #44, #45, and #46.
2. Provide a written report that documents the tree conditions of concern/defects detected, specific targets assessed, results of the assessments, results of the sonic tomography and resistance drilling, risk ratings, mitigation options with estimated **residual risk**, and a recommended inspection interval(s).

Assessment Procedures

The lower trunk of 22 trees had an advanced assessment for failure performed using sonic tomography and resistance drilling. The roots and/or root collars of live oaks #15, #43, #44, #45, and #46 had an advanced assessment for failure performed using resistance drilling. Sonic tomography was not used because of roots or root collar limitations below the soil. A scaffold branch in live oak #45 had an advanced assessment for failure performed using sonic tomography and resistance drilling (Table 1). The assessments occurred on January 2-5 and followed the *International Society of Arboriculture's (ISA) Best Management Practices for Tree Risk Assessment* and *American National Standards Institute A300 Tree Risk Assessment Standard).*

Tree risk ratings are derived from a combination of three factors: the likelihood of failure, the likelihood of the failed tree part impacting a target, and the consequences of the target being struck. These factors are then used to categorize tree risk as ***extreme****, high, moderate,* or *low*. The factors used to define your risk rating are identified in this report.

Sonic tomography was used to identify the potential loss of structural integrity within the lower trunk, and provide images used for analysis within this report. The ArborSonic 3D™ sonic tomography device uses soundwaves to estimate the presence of internal loss of structural integrity. Soundwaves move from sensor to sensor quicker through wood that is intact and not structurally compromised. Soundwaves have to move around compromised areas such as a crack, cavity, decay, or void, causing it to take longer to reach the other sensors. The times for a soundwave to reach the other sensors are presented as a graphic image, called a tomogram. Estimated structural integrity is represented by a color scale from areas with high structural integrity to areas of no structural integrity.

Resistance drilling was used to identify the potential loss of structural integrity within the lower trunk, and provide images used for analysis within this report. The IML PD400 device uses a small diameter drill bit to drill into the tree and measure the amount of resistance encountered. The drill bit will encounter more resistance in wood that is intact and not structurally compromised. The drill bit will move easily through compromised areas such as a crack, cavity, decay, or void, causing a drop in resistance. The amount of resistance measured is presented as a graphic image from areas with high structural integrity to areas of no structural integrity.

Climbing gear was used to assess the upper stems and/or crowns of live oaks #5, #8, #10, #24, #40, #43, #44, #45, and #46.

Observations

Franklin Square Park was located in the coastal city of Southport, NC, FL. The flat, one acre parcel was bordered by shops, schools, churches, and municipal building. An art gallery resides in the center of the space. These buildings provide the trees with some protection from winds. Seasonal markets are held below the arching branches and a summer concert series performs on the stage at the center of the park. Live oaks are deciduous trees, dropping their leaves across winter.

Live oaks #3, and #43 were in poor condition. The remaining 20 oaks were in fair condition.

Live Oak #1

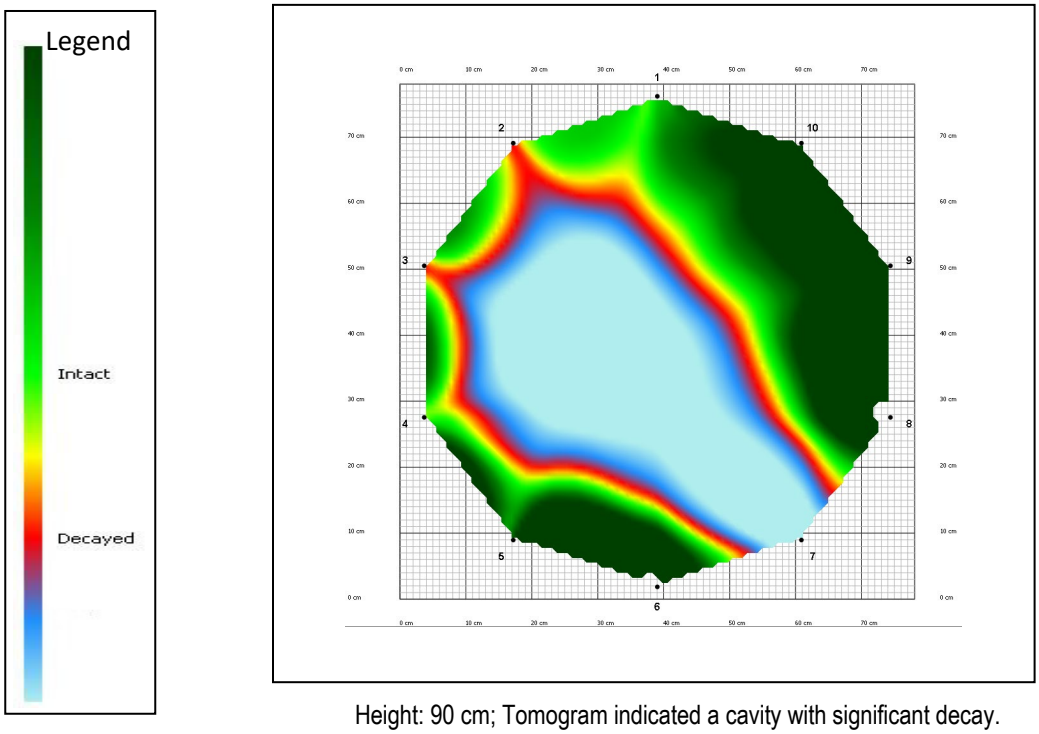
Photo 1: Looking north at live oak #1 showing the uneven crown hanging over on street parking, a sidewalk, and overhead lines.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	32 inches
Height	~40 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches >2 inches Uneven crown Co-dominant stems Root collar cavity
Targets considered	People using the park, Vehicles on road, overhead lines

Live oak #1 was in fair condition with dead branches in the crown, an unbalanced crown, co-dominant stems, and a cavity in the root collar.

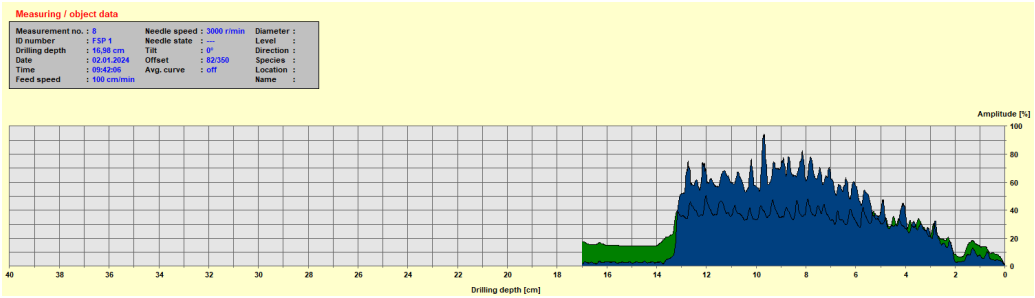
1. The live oak had dead branches estimated to be two to four inches in diameter.
2. The uneven crown was most likely the result of growing in close proximity to other large trees and the main building. The oak grew towards the west as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 12 feet above grade.
4. The trunk was assessed for decay at 90 cm (35.4 inches), and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensor #7 at 90 cm and at sensors #4 and #7 at 30 cm. Visual inspection confirmed that there were no cavities present at either level, however there was a cavity below the 30 cm level in between sensors #3 and #4. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 90 cm was 73.2 cm (28.8 inches) and the 15% threshold would be 11 cm (4.3 inches).
        i. the sensor #2 position indicated 13 cm (5.1 inches) of sound wood
        ii. the sensor #3 position indicated 8.5 cm (3.3 inches) of sound wood
        iii. the sensor #4 position indicated 5.5 cm (2.2 inches) of sound wood
        iv. the sensor #5 position indicated 22 cm (8.7 inches) of sound wood
        v. the sensor #6 position indicated 23 cm (9.1 inches) of sound wood
        vi. the sensor #7 position indicated 26.5 cm (10.4 inches) of sound wood
    b. The diameter of the trunk at 30 cm was 84.4 cm (33.2 inches) and the 15% threshold would be 12.6 cm (5 inches).
        i. the sensor #2 position indicated 17 cm (6.7 inches) of sound wood
        ii. the sensor #3 position indicated 15 cm (5.9 inches) of sound wood
        iii. the sensor #4 position indicated 8 cm (3.1 inches) of sound wood
        iv. the sensor #5 position indicated 15.5 cm (6.1 inches) of sound wood
        v. the sensor #6 position indicated 22.5 cm (8.9 inches) of sound wood
        vi. the sensor #7 position indicated 22.5 cm (8.9 inches) of sound wood
    c. The resistance drill readings at sensors #3 and #4 in the 90 cm level and sensor #4 in the 30 cm level are below the sound wood thresholds of each level. These readings were in the compression wood side of the trunk.
5. The root collar cavity was in the west, compression wood, side of the tree. It was approximately five inches deep and had response growth around the opening.

ArborSonic 3D™ Tomogram Live Oak #1 - 90 cm

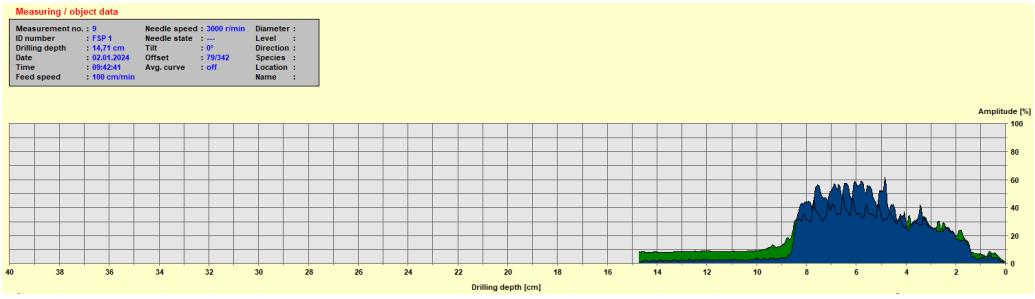


Height: 90 cm; Tomogram indicated a cavity with significant decay.

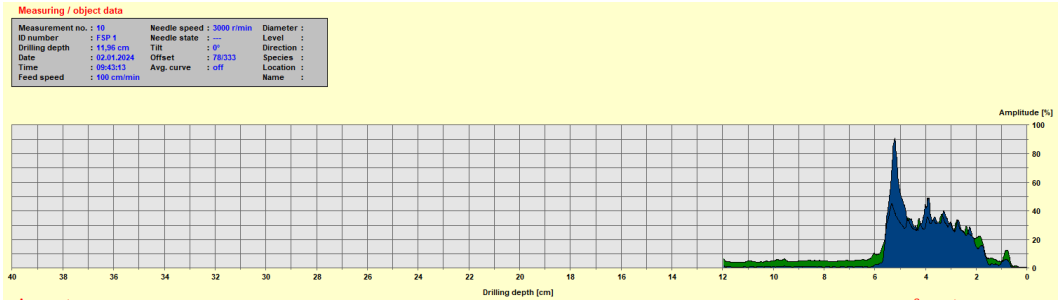
IML Resi-PD 400 Resistance Drill Readings: Live Oak #1- 90cm



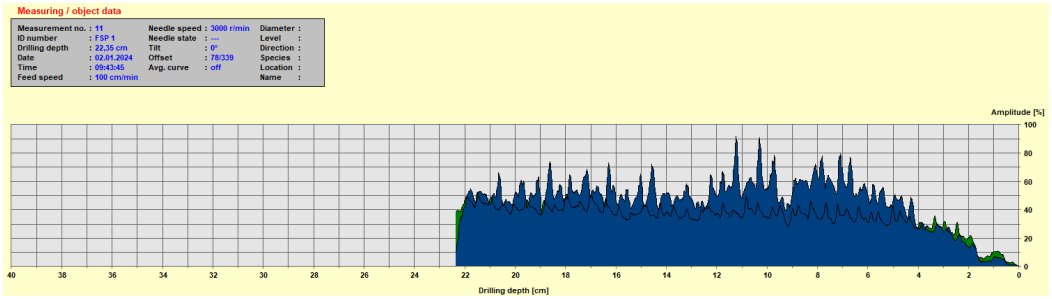
Drilling at 90 cm above grade, the sensor #2 position indicated 13 cm (5.1 inches) of sound wood.



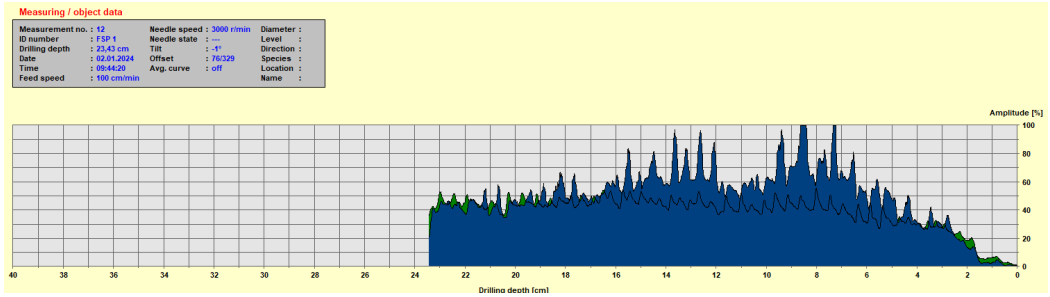
Drilling at 90 cm above grade, the sensor #3 position indicated 8.5 cm (3.3 inches) of sound wood.



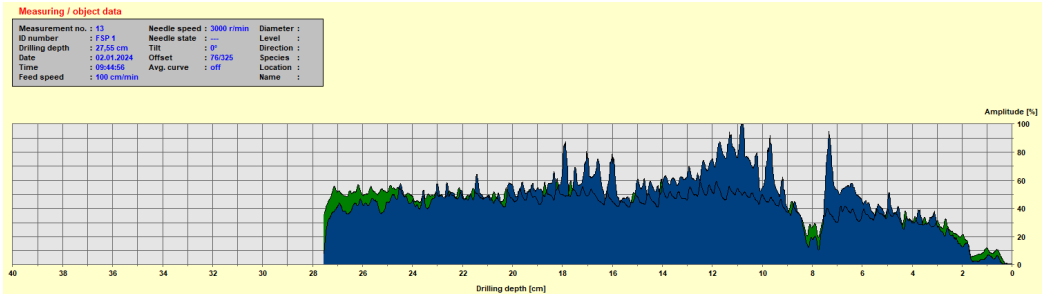
Drilling at 90 cm above grade, the sensor #4 position indicated 5.5 cm (2.2 inches) of sound wood.



Drilling at 90 cm above grade, the sensor #5 position indicated 22 cm (8.7 inches) of sound wood.

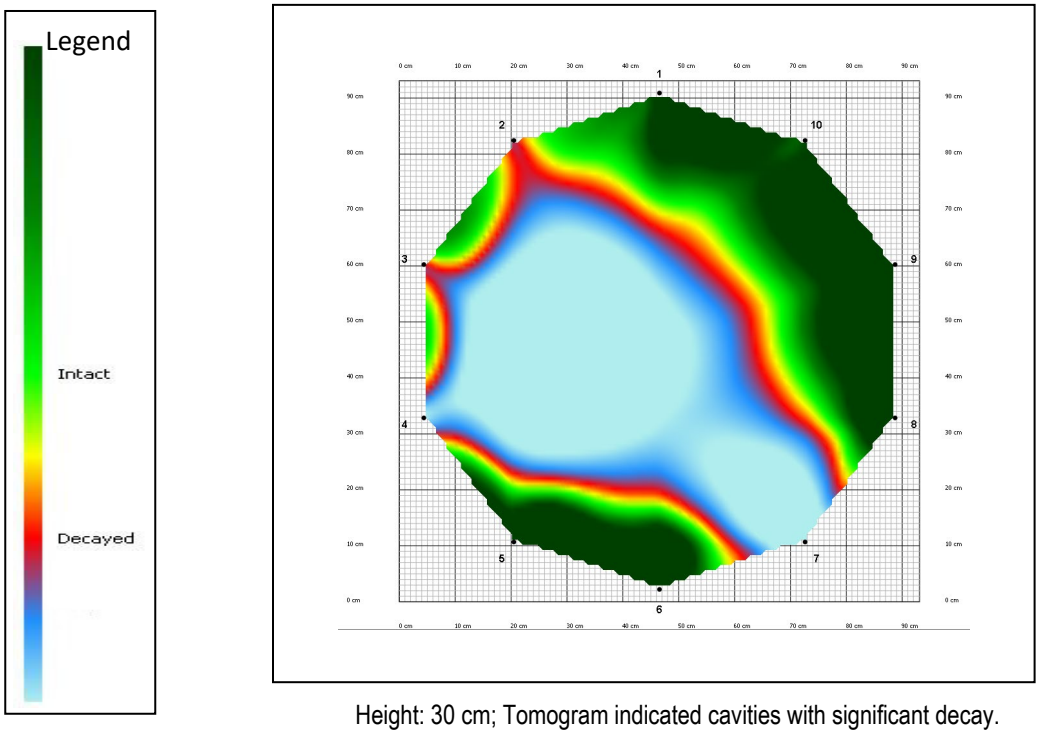


Drilling at 90 cm above grade, the sensor #6 position indicated 23 cm (9.1 inches) of sound wood.



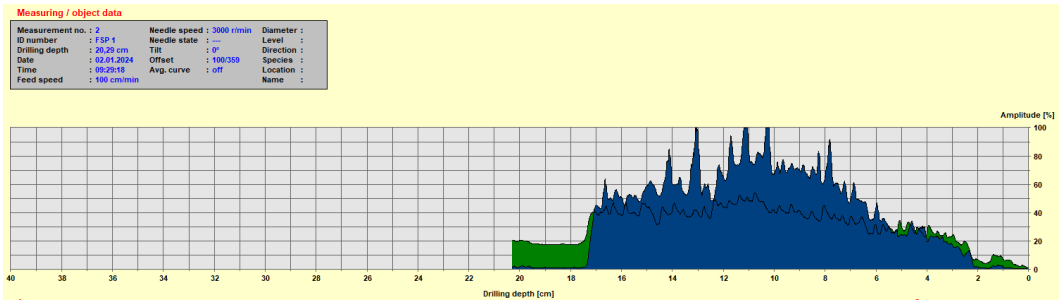
Drilling at 90 cm above grade, the sensor #7 position indicated 26.5 cm (10.4 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #1 - 30 cm

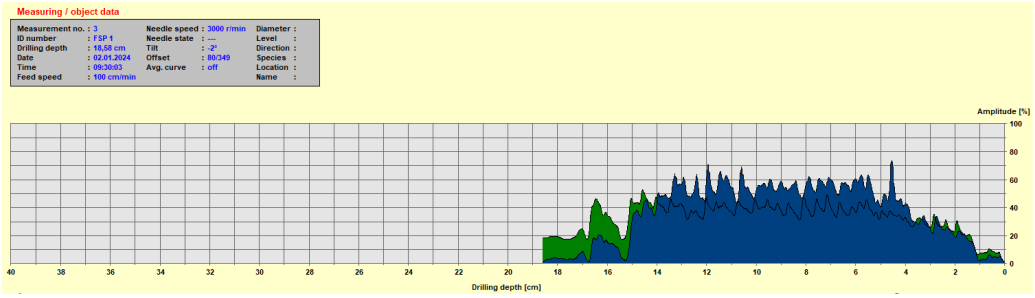


Height: 30 cm; Tomogram indicated cavities with significant decay.

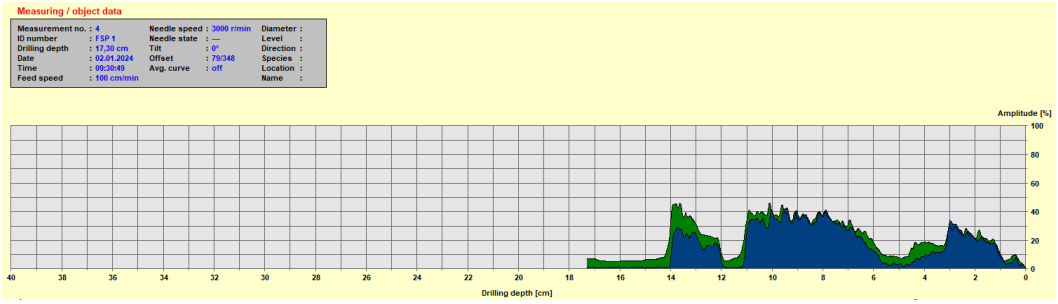
IML Resi-PD 400 Resistance Drill Readings: Live Oak #1 - 30cm



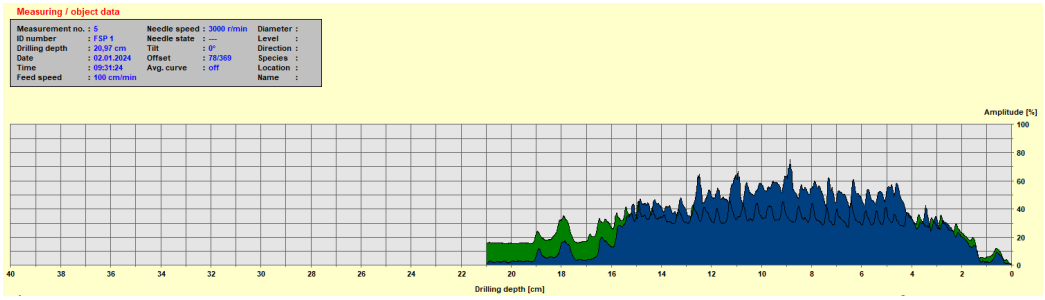
Drilling at 30 cm above grade, the sensor #2 position indicated 17 cm (6.7 inches) of sound wood.



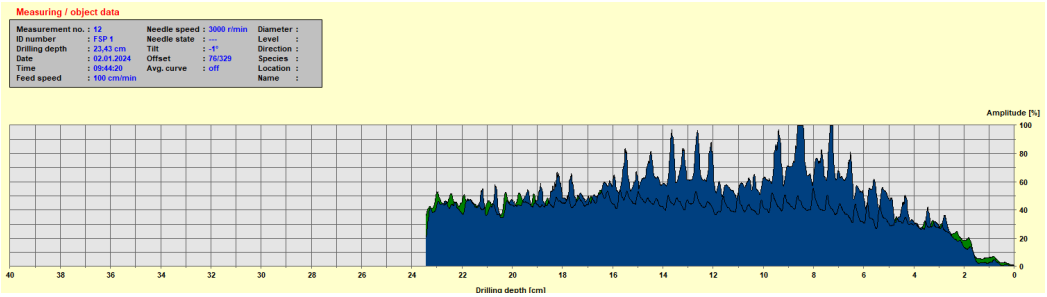
Drilling at 30 cm above grade, the sensor #3 position indicated 15 cm (5.9 inches) of sound wood.



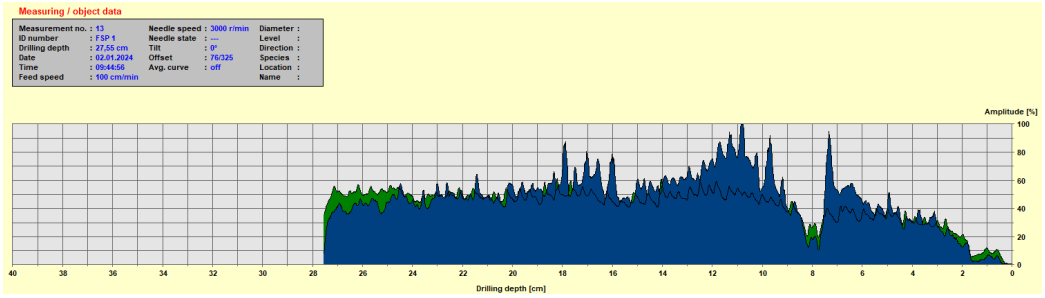
Drilling at 30 cm above grade, the sensor #4 position indicated 8 cm (3.1 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #5 position indicated 15.5 cm (6.1 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #6 position indicated 22.5 cm (8.9 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 22.5 cm (8.9 inches) of sound wood.

Live Oak #3

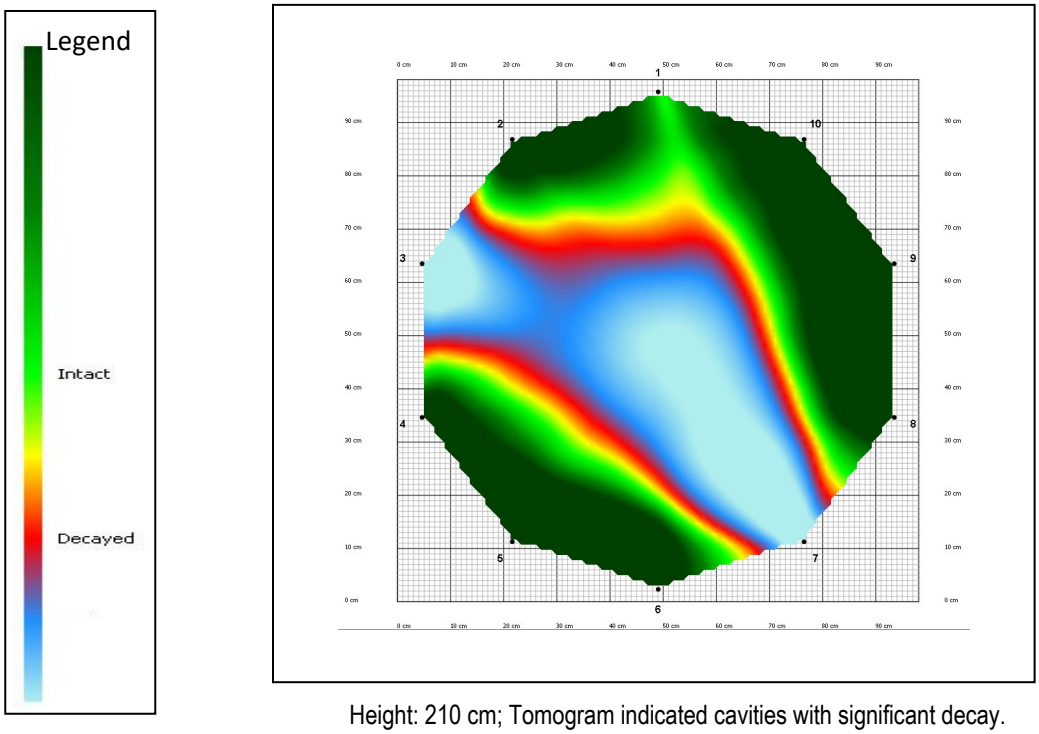
Photo 2: Looking northeast at live oak #3 showing the lions tail pruning and the co-dominant stems.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	40 inches
Height	~55 feet
Condition	Poor
Soil Conditions	Well-drained
Defects	Dead branches Co-dominant stems Stem cavity and decay Lion's tail pruning
Targets considered	People using the park

Live oak #3 was in poor condition with dead branches throughout the crown, co-dominant stems, lions tail pruning, a stem cavity, and decay in the stem.

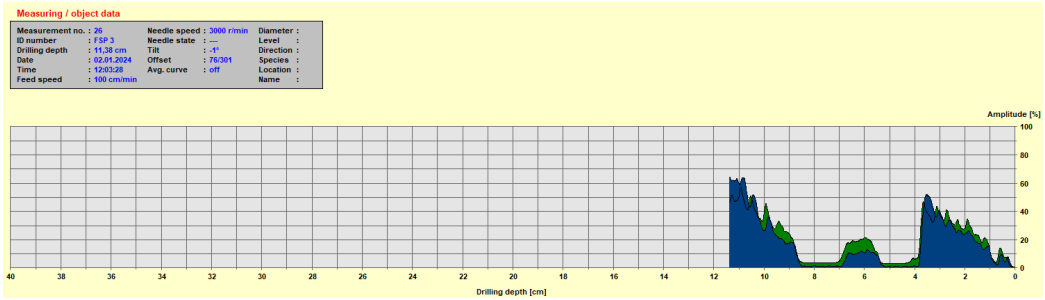
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The co-dominant stems are stems or large branches of a similar diameter the originate at the same point in a tree. These stems bifurcated at approximately 10 feet above grade.
3. The interior branches of the tree have been removed concentrating the foliage at tips of the branches.
4. The cavity was in between the co-dominant stems. A volunteer eastern red cedar (*Juniperus virginiana*) was growing from the cavity
5. The trunk was assessed for decay at 210 cm (82.7 inches), 150 cm (59 inches), and 90 cm (35.4 inches) above grade. The tomogram indicated cavities at sensor #7 at all levels and at sensor #3 in the 210 cm level. Visual inspection confirmed that there were no cavities present at any level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 210 cm was 103.5 cm (40.7 inches) and the 15% threshold would be 11 cm (4.3 inches).
        i. the sensor #3 position indicated 5 cm (2 inches) of sound wood
        ii. the sensor #7 position indicated 6 cm (2.6 inches) of sound wood
    b. The diameter of the trunk at 150 cm was 97.1 cm (38.2 inches) and the 15% threshold would be 13.7 cm (5.4 inches).
        i. the sensor #1 position indicated 31 cm (12.2 inches) of sound wood
        ii. the sensor #7 position indicated 31 cm (12.2 inches) of sound wood
    c. The diameter of the trunk at 90 cm was 100.3 cm (39.5 inches) and the 15% threshold would be 15 cm (5.9 inches).
        i. the sensor #4 position indicated 18 cm (7 inches) of sound wood
        ii. the sensor #7 position indicated 29 cm (11.4 inches) of sound wood
    d. The resistance drill readings at sensors #3 and #7 in the 210 cm level are below the sound wood thresholds of each level.
6. The remnants of a fungal conk was observed on the west side of the trunk, between the 90 cm and 150 mcm levels of decay detection. The conk had been removed before this assessment and could not be identified.

ArborSonic 3D™ Tomogram Live Oak #3 - 210 cm

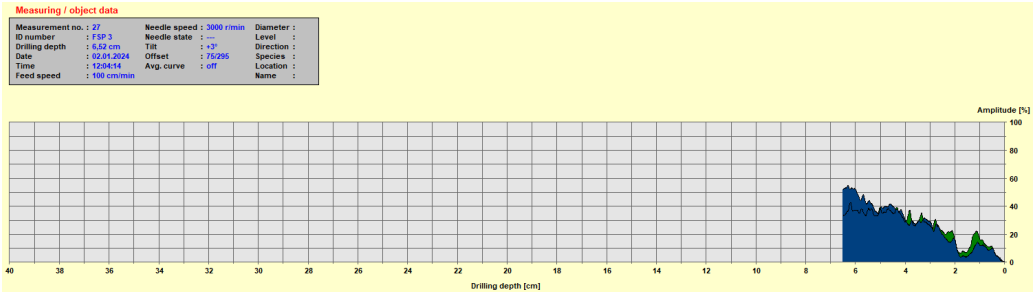


Height: 210 cm; Tomogram indicated cavities with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #3 - 210cm

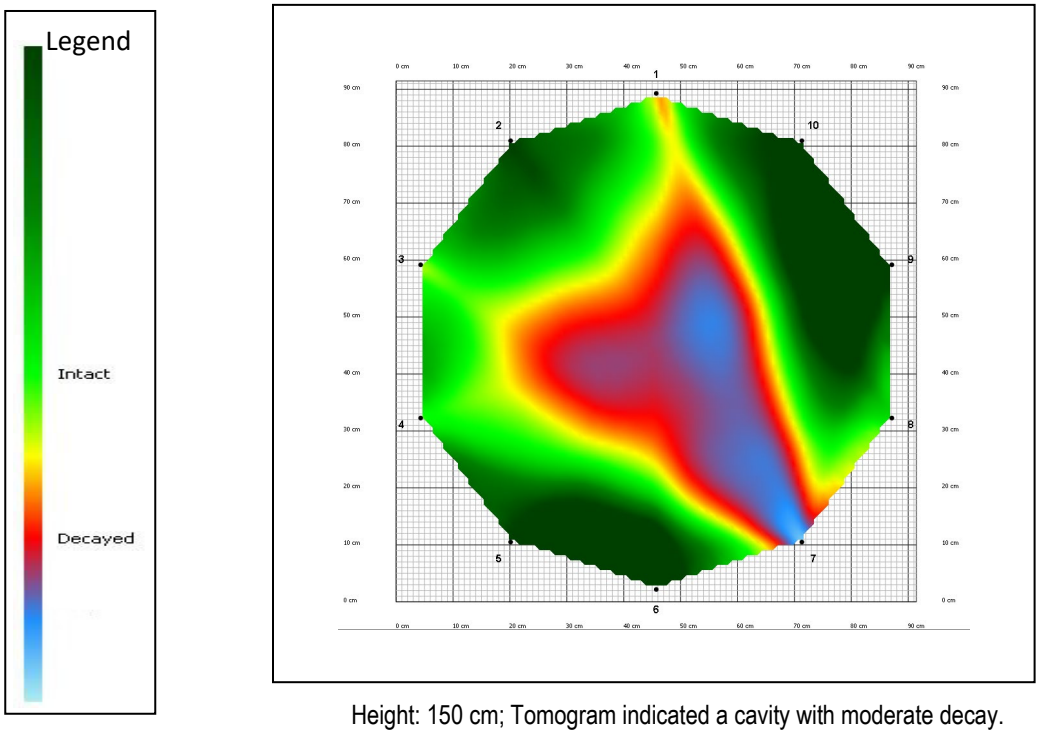


Drilling at 210 cm above grade, the sensor #3 position indicated 5 cm (2 inches) of sound wood.



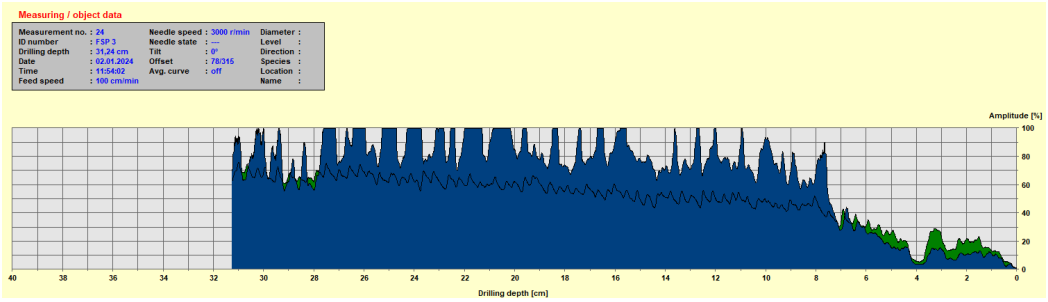
Drilling at 210 cm above grade, the sensor #7 position indicated 6 cm (2.6 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #3 - 150 cm

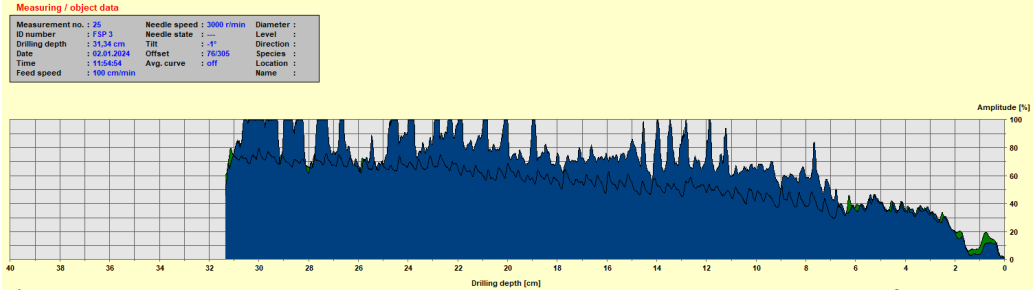


Height: 150 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #3 - 150cm

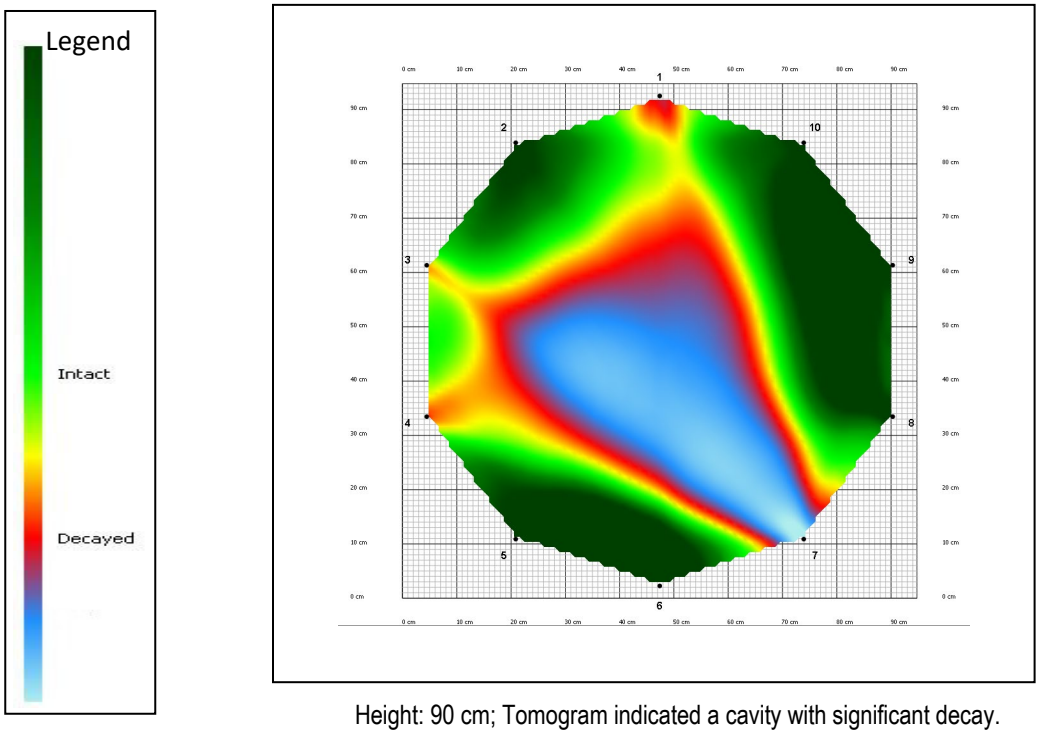


Drilling at 150 cm above grade, the sensor #1 position indicated 31 cm (12.2 inches) of sound wood.



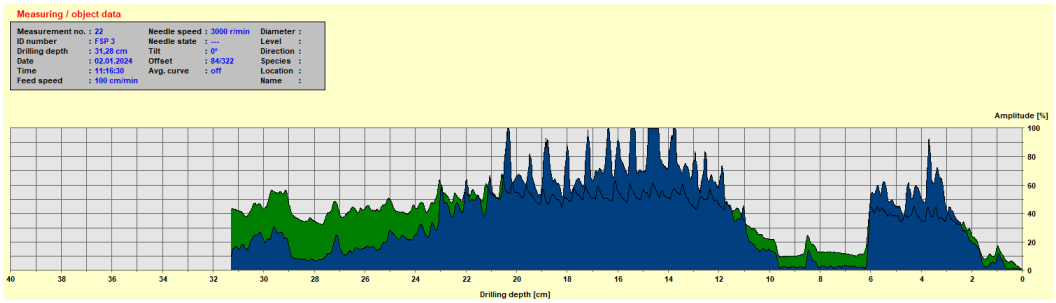
Drilling at 150 cm above grade, the sensor #7 position indicated 31 cm (12.2 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #3 - 90 cm

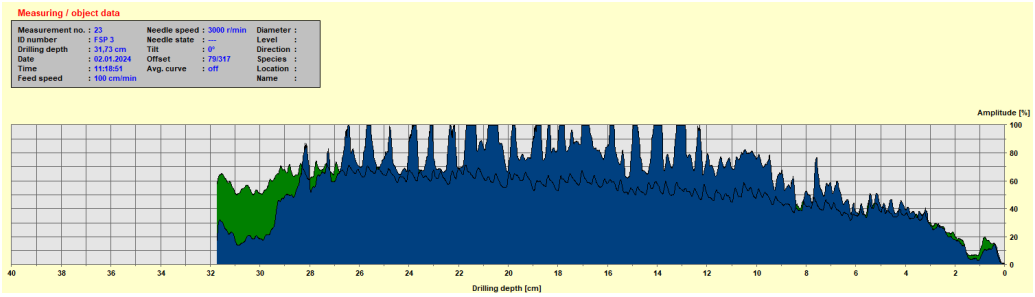


Height: 90 cm; Tomogram indicated a cavity with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #3 - 90cm



Drilling at 90 cm above grade, the sensor #4 position indicated 18 cm (7 inches) of sound wood.



Drilling at 90 cm above grade, the sensor #7 position indicated 29 cm (11.4 inches) of sound wood.

Live Oak #5

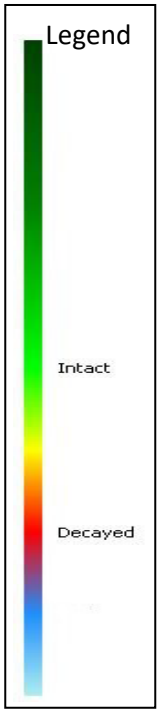
Photo 3: Looking north at live oak #5 showing the uneven crown and leaning stem.

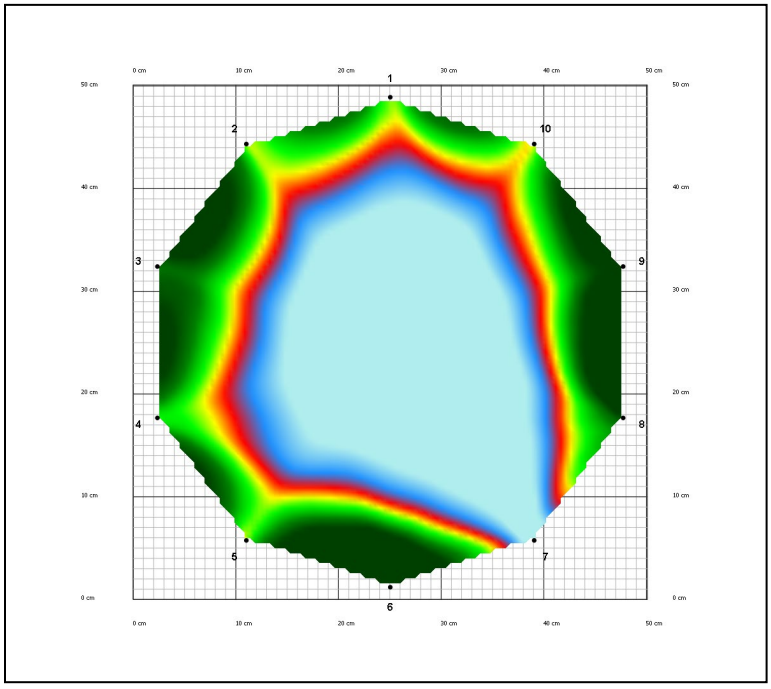
Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	47 inches
Height	~45 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Co-dominant stems Branch cavity with decay Fungal conk Stem cavity
Targets considered	People using the park, Vehicles on road, overhead lines

Live oak #1 was in fair condition with dead branches in the crown, co-dominant stems, a cavity with decay in the west scaffold branch, and a cavity in the stem.

1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The co-dominant stems bifurcated at approximately eight feet above grade.
3. The west scaffold branch had a long shallow cavity with conks form two fungal organisms, one identified by our pathologist as *Inonotus hispidus* and the other identified as *Fomitiporia dryophila*. This scaffold branch was assessed for decay at 1000 cm (33 feet) above grade. The tomogram indicated the cavity at sensor #7. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the west scaffold branch at 1000 cm was 55.7 cm (21.9) and the 15% threshold would be 8.4 cm (3.3 inches).
        i. the sensor #2 position indicated 8.5 cm (3.3 inches) of sound wood
        ii. the sensor #7 position indicated 8.5 cm (3.3 inches) of sound wood.
4. The trunk was assessed for decay at 210 cm (82.7 inches) above grade. The tomogram indicated cavities at sensor #7. cm. Visual inspection confirmed that no cavities were present at either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 210 cm was 119.4 cm (47 inches) and the 15% threshold would be 17.9 cm (7 inches).
        i. the sensor #2 position indicated 33 cm (13 inches) of sound wood
        ii. the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.

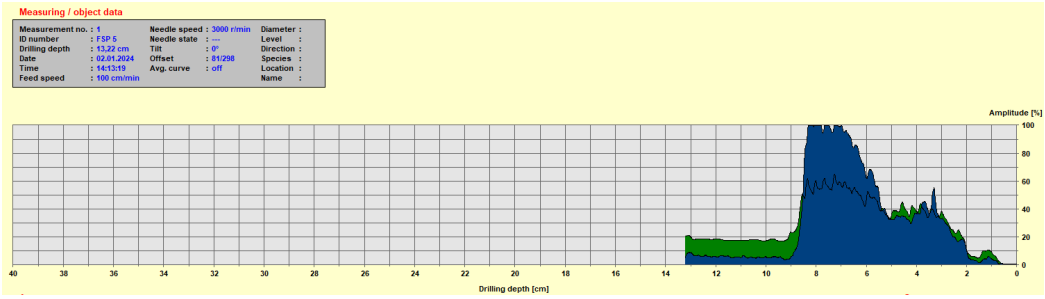
ArborSonic 3D™ Tomogram Live Oak #5- W Scaffold Branch - 1000 cm



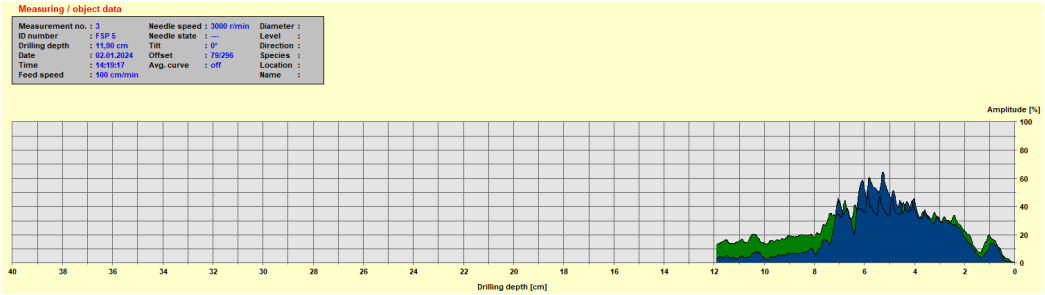


West scaffold branch: 1000 cm; Tomogram indicated a cavity with severe decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #4- W Scaffold Branch 1000 cm

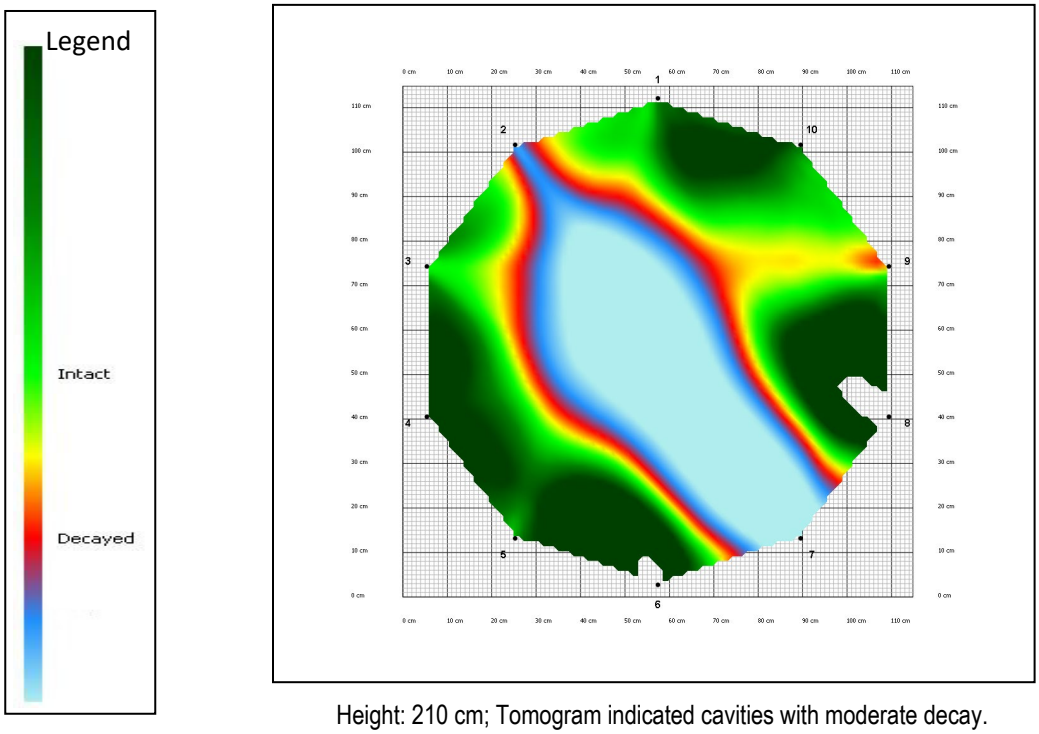


Drilling at 1000 cm above grade, the sensor #2 position indicated 8.5 cm (3.3 inches) of sound wood.



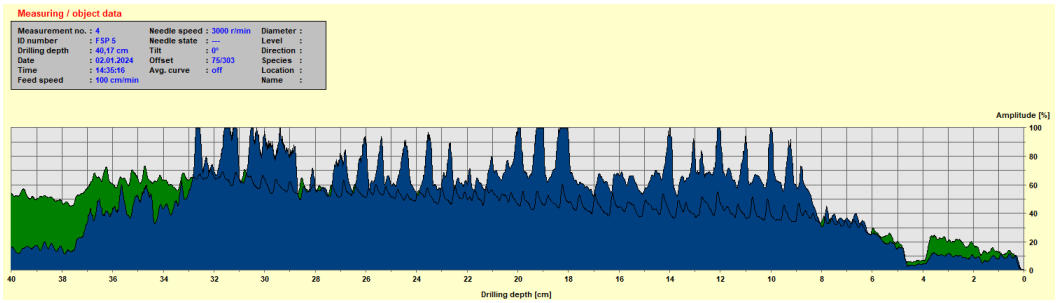
Drilling at 1000 cm above grade, the sensor #7 position indicated 8.5 cm (3.3 inches) of sound wood

ArborSonic 3D™ Tomogram Live Oak #5- 210 cm

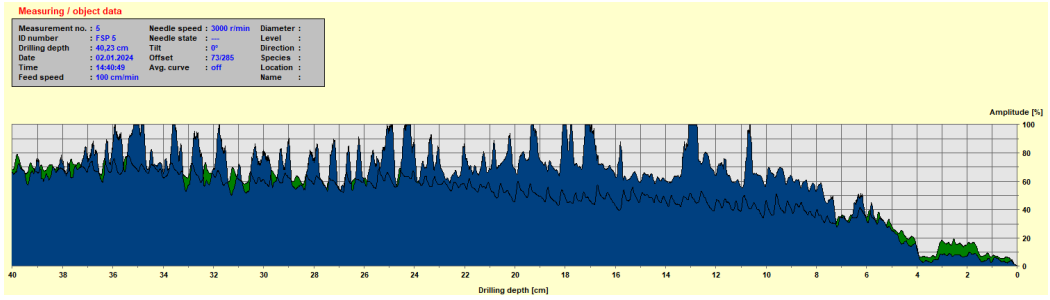


Height: 210 cm; Tomogram indicated cavities with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #5- 210cm



Drilling at 210 cm above grade, the sensor #2 position indicated 33 cm (13 inches) of sound wood.



Drilling at 210 cm above grade, the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.

Live Oak #8

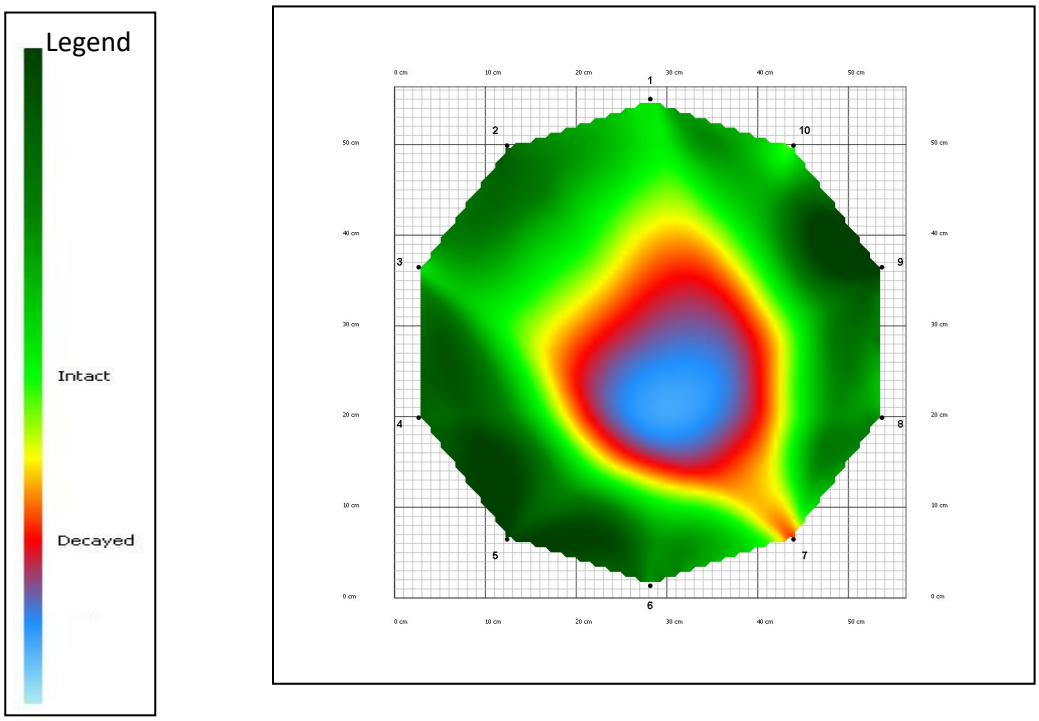
Photo 4: Looking east at live oak #8 showing the close proximity to the building.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	53 inches
Height	~40 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Stem cavity
Targets considered	People using the park, building

Live oak #8 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, and a stem cavity.

1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of pruning to provide clearance to the building to the south.
3. The co-dominant stems bifurcated at approximately 15 feet above grade.
4. The trunk was assessed for decay at 500 cm (16.4 feet) above grade. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 500 cm was 63.7 cm (25.1 inches) and the 15% threshold would be 9.6 cm (3.8 inches). The tomogram did not indicate a need to resistance drill this level.

ArborSonic 3D™ Tomogram Live Oak #8 - 500 cm



Height: 100 cm; Tomogram indicated minor decay.

Live Oak #10

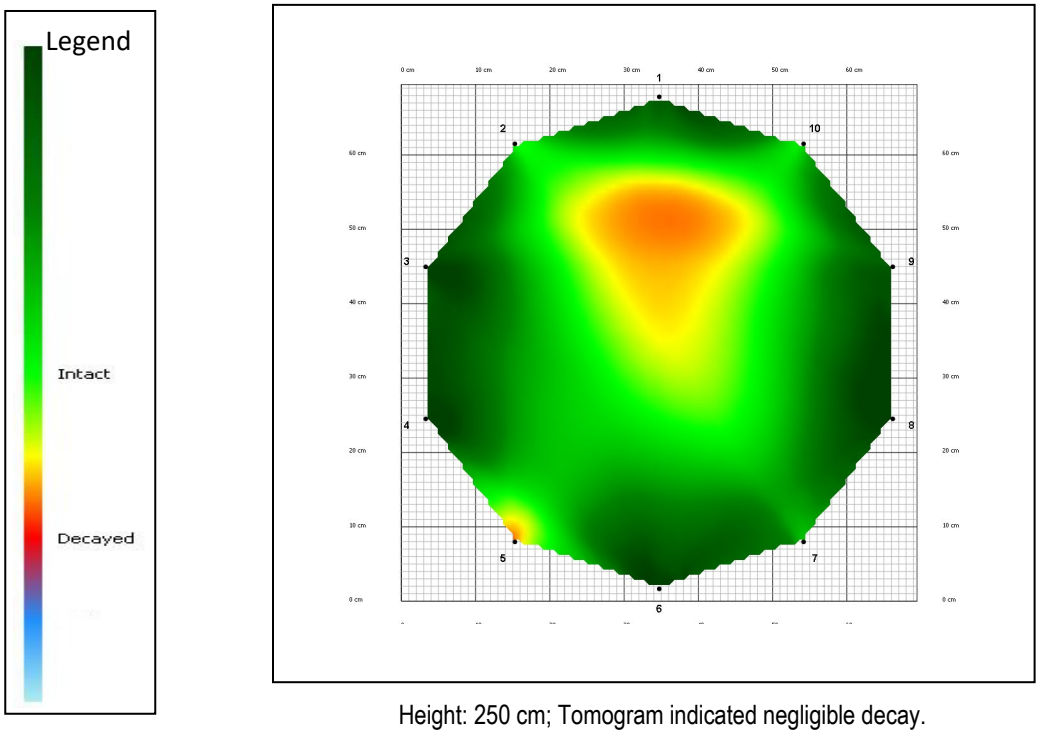
Photo 5: Looking west at live oak #10 showing the over-extended branch at the right.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	34 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches >2 inches Uneven crown Stem cavities
Targets considered	People using the park

Live oak #10 was in fair condition with dead branches, an unbalanced crown, a cavity in the north side of the stem, and a cavity in the west side of the lower stem.

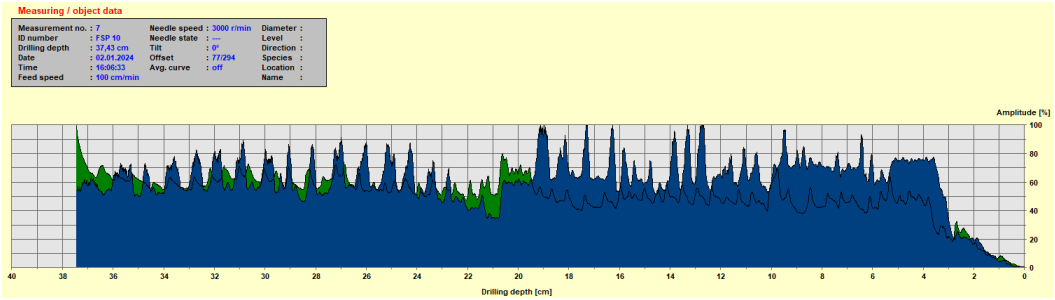
1. The live had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the south as it competed for sunlight.
3. A cavity was visible in the north side of the trunk. It was approximately 10 feet above grade and extended 25.4 cm (10 inches) into the trunk. A shallow cavity was visible in the west side of the lower trunk, extending from the root collar to 116.4 cm (46 inches).
4. The trunk was assessed for decay at 250 cm (98.4 inches), 135cm (53.1 inches), and 40 cm (15.7 inches) above grade. The tomogram indicated cavities at sensors #3,#4 and #7 at 30 cm and at sensor #7 at 135 cm. Visual inspection confirmed the shallow cavity between sensors #3 and #4 at 40 cm and no cavities at sensor #7 at 30 cm or 135 cm. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 250 cm was 74.2 cm (29.2 inches) and the 15% threshold would be 11.1 cm (4.4 inches).
        i. the sensor #1 position indicated 37 cm (14.6 inches) of sound wood.
        ii. the sensor #10 position indicated 19 cm (7.5 inches) of sound wood.
    b. The diameter of the trunk at 135 cm was 73.9 cm (29.1 inches) and the 15% threshold would be 11.1 cm (4.4 inches)
        i. the sensor #7 position indicated 22 cm (9.1 inches) of sound wood.
    c. The diameter of the trunk at 40 cm was 90.8 cm (35.7 inches) and the 15% threshold would be 13.6 cm (5.4 inches).
        i. the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #10 250 cm

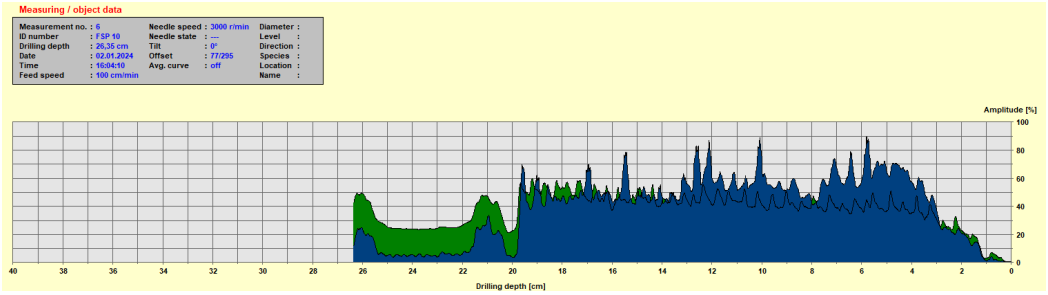


Height: 250 cm; Tomogram indicated negligible decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #10- 250 cm

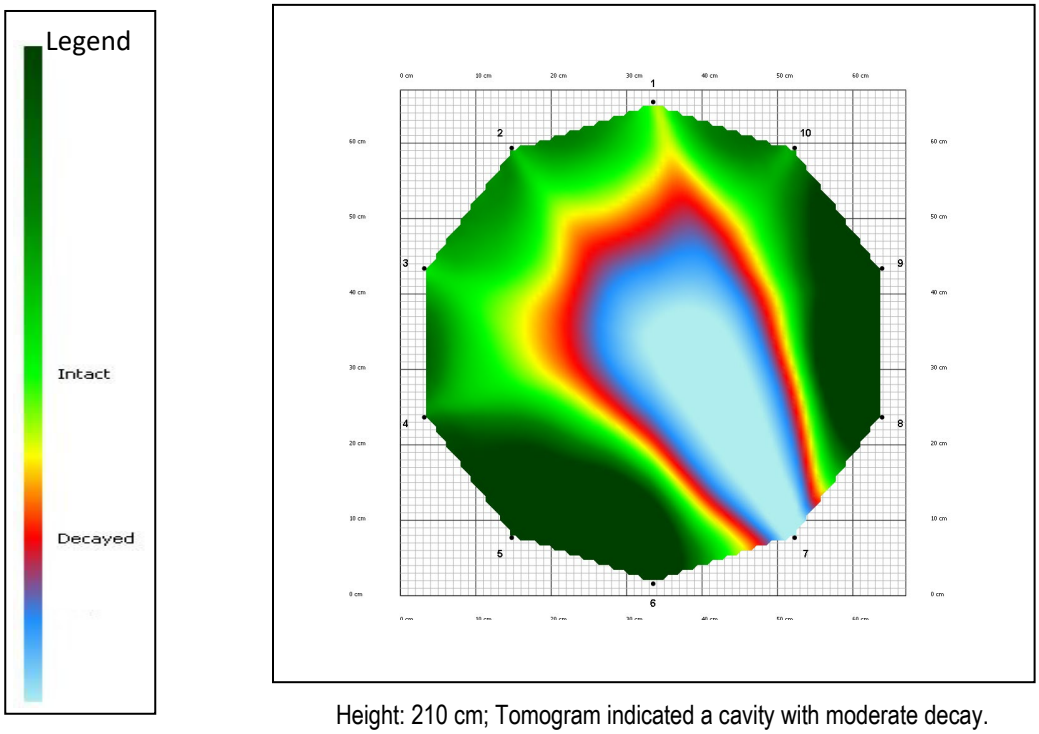


Drilling at 250 cm above grade, the sensor #1 position indicated 37 cm (14.6 inches) of sound wood.



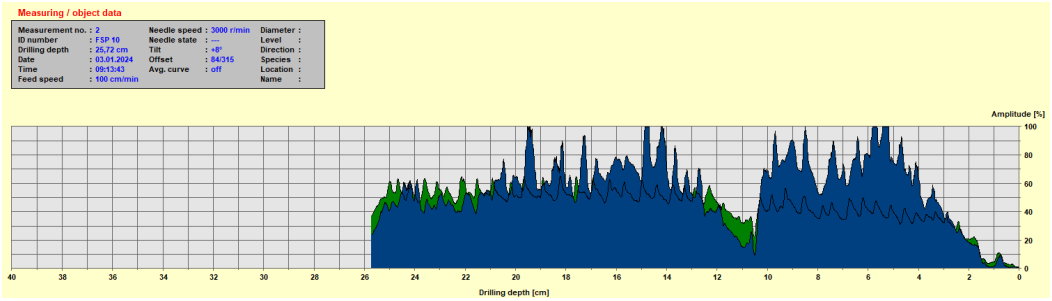
Drilling at 250 cm above grade, the sensor #10 position indicated 19 cm (7.5 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #10- 135 cm



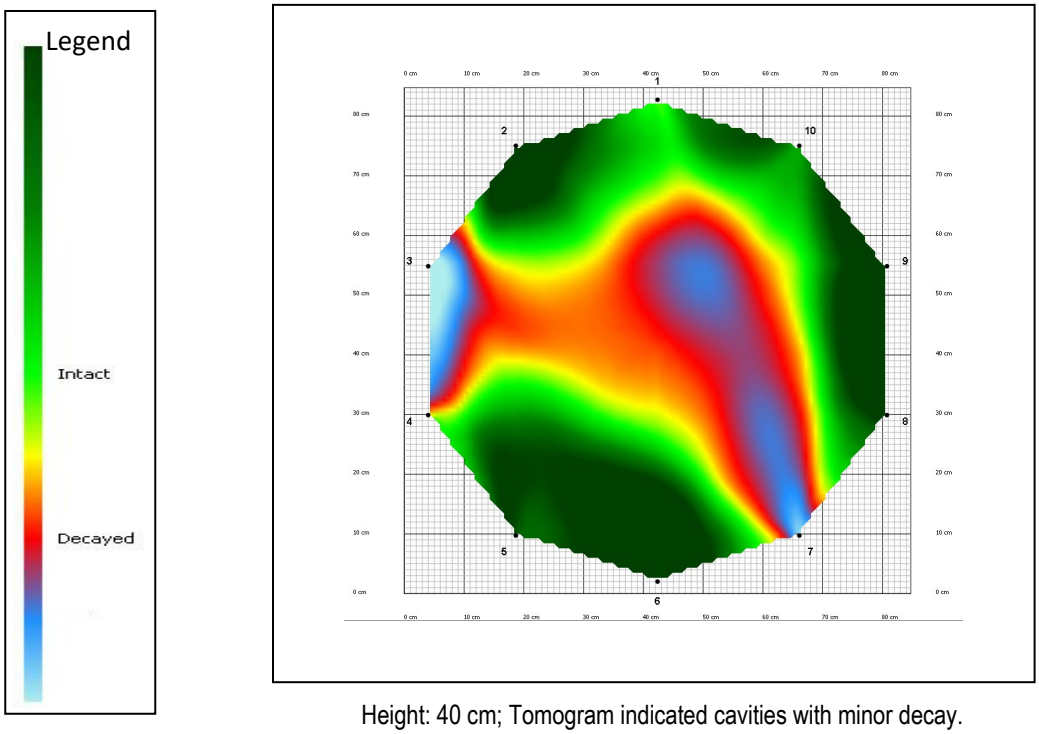
Height: 210 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #10 – 135 cm



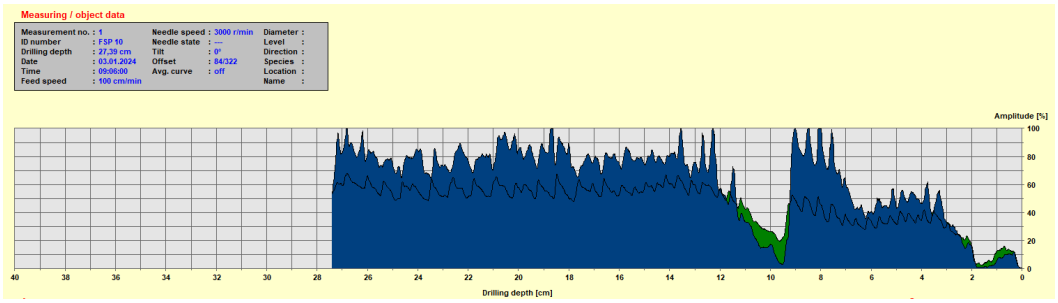
Drilling at 135 cm above grade, the sensor #7 position indicated 33 cm (13 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #10 - 40 cm



Height: 40 cm; Tomogram indicated cavities with minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #10 – 40 cm



Drilling at 40 cm above grade, the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.

Live Oak #14

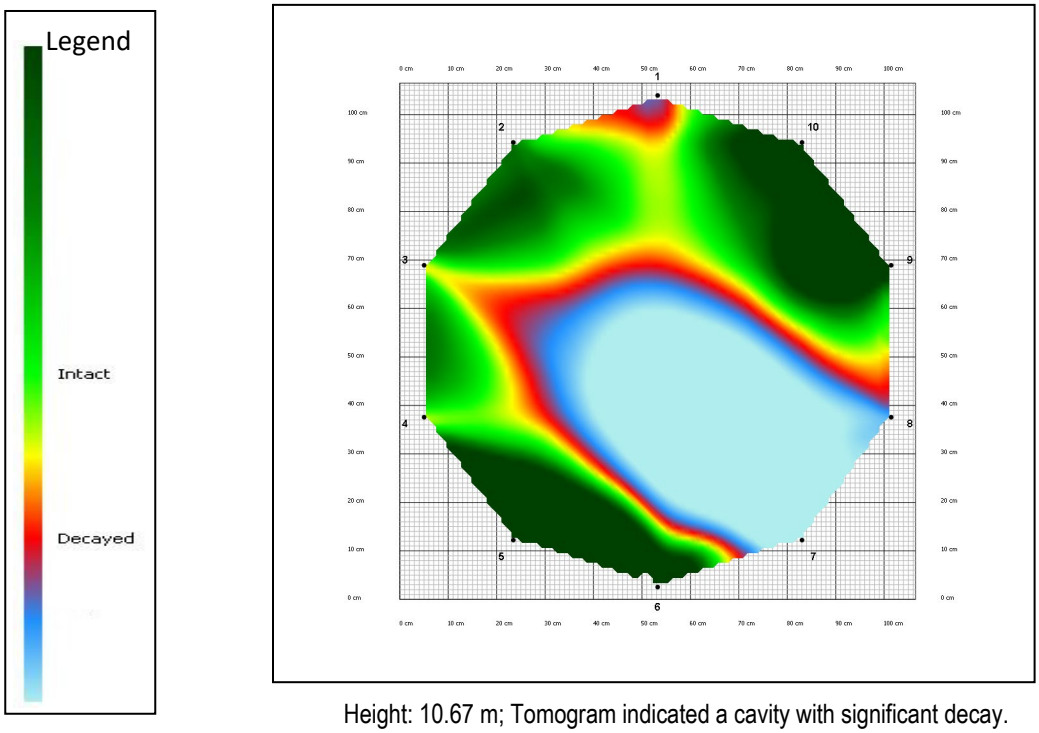
Photo 6: Looking north at live oak #14 showing the co-dominant stems.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	47 inches
Height	~55 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Co-dominant stems Stem wounds
Targets considered	People using the park

Live oak #14 was in fair condition with dead branches throughout the crown, co-dominant stems, and shallow cavities in the lower trunk.

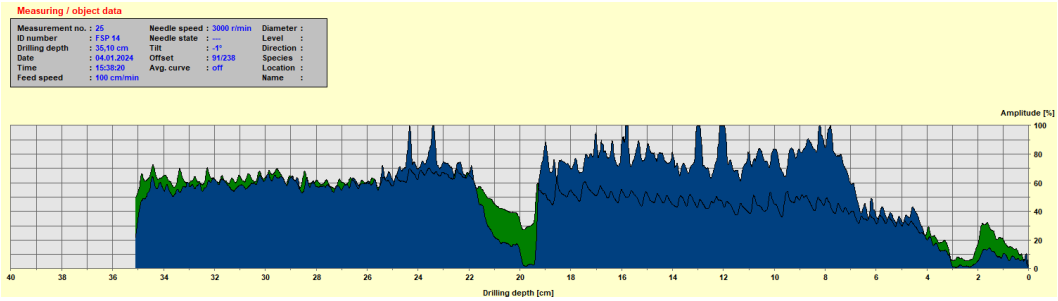
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The co-dominant stems bifurcated at approximately 15 feet above grade.
3. The lower trunk had two shallow wounds, one on the north side and one on the southeast side. The northern wound was below a wound where a large, co-dominant stem had been removed.
4. The trunk was assessed for decay at 100 cm (39.3 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensor #7 at 30 cm and 100 cm. Visual inspection confirmed the shallow wound at sensor #7 at both levels. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 100 cm was 111.5 cm (43.9 inches) and the 15% threshold would be 16.7 cm (6.6 inches).
        i. the sensor #7 position indicated 35 cm (13.8 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 129 cm (50 inches) and the 15% threshold would be 19.4 cm (7.6 inches).
        i. the sensor #1 position indicated 40 cm (15.7 inches) of sound wood.
        ii. the sensor #7 position indicated 35 cm (13.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #14 – 100 cm



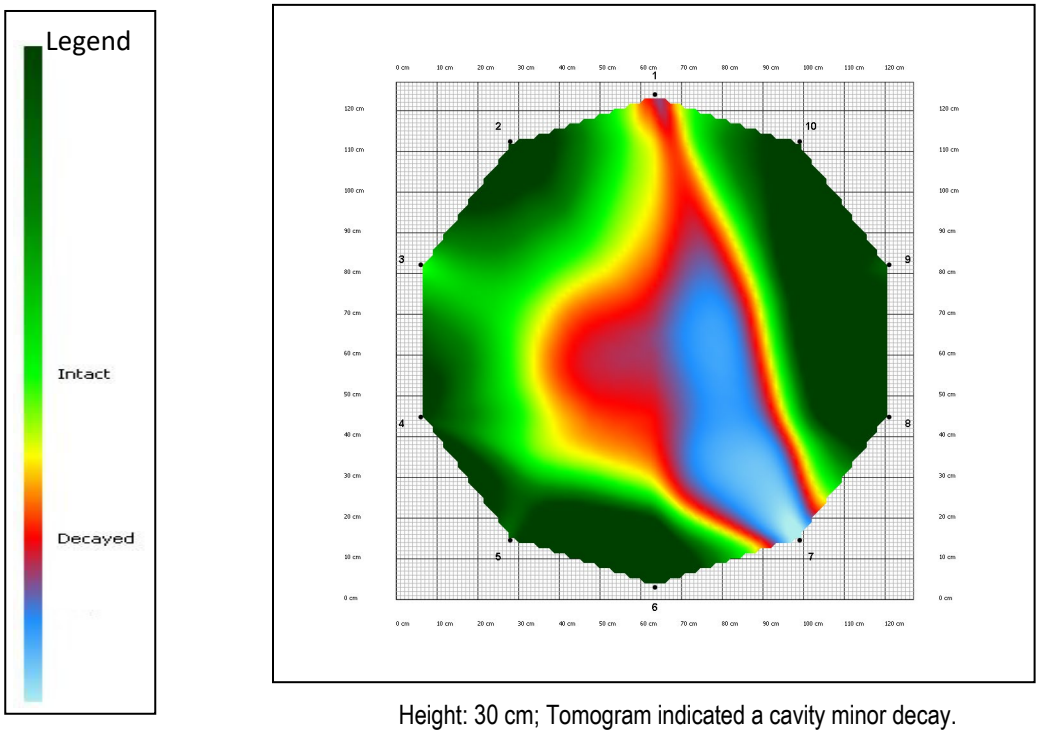
Height: 10.67 m; Tomogram indicated a cavity with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #14 – 100 cm



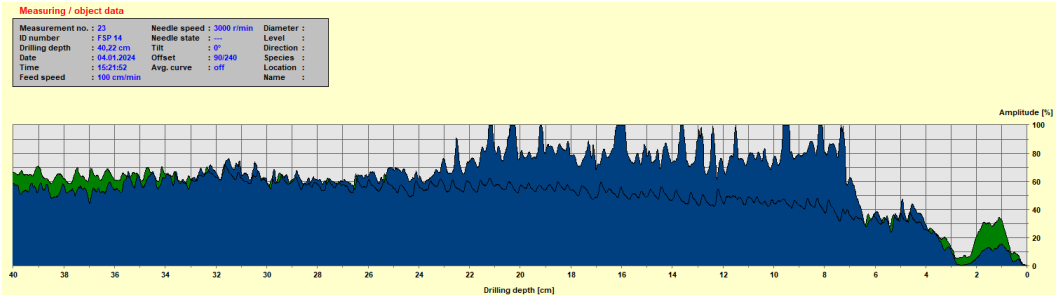
Drilling at 10.67m above grade, the sensor #7 position indicated 35 cm (13.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #14 - 30 cm

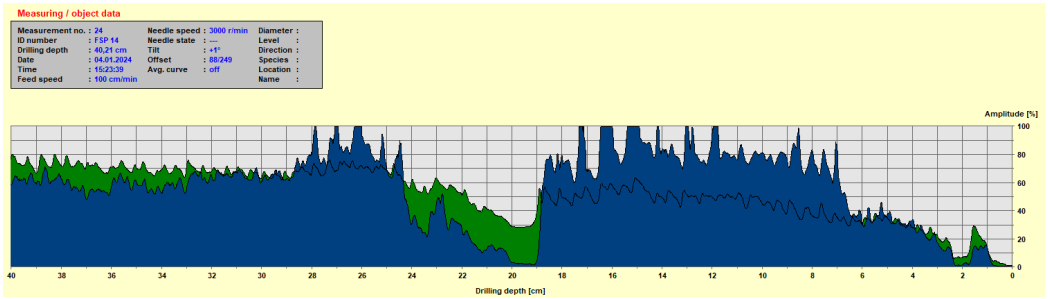


Height: 30 cm; Tomogram indicated a cavity minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #14 - 30cm



Drilling at 30 cm above grade, the sensor #1 position indicated 40 cm (15.7 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 35 cm (13.8 inches) of sound wood.

Live Oak #15

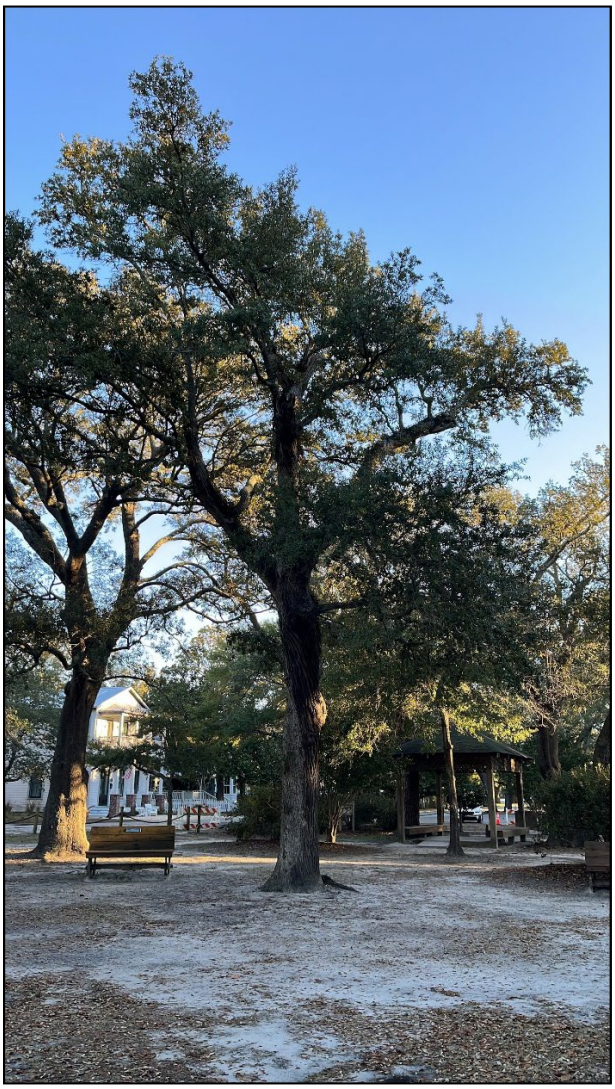


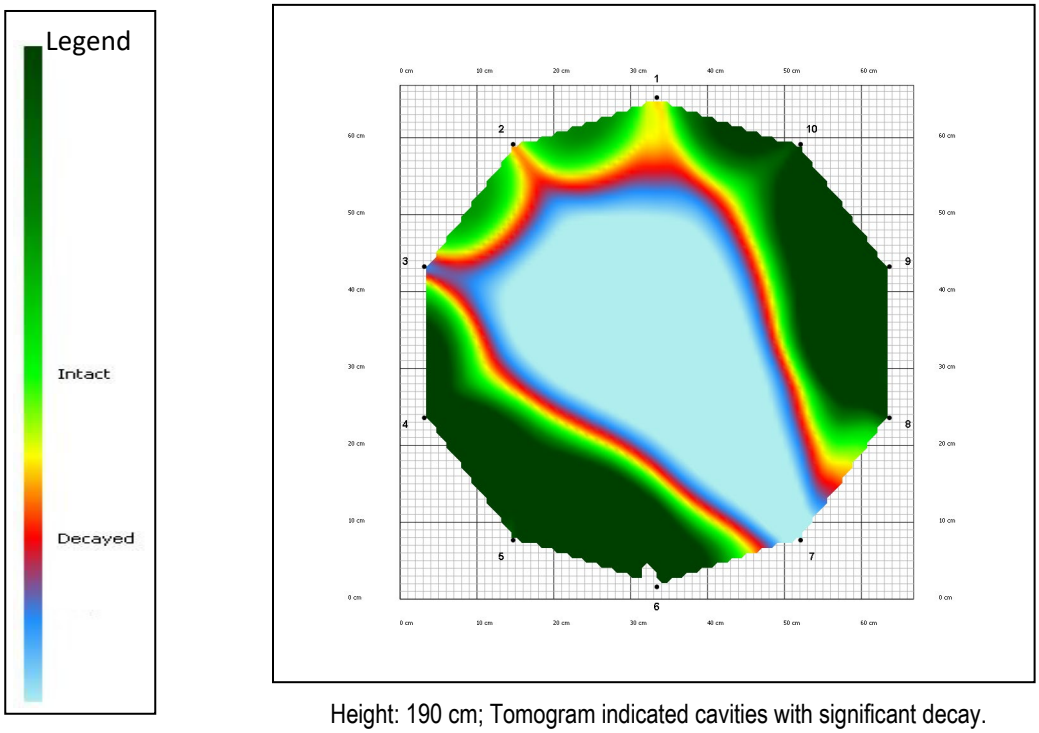
Photo 7: Looking northwest at live oak #15 showing the co-dominant stems.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	29 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Stem cavity Girdling root
Targets considered	People using the park

Live oak #15 was in fair condition with dead branches throughout the crown, co-dominant stems, a cavity in the trunk, and a girdling root.

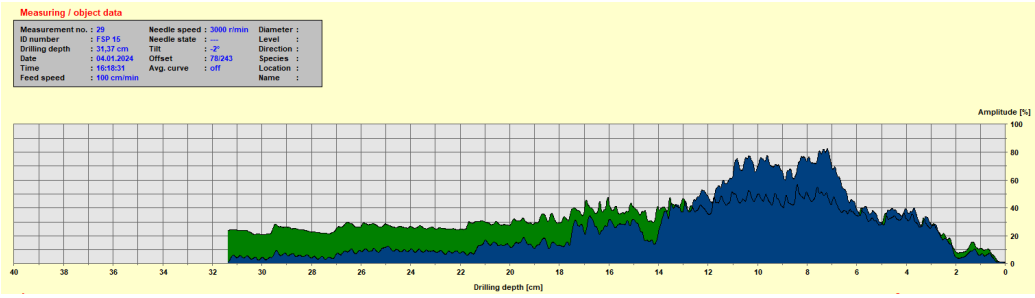
1. The live oak had dead branches estimated to be two to four inches in diameter.
2. The co-dominant stems bifurcated at approximately 15 feet above grade.
3. The cavity was 10 feet above grade and in the southeast side of the stem .
4. The trunk was assessed for decay at 190 cm (74.8 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #3 and #7 at 190 cm and at sensors #2 and #7 at 30 cm. Visual inspection confirmed a shallow cavity between sensors #7 and #8 in the 30 cm level. No cavities were visible at the other sensors. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 190 cm was 71.7 cm (28.2 inches) and the 15% threshold would be 10.7 cm (4.2 inches).
        i. the sensor #1 position indicated 17.5 cm (6.9 inches) of sound wood.
        ii. the sensor #2 position indicated 17.5 cm (6.9 inches) of sound wood.
        iii. the sensor #3 position indicated 16 cm (6.3 inches) of sound wood.
        iv. the sensor #7 position indicated 32 cm (12.6 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 86 cm (33.9 inches) and the 15% threshold would be 19.4 cm (7.6 inches).
        i. the sensor #2 position indicated 16 cm (6.3 inches) of sound wood.
        ii. the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.
5. The girdling root was located on the southeast side of the root collar. The resistance drill reading indicated 28.5 cm (11.2 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #15- 190 cm

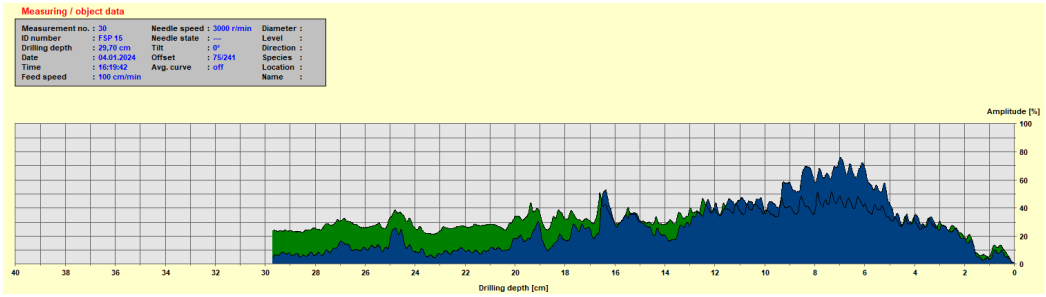


Height: 190 cm; Tomogram indicated cavities with significant decay.

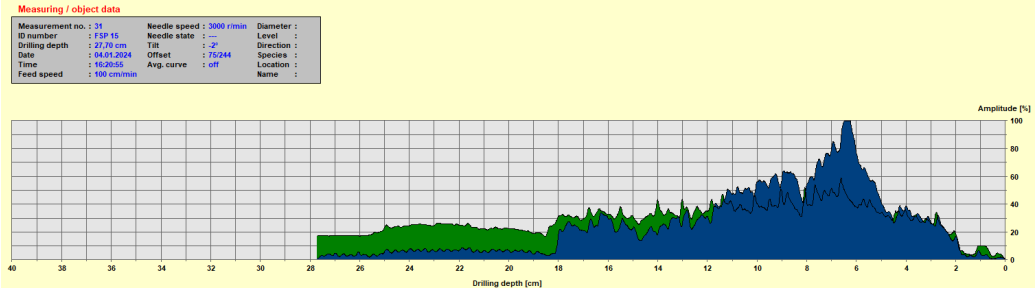
IML Resi-PD 400 Resistance Drill Readings: Live Oak #15- 190 cm



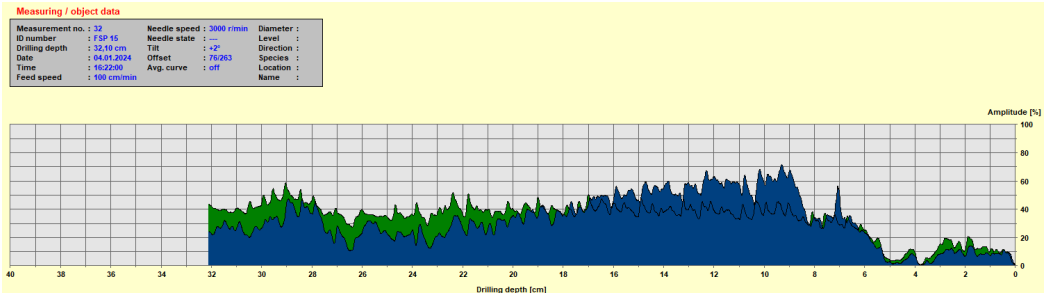
Drilling at 190 cm above grade, the sensor #1 position indicated 17.5 cm (6.9 inches) of sound wood.



Drilling at 190 cm above grade, the sensor #2 position indicated 17.5 cm (6.9 inches) of sound wood.

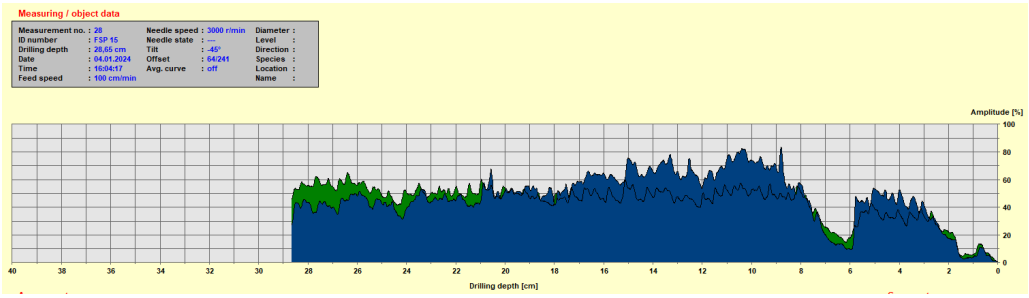


Drilling at 190 cm above grade, the sensor #3 position indicated 16 cm (6.3 inches) of sound wood.



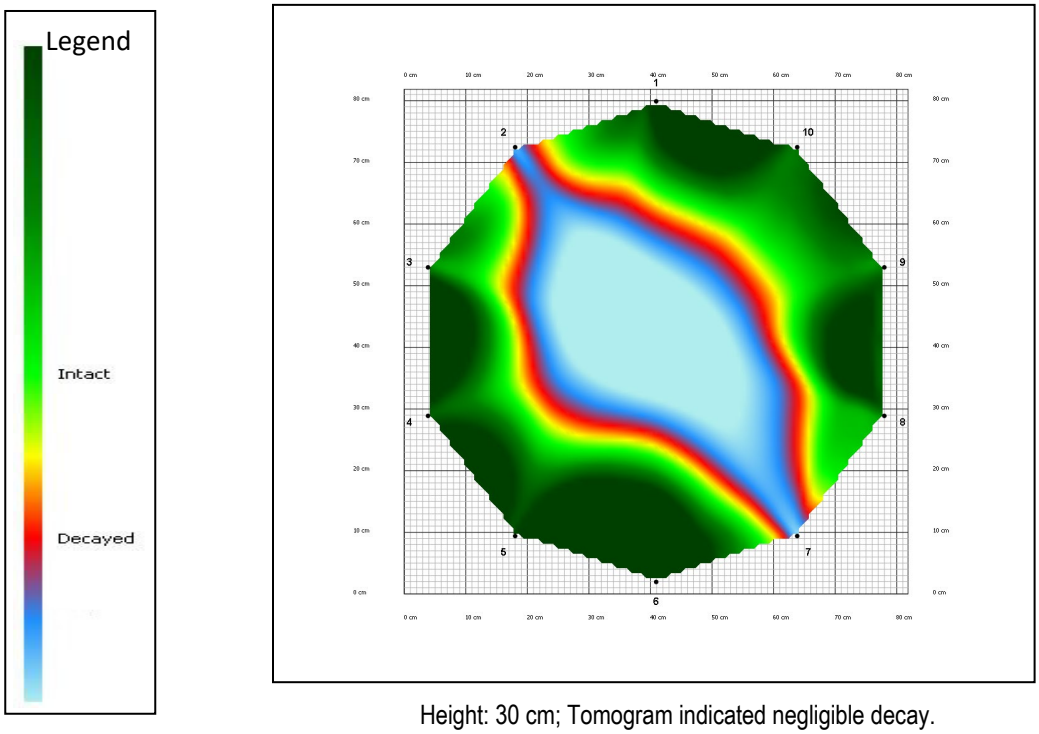
Drilling at 190 cm above grade, the sensor #7 position indicated 32 cm (12.6 inches) of sound wood.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #15- Root Collar



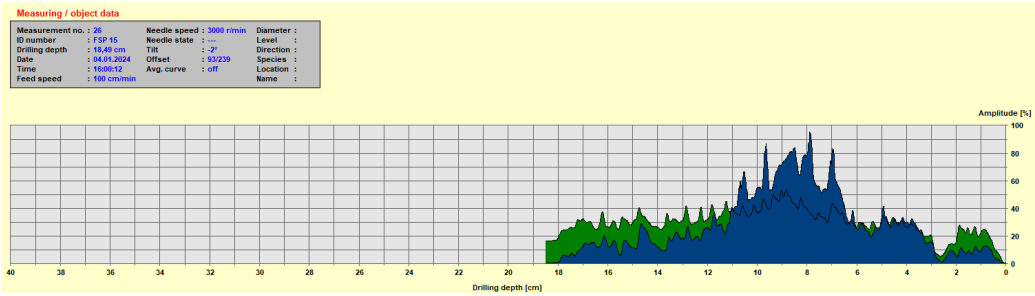
Drilling at the root collar, the southeast position indicated 28.5 cm (11.2 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #15- 30 cm

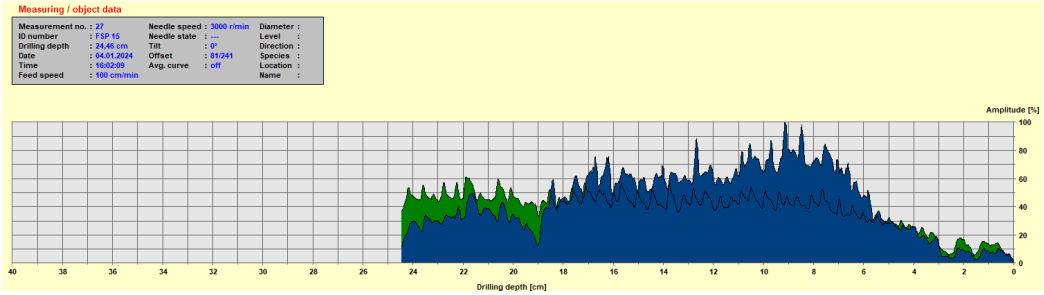


Height: 30 cm; Tomogram indicated negligible decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #15- 30 cm



Drilling at 30 cm above grade, the sensor #2 position indicated 16 cm (6.3 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.

Live Oak #16

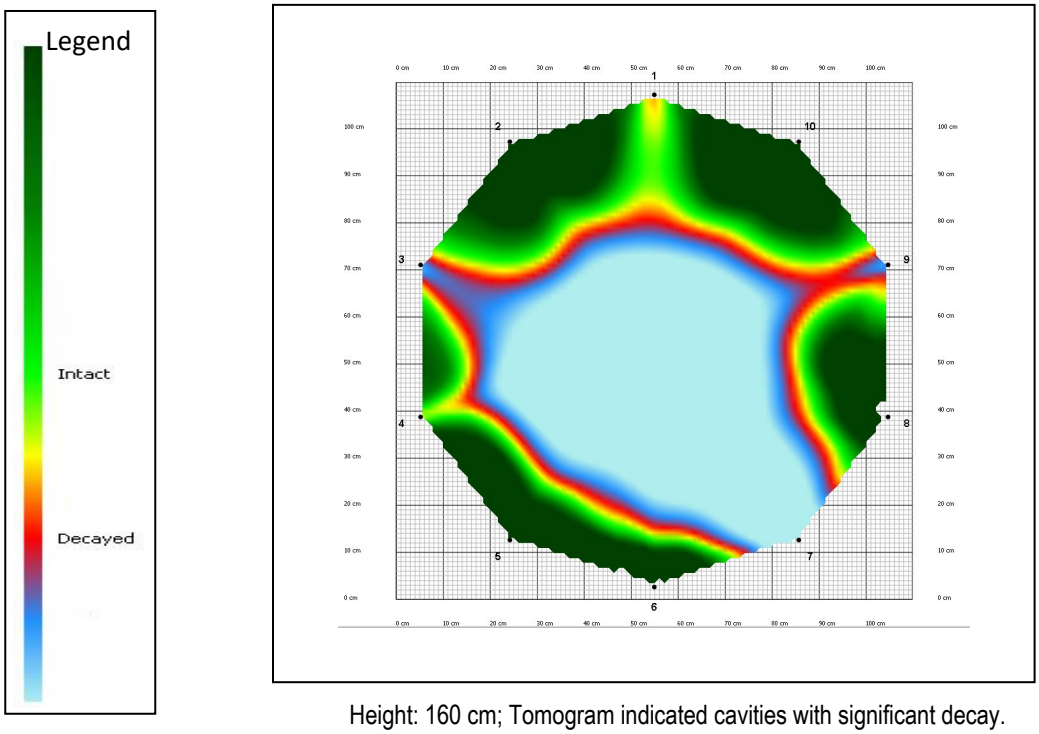
Photo 8: Looking west at live oak #16 showing the leaning trunk and proximity to the stage.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	42 inches
Height	~40 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Trunk lean Stem cavity Remnant of fungal conk
Targets considered	People using the park, building

Live oak #16 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, a trunk lean, a cavity in the trunk, and decay in the lower stem.

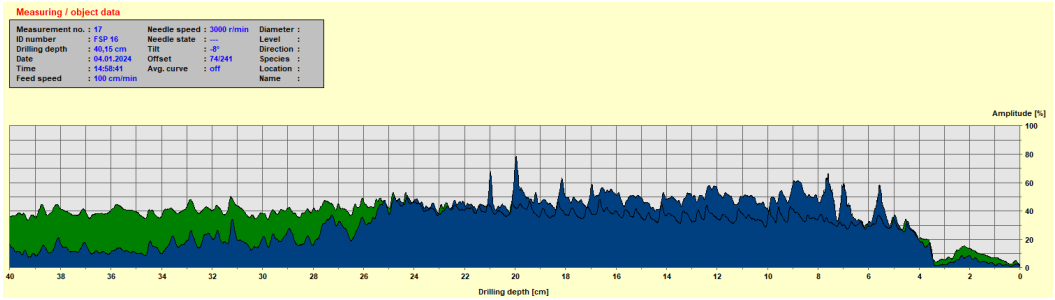
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the west as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 18 feet above grade.
4. The trunk leaned to the northeast and was approximately 8 degrees off vertical.
5. The cavity was 11 feet above grade and in the south side of the stem .
6. The trunk was assessed for decay at 160 cm (63 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #3, #7, and #9 at 160 cm and at sensors #2 and #7 at 30 cm. Visual inspection confirmed a shallow cavity between sensors #1, #6. #7 and #9 in the 30 cm level. No cavities were visible at the other sensors. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 160 cm was 114.6 cm (45.1 inches) and the 15% threshold would be 17.2 cm (6.8 inches).
        i. the sensor #3 position indicated 25 cm (9.8 inches) of sound wood.
        ii. the sensor #4 position indicated 27 cm (10.6 inches) of sound wood.
        iii. the sensor #5 position indicated 16 cm (6.3 inches) of sound wood.
        iv. the sensor #6 position indicated 23 cm (9.1inches) of sound wood.
        v. the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.
        vi. the sensor #9 position indicated 32 cm (12.6 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 129 cm (50.8 inches) and the 15% threshold would be 19.4 cm (7.6 inches).
        i. the sensor #1 position indicated 31 cm (12.2 inches) of sound wood.
        ii. the sensor #2 position indicated 26 cm (10.4 inches) of sound wood.
        iii. the sensor #5 position indicated 25 cm (9.8 inches) of sound wood.
        iv. the sensor #6 position indicated 12 cm (4.7 inches) of sound wood.
        v. the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.
        vi. the sensor #9 position indicated 25 cm (9.8 inches) of sound wood.
    c. Sensor 35 in the 160 cm level and sensor #6 in the 30 cm are below the sound wood thresholds for each level.
7. The remnants of a fungal conk was observed in the northeast, below sensors #9 and #10, side of the lower stem. It had deteriorated and could not be identified.

ArborSonic 3D™ Tomogram Live Oak #16- 160 cm

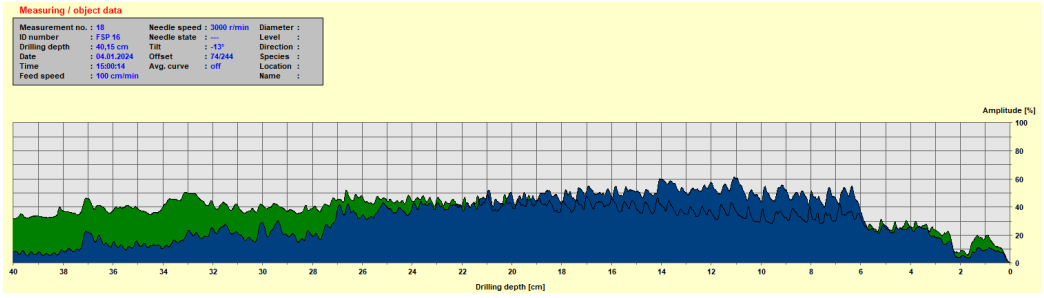


Height: 160 cm; Tomogram indicated cavities with significant decay.

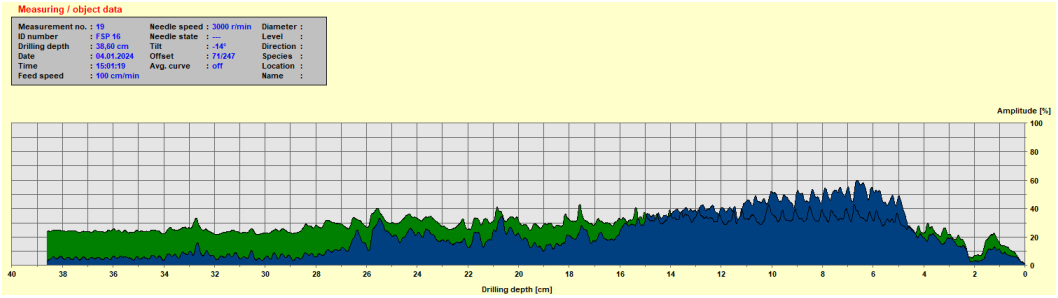
IML Resi-PD 400 Resistance Drill Readings: Live Oak #16- 160cm



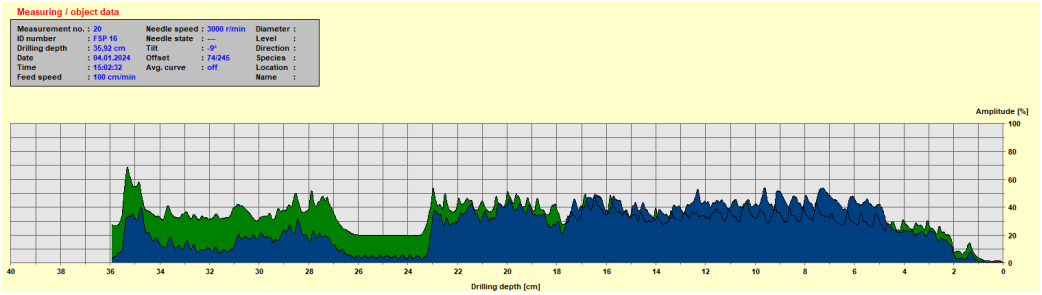
Drilling at 160 cm above grade, the sensor #3 position indicated 25 cm (9.8 inches) of sound wood.



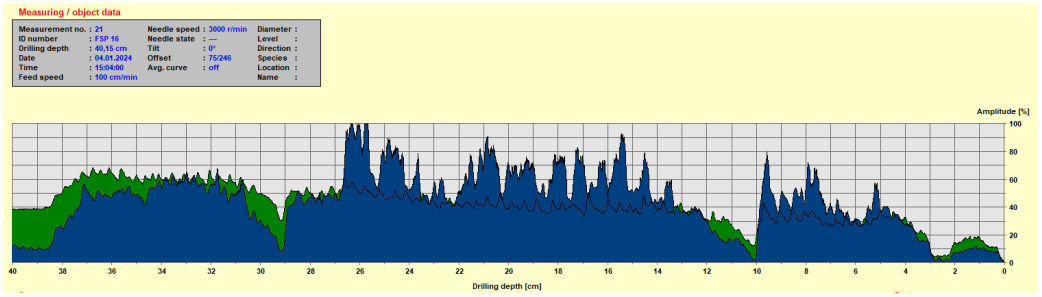
Drilling at 160 cm above grade, the sensor #4 position indicated 27 cm (10.6 inches) of sound wood.



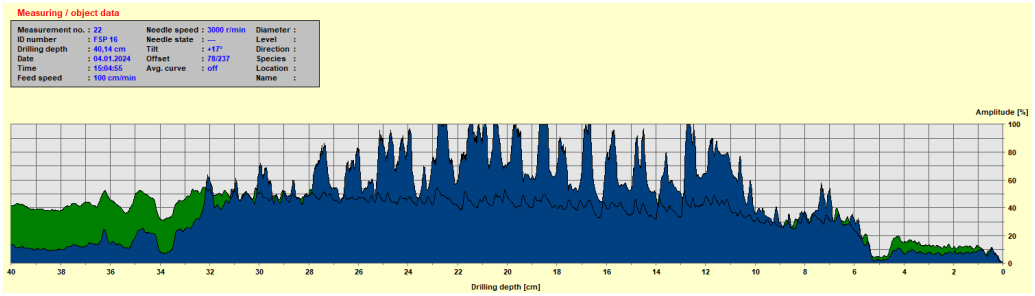
Drilling at 160 cm above grade, the sensor #5 position indicated 16 cm (6.3 inches) of sound wood.



Drilling at 160 cm above grade, the sensor #6 position indicated 23 cm (9.1 inches) of sound wood.

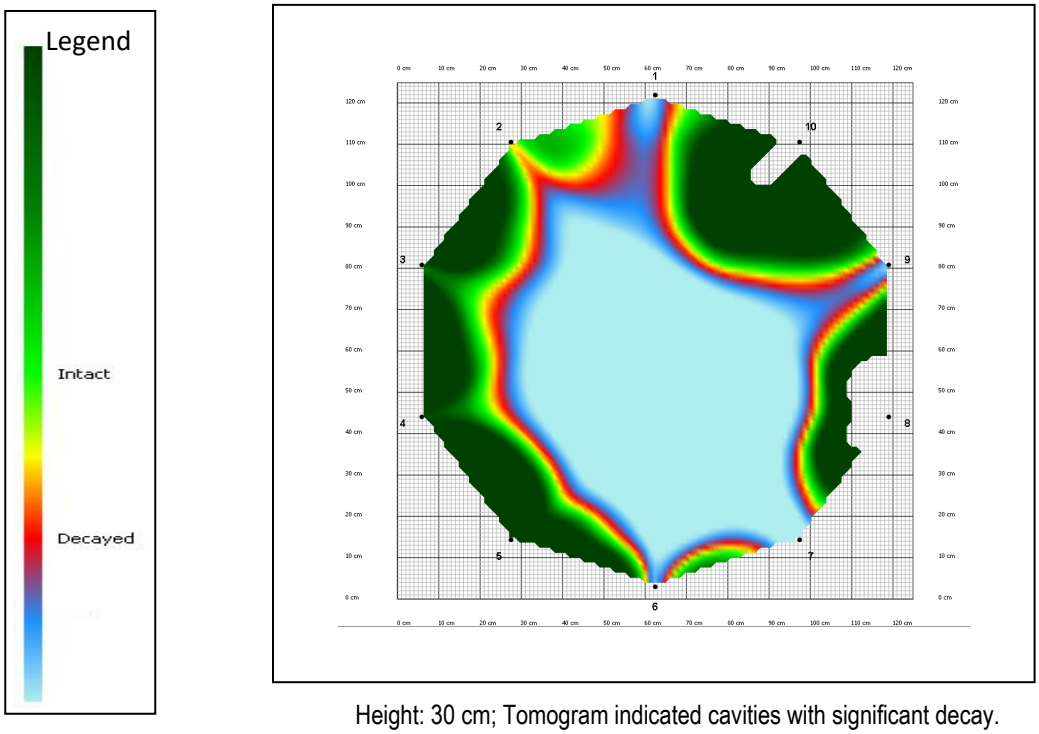


Drilling at 160 cm above grade, the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.



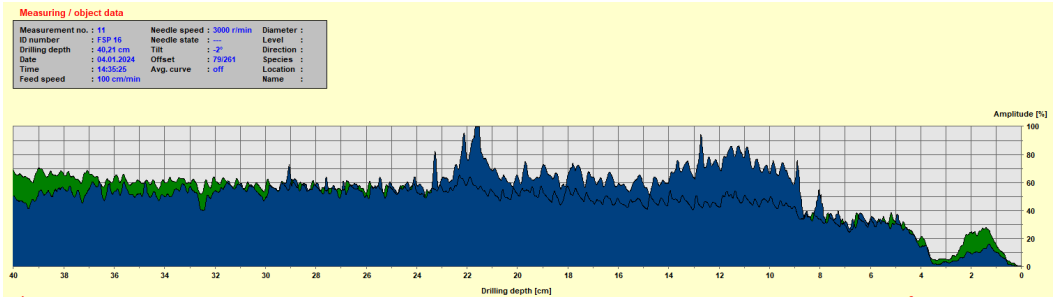
Drilling at 160 cm above grade, the sensor #8 position indicated 32 cm (12.6 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #16- 30 cm

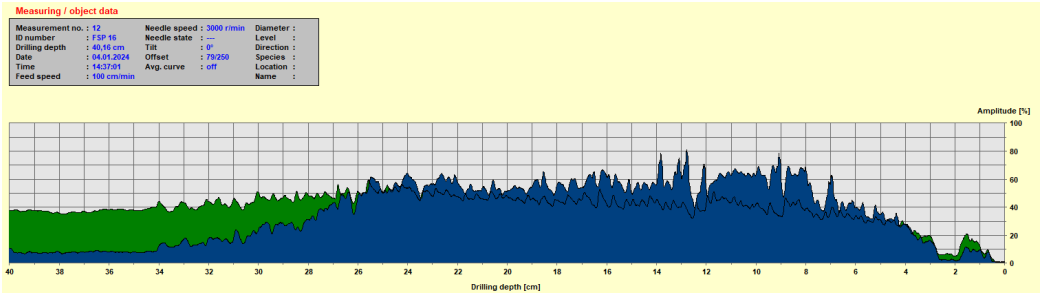


Height: 30 cm; Tomogram indicated cavities with significant decay.

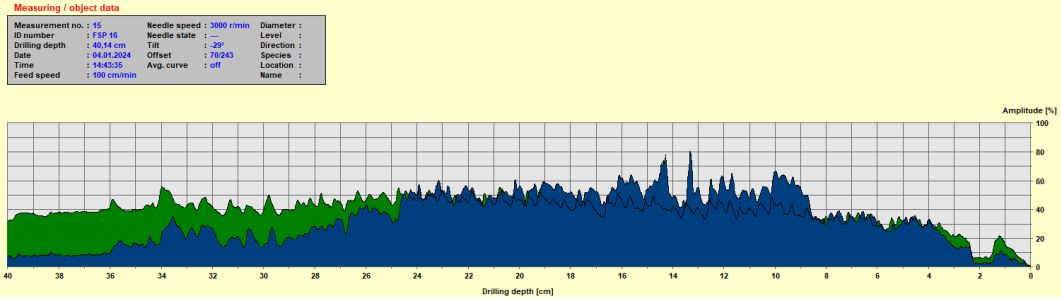
IML Resi-PD 400 Resistance Drill Readings: Live Oak #16- 30cm



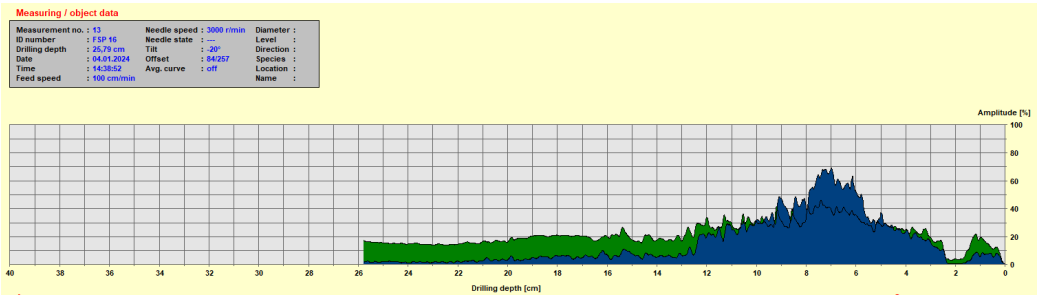
Drilling at 30 cm above grade, the sensor #1 position indicated 31 cm (12.2 inches) of sound wood.



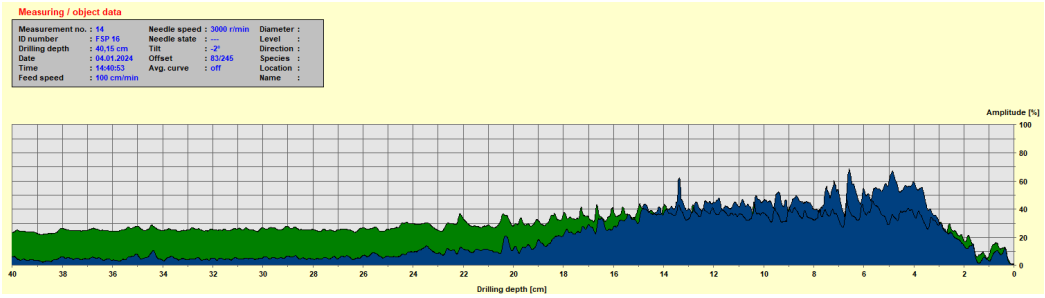
Drilling at 30 cm above grade, the sensor #2 position indicated 26 cm (10.4 inches) of sound wood.



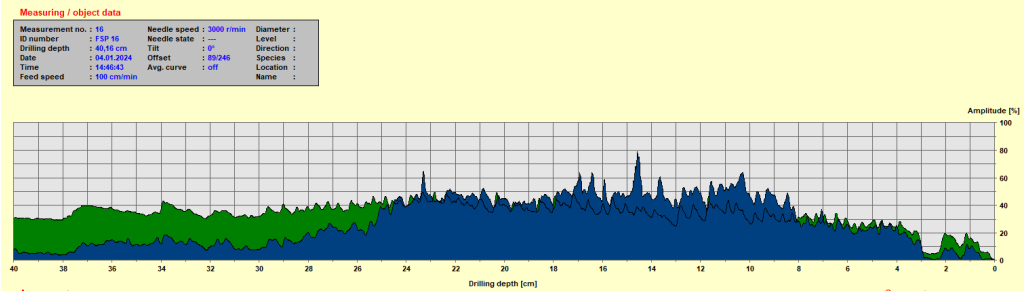
Drilling at 30 cm above grade, the sensor #5 position indicated 25 cm (9.8 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #6 position indicated 12 cm (4.7 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #9 position indicated 25 cm (8.8 inches) of sound wood.

Live Oak #18

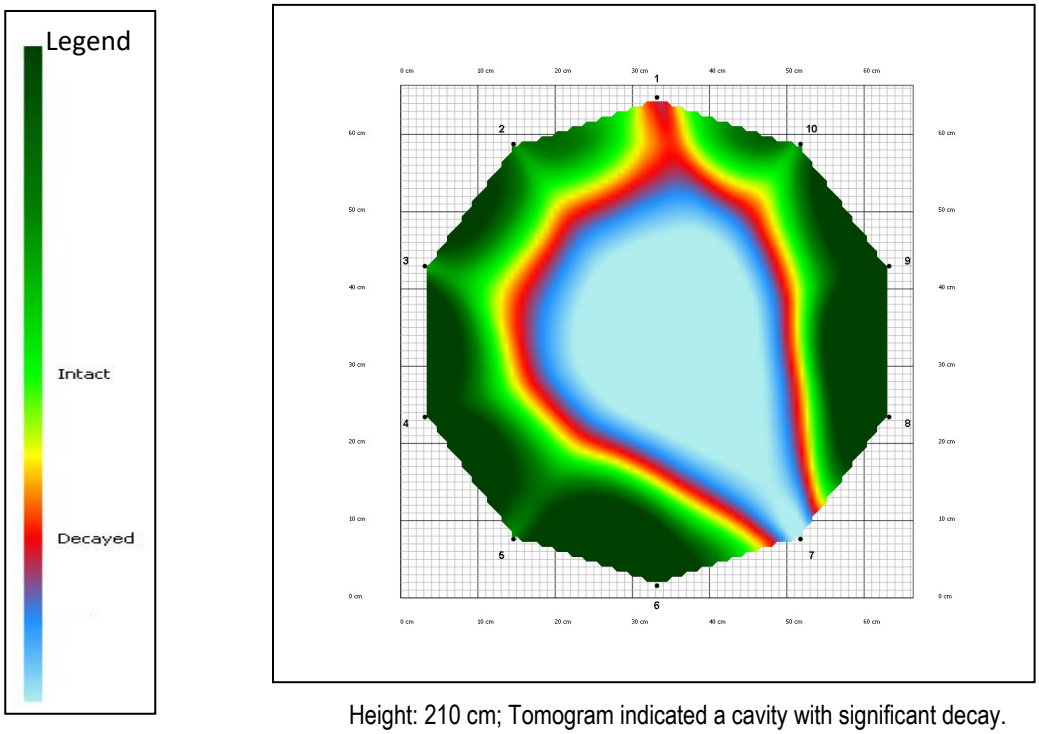
Photo 9:Looking west at live oak #18 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	28 inches
Height	~45 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Stem cavity Restricted root collar
Targets considered	People using the park

Live oak #18 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, a trunk lean, a cavity in the trunk, and decay in the lower stem.

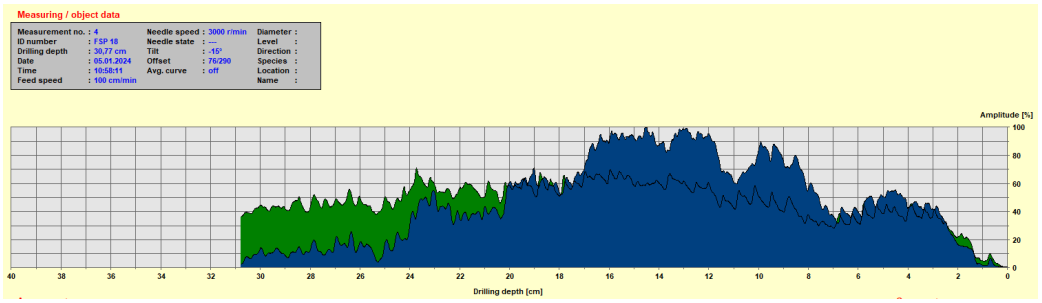
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the south as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 11 feet above grade.
4. The cavity was 10 feet above grade and in the south side of the stem, below the east co-dominant stem.
5. The trunk was assessed for decay at 210 cm (82.7 inches) and 120 cm (47.2 inches) above grade. The tomogram indicated cavities at sensors #7 at 210 cm. Visual inspection confirmed that there were no cavities at this level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 210 cm was 73.2 cm (28.8 inches) and the 15% threshold would be 11 cm (4.3 inches). The reading for senor #1 was moved to the west, between sensors #1 and #2, due to the proximity of live oak #19
        i. the sensor #1 position indicated 23 cm (9.1 inches) of sound wood.
        ii. the sensor #7 position indicated 15 cm (5.9 inches) of sound wood.
    b. The diameter of the trunk at 120 cm was 70 cm (27.6 inches) and the 15% threshold would be 10.5 cm (4.1 inches).
        i. the sensor #1 position indicated 30 cm (11.8 inches) of sound wood.
        ii. the sensor #7 position indicated 31 cm (12.2 inches) of sound wood.
6. The north side of the root collar was growing into the south side of root collar of live oak #19.

ArborSonic 3D™ Tomogram Live Oak #18- 210 cm

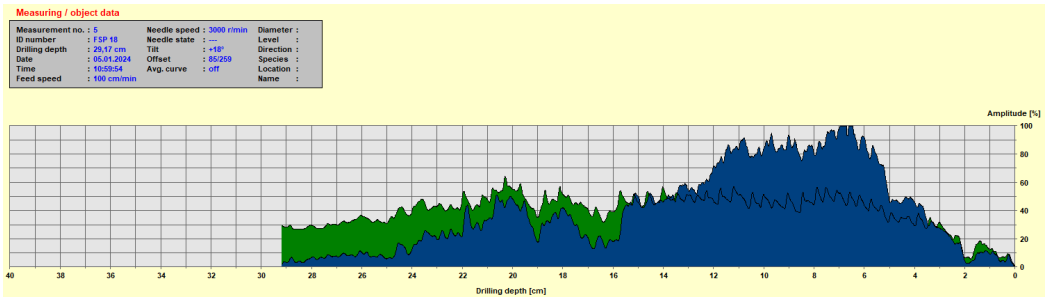


Height: 210 cm; Tomogram indicated a cavity with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #18 - 210cm

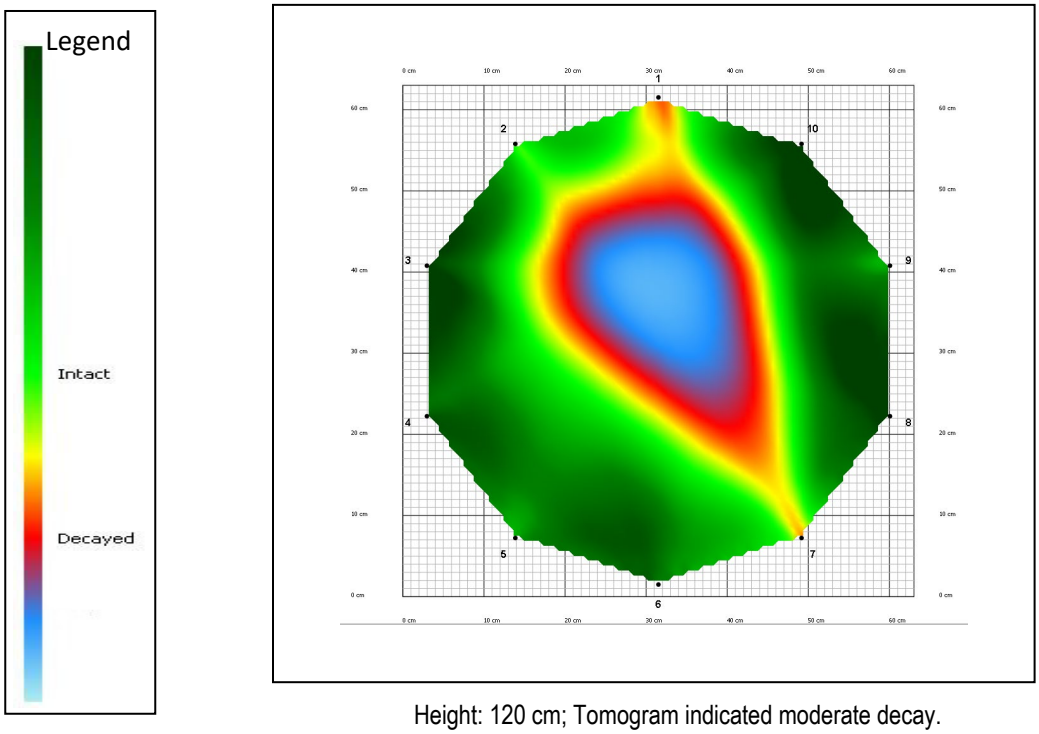


Drilling at 210 cm above grade, the sensor #1 position indicated 23 cm (9.1 inches) of sound wood.



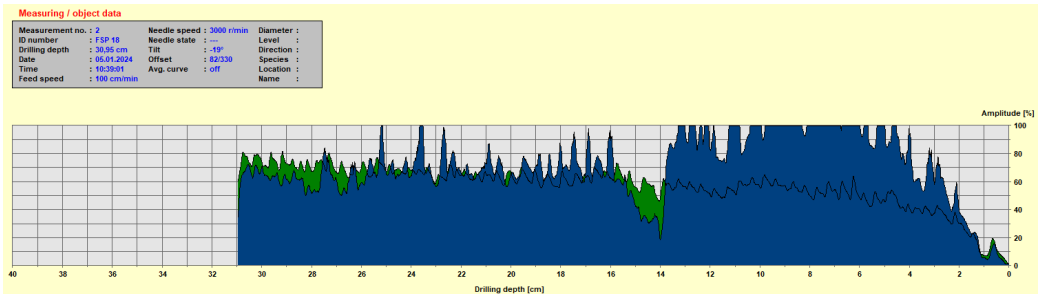
Drilling at 210 cm above grade, the sensor #7 position indicated 15 cm (5.9 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #18- 120 cm

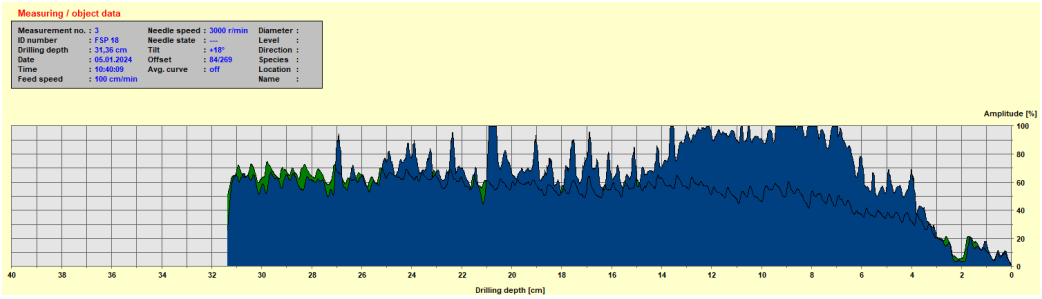


Height: 120 cm; Tomogram indicated moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #18 - 120cm



Drilling at 120 cm above grade, the sensor #1 position indicated 30 cm (11.8 inches) of sound wood.



Drilling at 120 cm above grade, the sensor #7 position indicated 31 cm (12.2 inches) of sound wood.

Live Oak #22

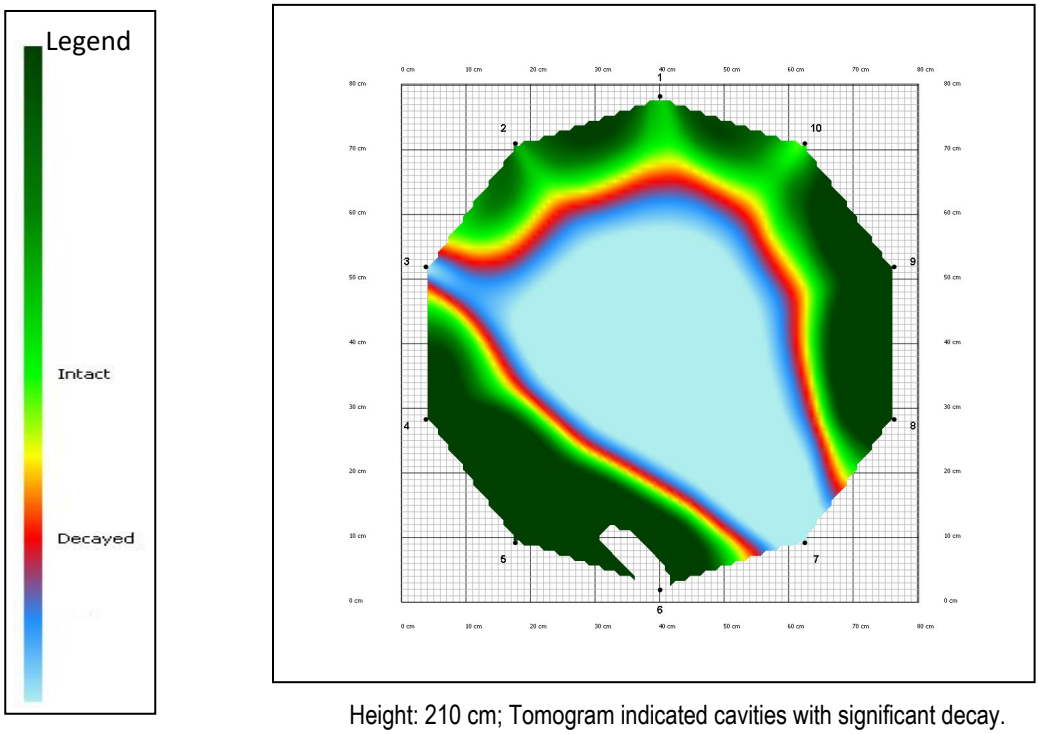
Photo 10: Looking north at live oak #22 showing the uneven crown and proximity to the building.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	33 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Stem cavity
Targets considered	People using the park, propane tank

Live oak #22 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, a trunk lean, a cavity in the trunk, and decay in the lower stem.

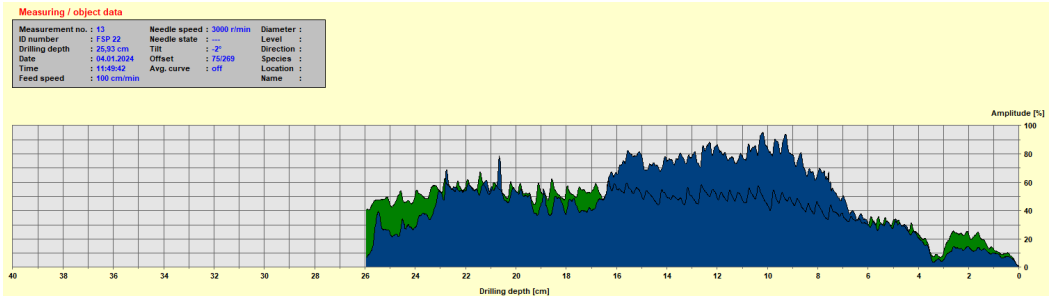
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the south as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 12 feet above grade.
4. The cavity was 7.5 feet above grade and in the east side of the stem.
5. The trunk was assessed for decay at 210 cm (82.7 inches), 90 cm (35.4 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #7 at all three levels and at sensor #3 at 210 cm. Visual inspection confirmed that there were no cavities at this level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 210 cm was 84.4 cm (32.2 inches) and the 15% threshold would be 12.7 cm (5 inches).
        i. the sensor #3 position indicated 20 cm (7.9 inches) of sound wood.
        ii. the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.
    b. The diameter of the trunk at 90 cm was 87.6 cm (34.5 inches) and the 15% threshold would be 13.1 cm (5.2 inches).
        i. the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.
    c. The diameter of the trunk at 30 cm was 92.4 cm (36.4 inches) and the 15% threshold would be 13.9 cm (5.5 inches).
        i. the sensor #1 position indicated 26 cm (10.2 inches) of sound wood.
        ii. the sensor #2 position indicated 26 cm (10.2 inches) of sound wood.
        iii. the sensor #3 position indicated 26 cm (10.2 inches) of sound wood.
        iv. the sensor #7 position indicated 19 cm (7.5 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #22 - 210 cm

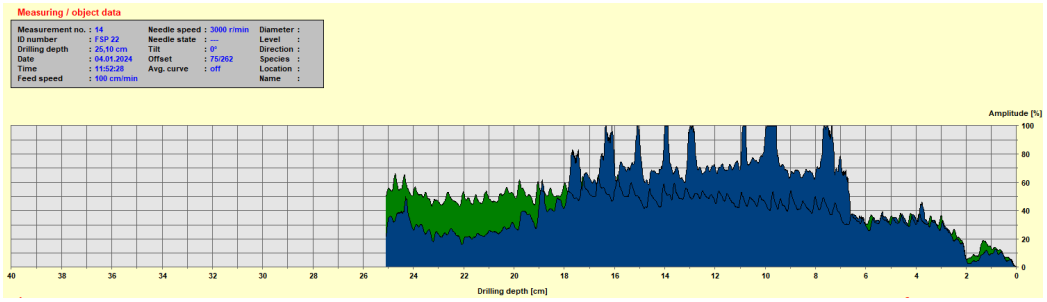


Height: 210 cm; Tomogram indicated cavities with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #22 – 210 cm

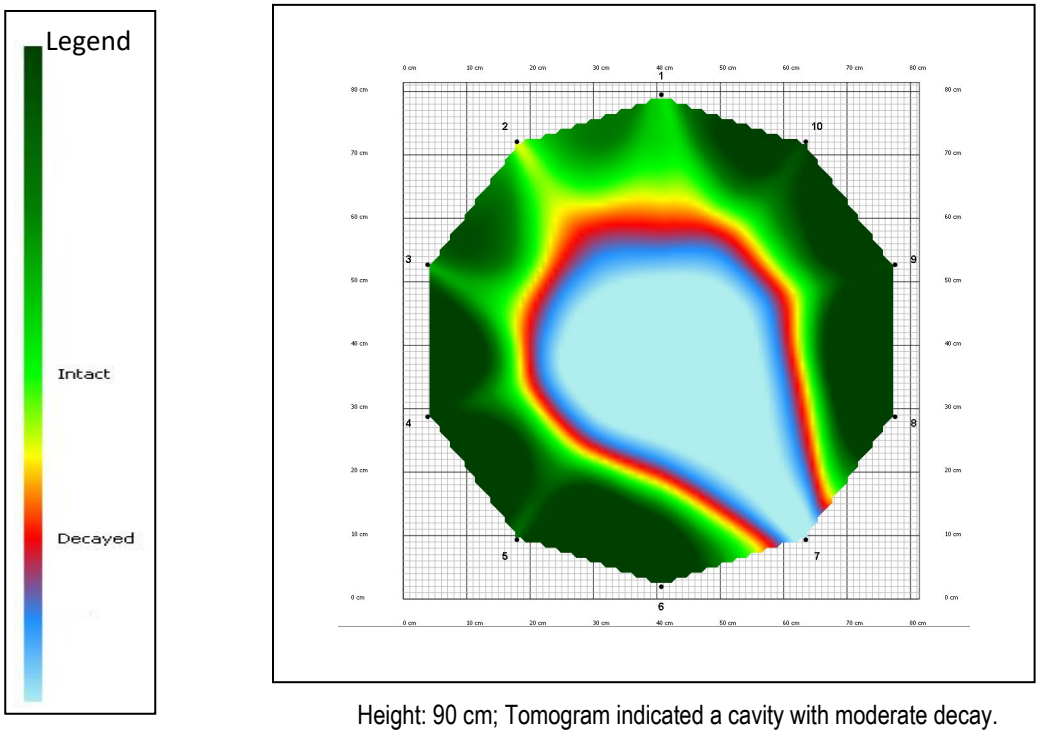


Drilling at 210 cm above grade, the sensor #3 position indicated 20 cm (7.9 inches) of sound wood.



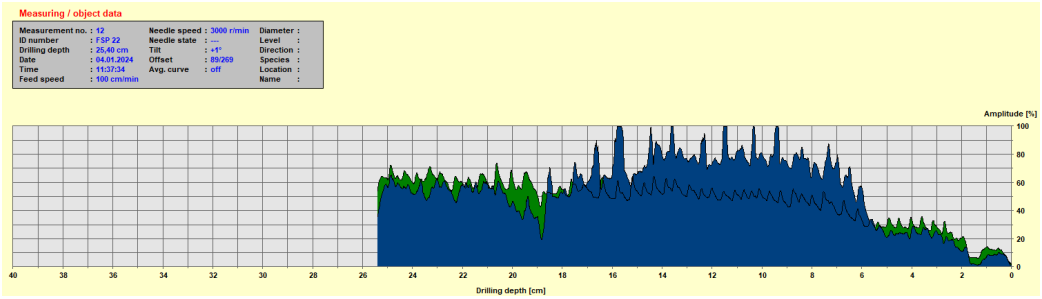
Drilling at 210 cm above grade, the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #22 - 90 cm



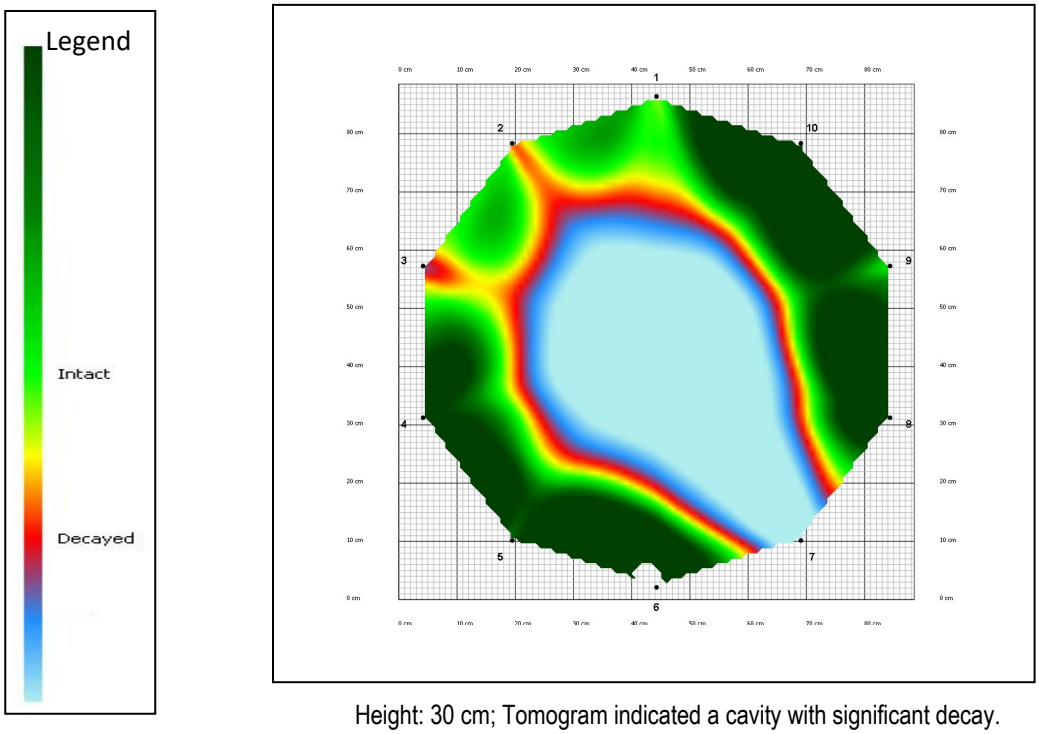
Height: 90 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #22 – 90 cm



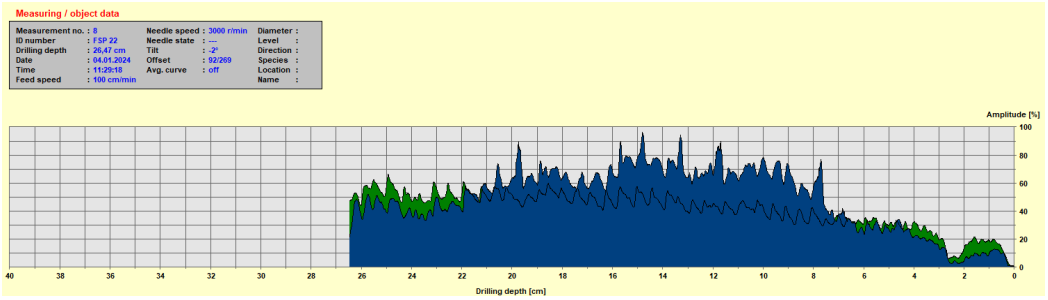
Drilling at 90 cm above grade, the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #22 - 30 cm

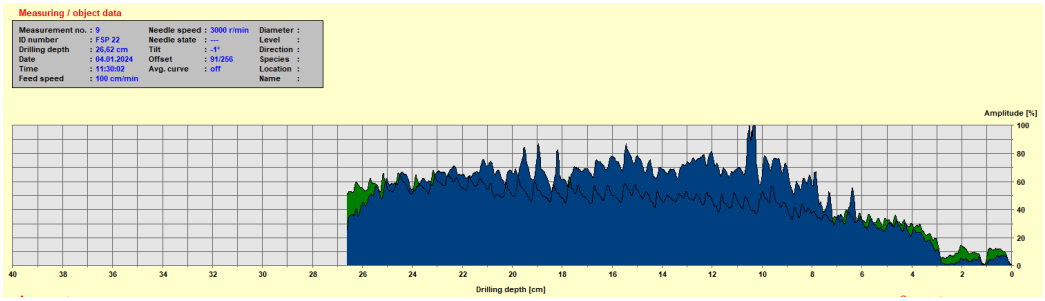


Height: 30 cm; Tomogram indicated a cavity with significant decay.

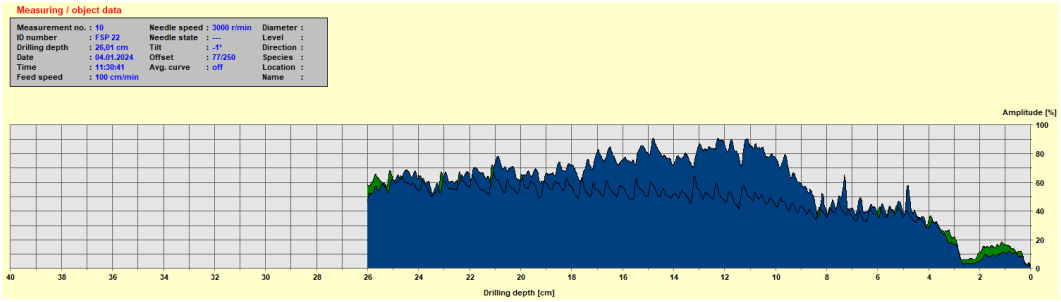
IML Resi-PD 400 Resistance Drill Readings: Live Oak #22 – 30 cm



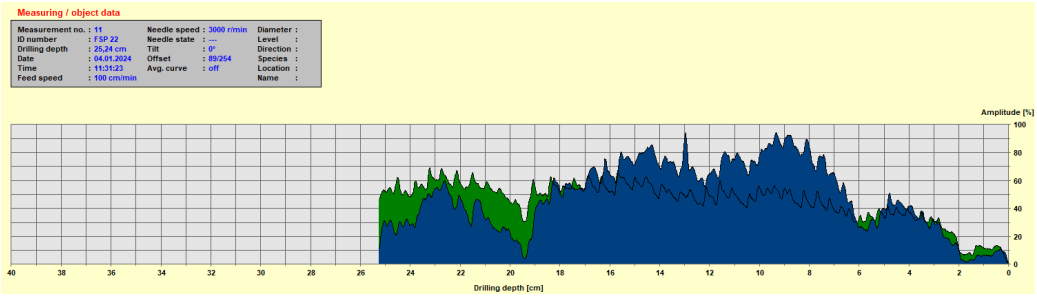
Drilling at 30 cm above grade, the sensor #1 position indicated 26 cm (10.2 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #2 position indicated 26 cm (10.2 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #3 position indicated 26 cm (10.2 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 19 cm (7.5 inches) of sound wood.

Live Oak #24

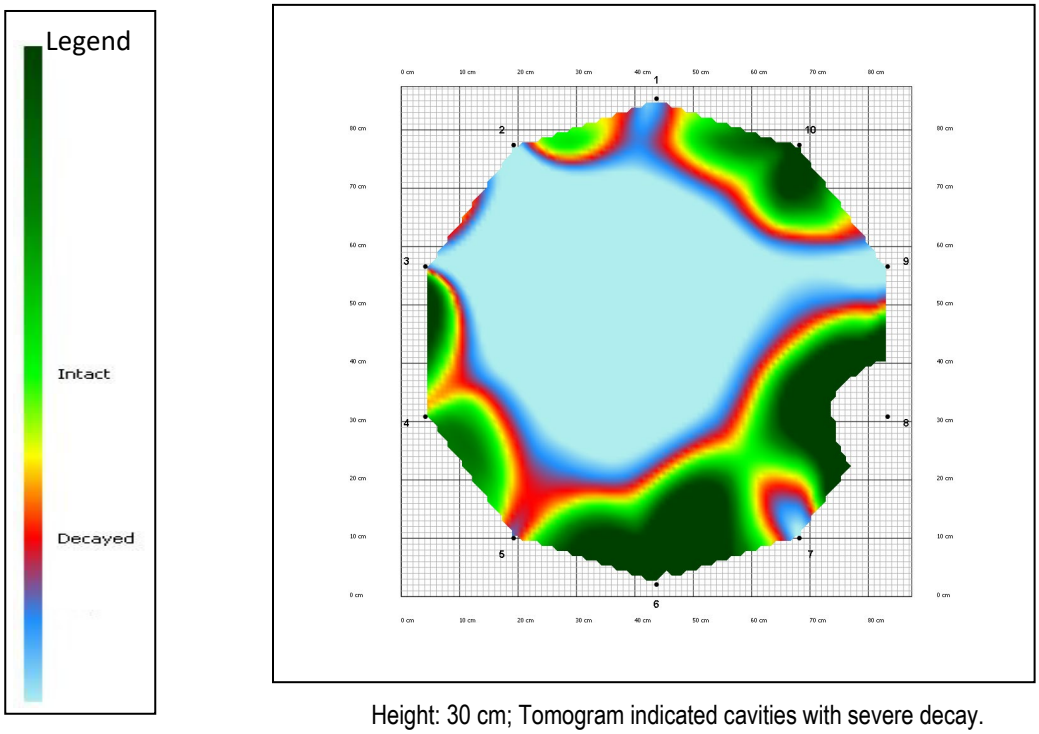
Photo 11: Looking north at live oak #24 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	35 inches
Height	~50 feet
Condition	Poor
Soil Conditions	Well-drained
Defects	Uneven crown Stem crack Stem cavity
Targets considered	People using the park

Live oak #24 was in poor condition with an uneven crown, a vertical crack in the stem, and a cavity in the stem.

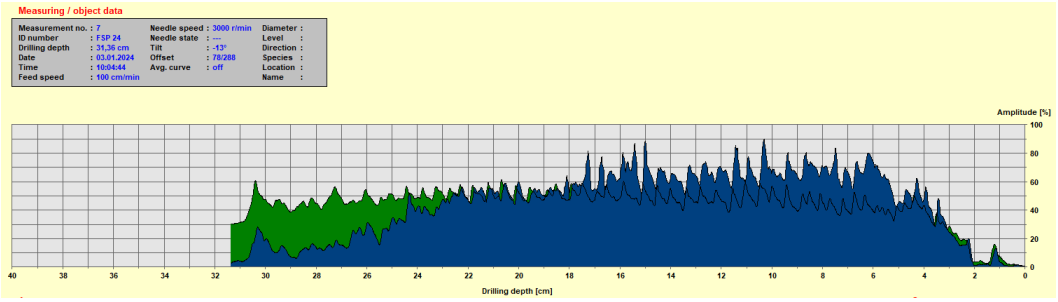
1. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the southeast as it competed for sunlight.
2. The six foot long vertical crack started in the west side of the trunk at five feet above grade. It extended up the north-northwest side to approximately 12 feet. A two inch wide by seven inch long cavity opened in the middle of the crack. This crack was in the tension wood side of the trunk.
3. The trunk was assessed for decay at 280 cm (110.2 inches) and 220 cm (86.6 inches) above grade. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 280 cm was 93.3 cm (36.7 inches) and the 15% threshold would be 14 cm (5.5 inches).
        i. the sensor #2 position indicated 24 cm (9.4 inches) of sound wood.
        ii. the sensor #3 position indicated 8 cm (3.1 inches) of sound wood.
        iii. the sensor #4 position indicated 19 cm (7.5 inches) of sound wood.
    b. The diameter of the trunk at 220 cm was 92.4 cm (36.4 inches) and the 15% threshold would be 13.9 cm (5.5 inches).
        i. the sensor #2 position indicated 30 cm (11.8 inches) of sound wood.
        ii. the sensor #3 position indicated 21 cm (8.2 inches) of sound wood.
        iii. the sensor #4 position indicated 18 cm (7.1 inches) of sound wood.
    c. The resistance drill reading at sensors #3 at 280 cm was below the sound wood threshold.

ArborSonic 3D™ Tomogram Live Oak #24 - 280 cm

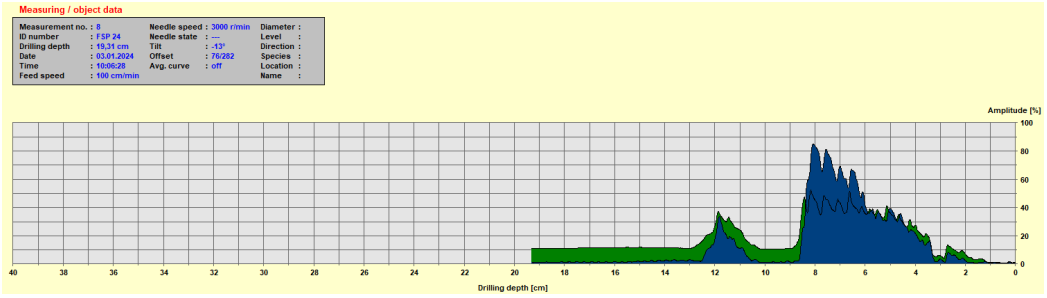


Height: 30 cm; Tomogram indicated cavities with severe decay.

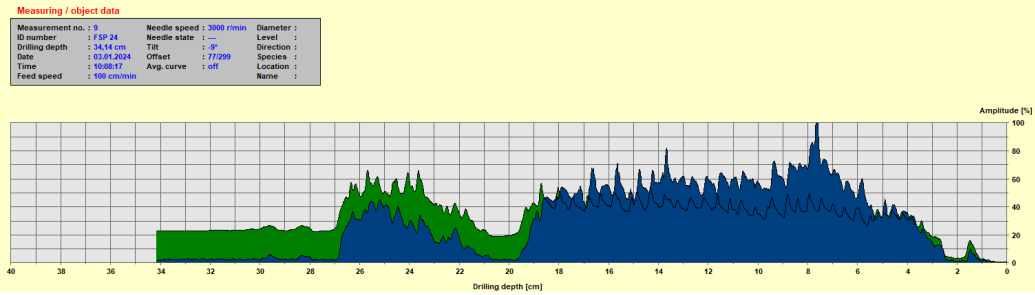
IML Resi-PD 400 Resistance Drill Readings: Live Oak #24 - 280cm



Drilling at 280 cm above grade, the sensor #2 position indicated 24 cm (9.4 inches) of sound wood.

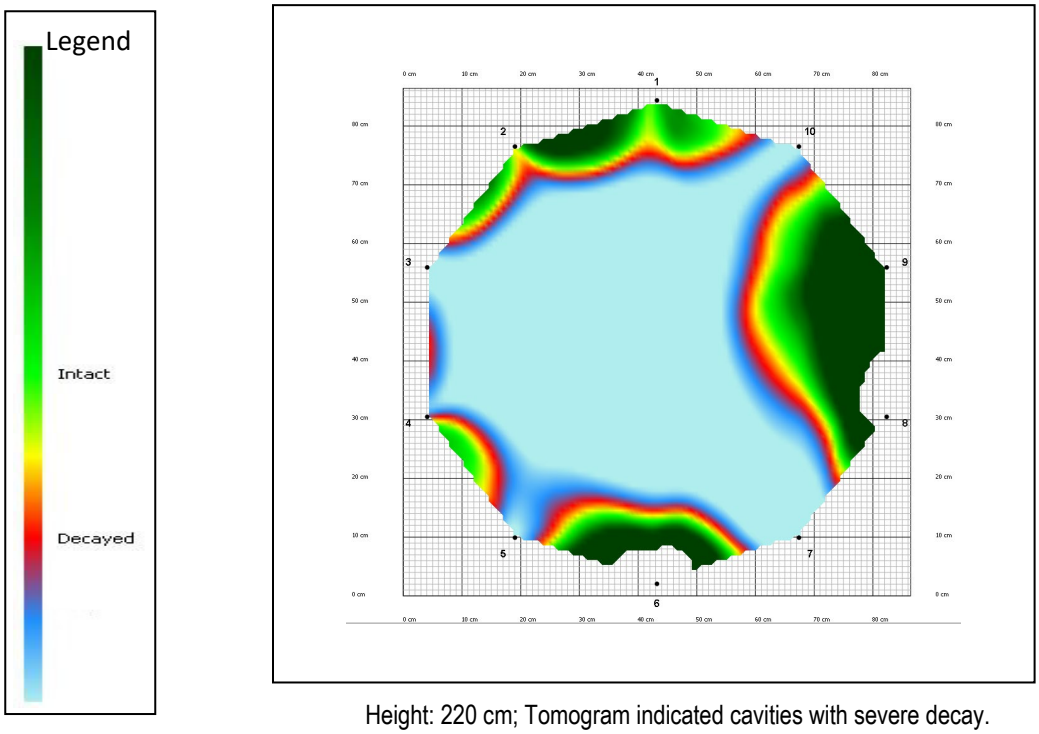


Drilling at 280 cm above grade, the sensor #3 position indicated 8 cm (3.1 inches) of sound wood.



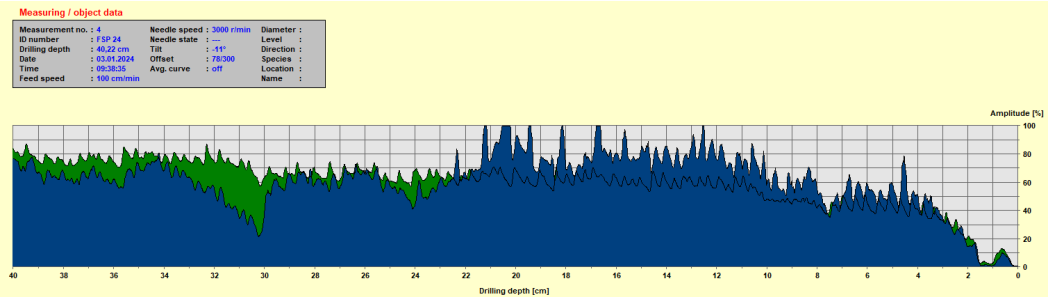
Drilling at 280 cm above grade, the sensor #4 position indicated 19 cm (7.5 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #24 - 220 cm

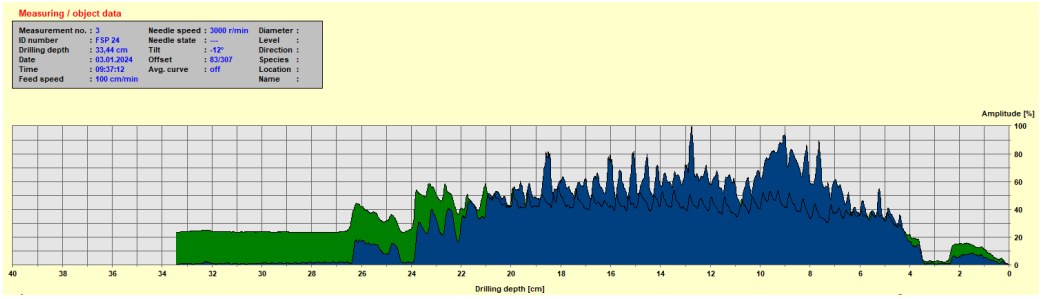


Height: 220 cm; Tomogram indicated cavities with severe decay.

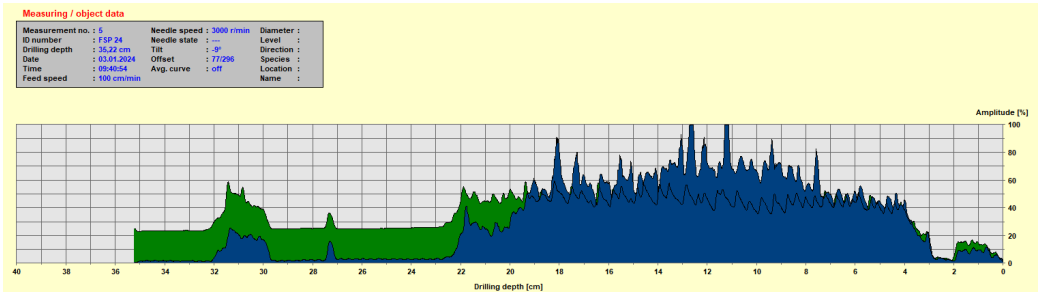
IML Resi-PD 400 Resistance Drill Readings: Live Oak #24 - 220cm



Drilling at 220 cm above grade, the sensor #2 position indicated 30 cm (11.8 inches) of sound wood.



Drilling at 220 cm above grade, the sensor #3 position indicated 21 cm (8.2 inches) of sound wood.



Drilling at 220 cm above grade, the sensor #4 position indicated 18 cm (7.1 inches) of sound wood.

Live Oak #25

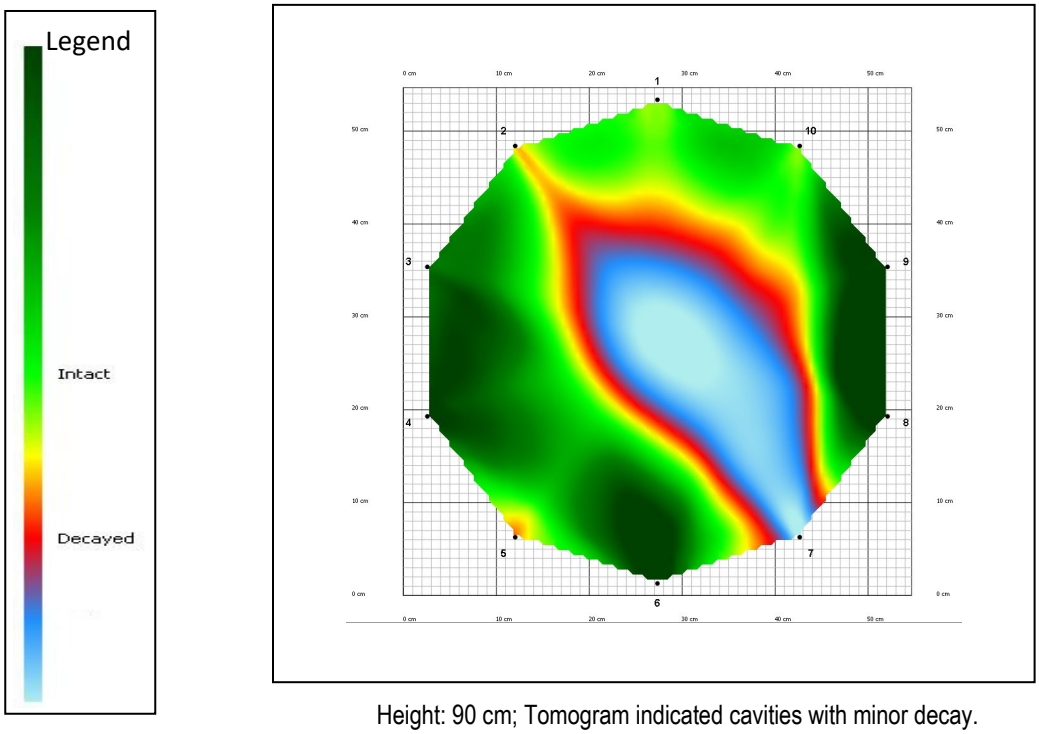
Photo 12: Looking west at live oak #25 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	23 inches
Height	~50 feet
Condition	Poor
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant stems Stem decay
Targets considered	People using the park

Live oak #25 was in poor condition with dead branches throughout the crown, an uneven crown, co-dominant stems, and decay in the lower stem.

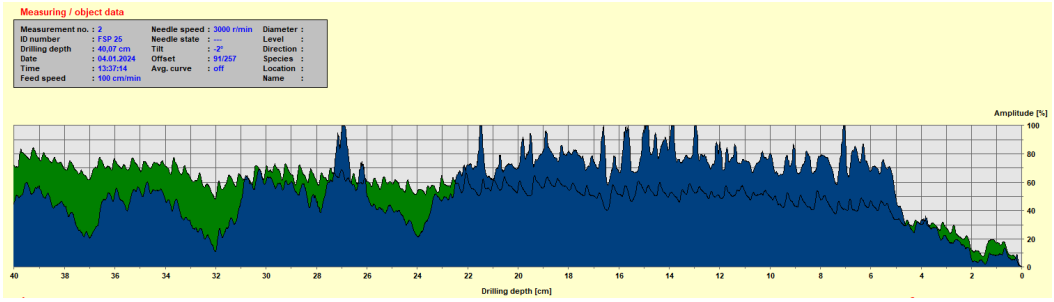
1. The live oak had dead branches estimated to be two to four inches in diameter.
2. The uneven crown was most likely the result of excessive pruning to mitigate storm damage.
3. The co-dominant stems bifurcated at approximately 12 feet above grade.
4. The trunk was assessed for decay at 90 cm (35.4 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #7 at all both levels. Visual inspection confirmed that there were no cavities at this level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 90 cm was 62.1 cm (24.4 inches) and the 15% threshold would be 9.3 cm (3.7 inches).
        i. the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 73.2 cm (28.8 inches) and the 15% threshold would be 11 cm (4.3 inches).
        i. the sensor #7 position indicated 18 cm (7.1 inches) of sound wood

ArborSonic 3D™ Tomogram Live Oak #25 - 90 cm



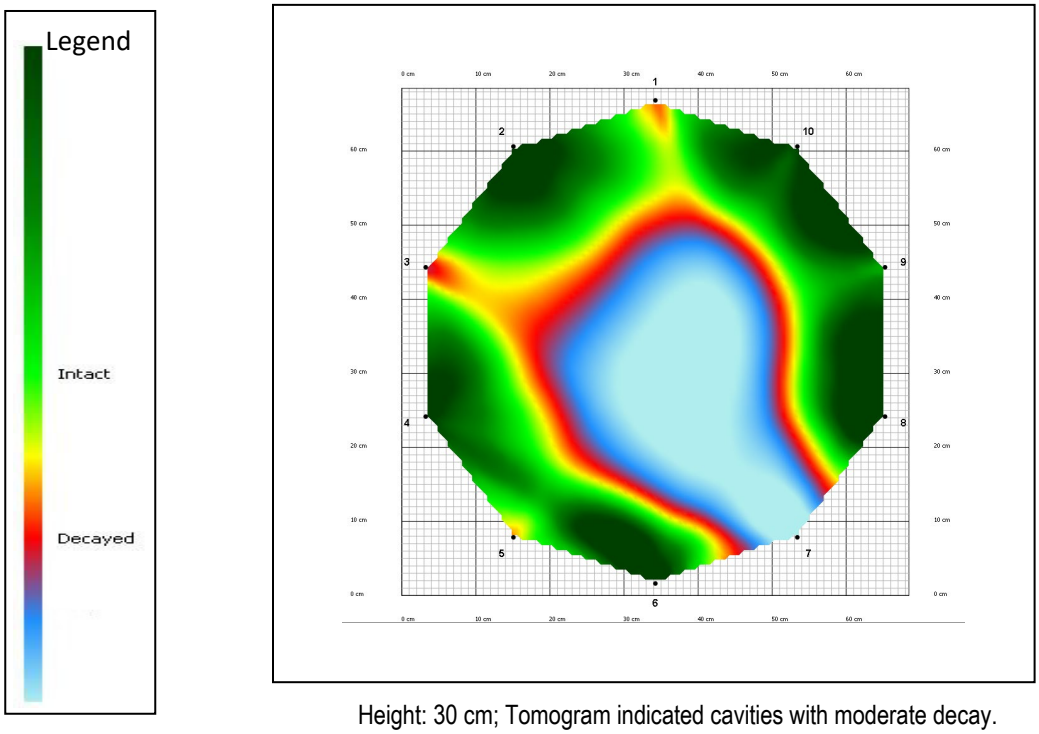
Height: 90 cm; Tomogram indicated cavities with minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #25 - 90cm



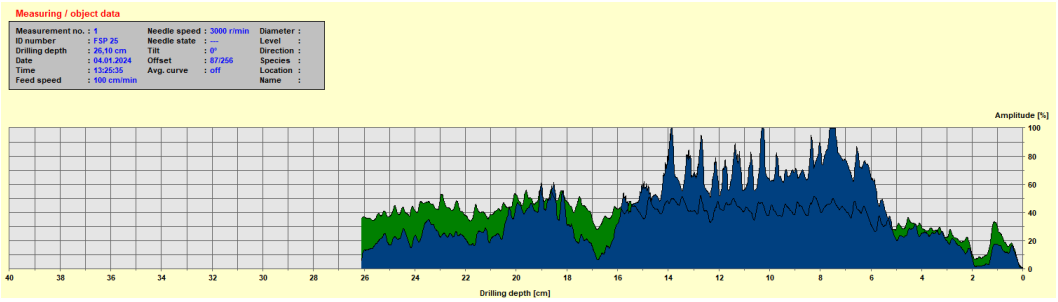
Drilling at 90 cm above grade, the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #25 - 30 cm



Height: 30 cm; Tomogram indicated cavities with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #25 - 30cm



Drilling at 30 cm above grade, the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.

Live Oak #29

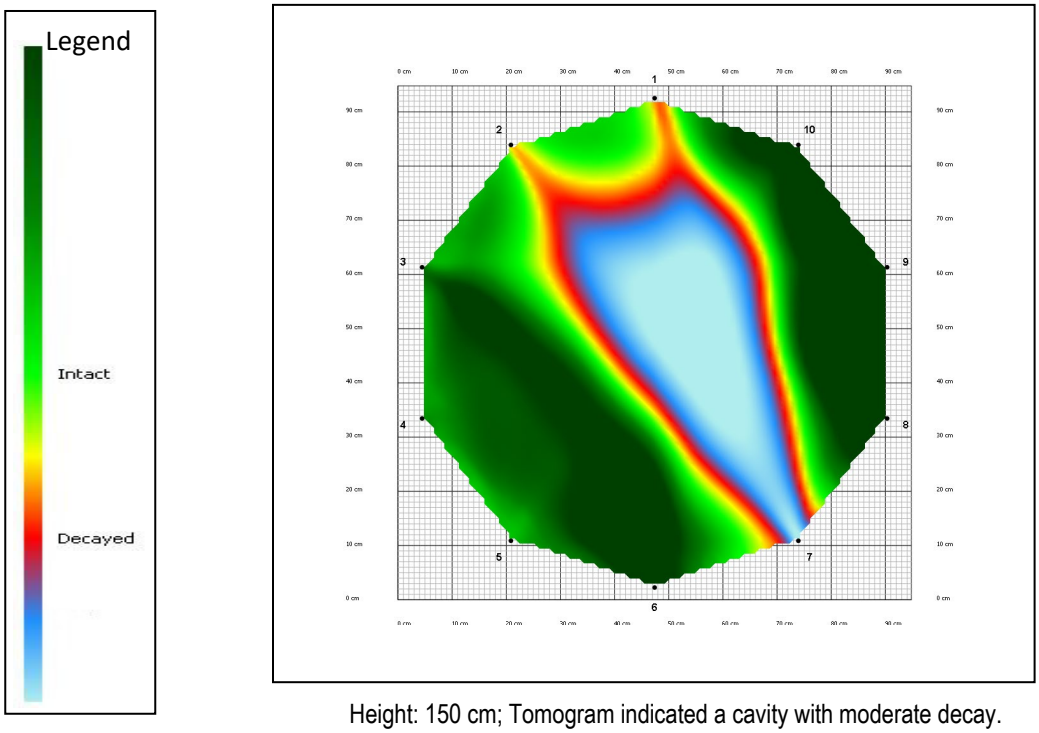
Photo 13: Looking west at live oak #29 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	40 inches
Height	~45 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Co-dominant Stem cavity Buried root collar
Targets considered	People using the park, building, generator

Live oak #29 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, decay in the lower stem, and a buried root collar.

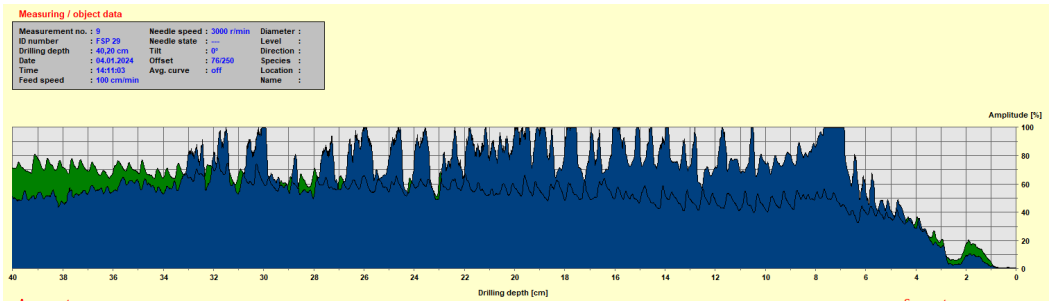
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees and pruning to provide clearance to the building to the south. The oak grew towards the north and west as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 12 feet above grade.
4. The trunk was assessed for decay at 150 cm (59 inches), 90 cm (35.4 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #7 at all three levels, at sensor # 2 at 90 cm, and at sensor #4 at 30 cm. Visual inspection confirmed that there were no cavities at this level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 150 cm was 100.3 cm (39.5 inches) and the 15% threshold would be 15 cm (5.9 inches).
        i. the sensor #2 position indicated 40 cm (15.7 inches) of sound wood.
        ii. the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.
    b. The diameter of the trunk at 90 cm was 100.3 cm (39.5 inches) and the 15% threshold would be 15 cm (5.9 inches).
        i. the sensor #2 position indicated 32.5 cm (12.8 inches) of sound wood.
        ii. the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.
    c. The diameter of the trunk at 30 cm was 111.5 cm (36.4 inches) and the 15% threshold would be 16.7 cm (6.6 inches).
        i. the sensor #4 position indicated 27 cm (10.6 inches) of sound wood.
        ii. the sensor #7 position indicated 27 cm (10.6 inches) of sound wood.
5. The root collar was buried with approximately four to six inches of soil and/or mulch.

ArborSonic 3D™ Tomogram Live Oak #29 - 150 cm

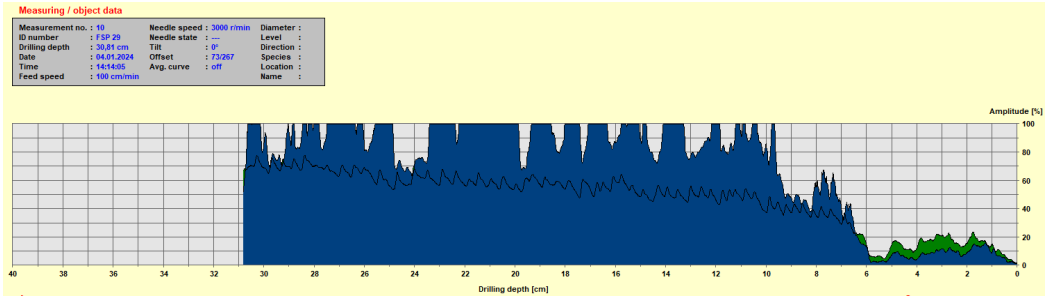


Height: 150 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #29 – 90 cm

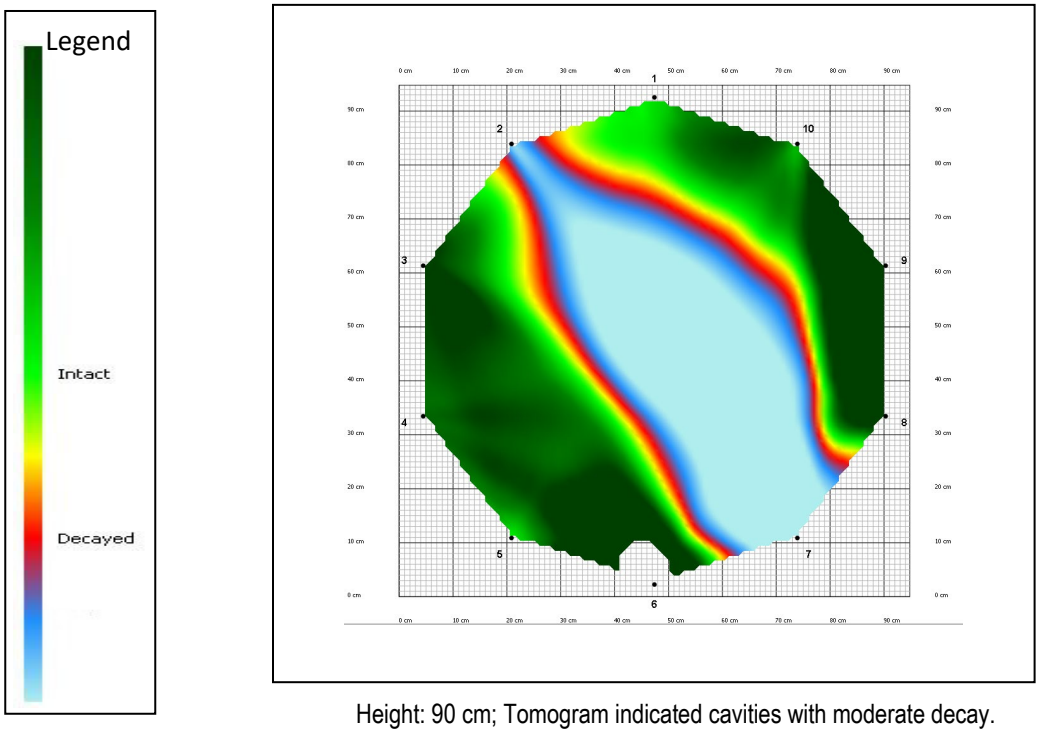


Drilling at 150 cm above grade, the sensor #2 position indicated 40 cm (15.7 inches) of sound wood.



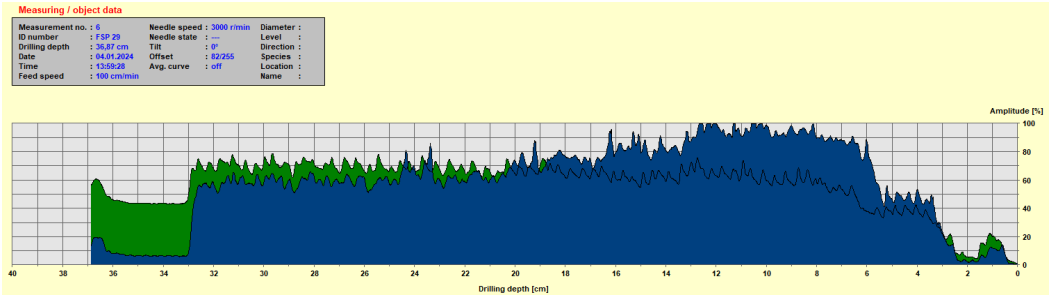
Drilling at 150 cm above grade, the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #29 - 90 cm

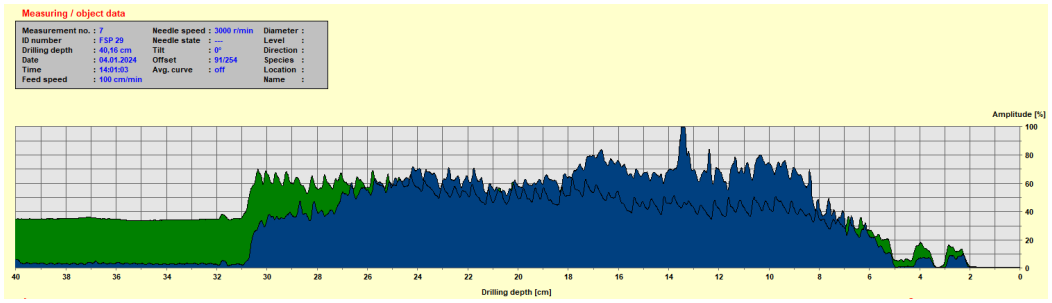


Height: 90 cm; Tomogram indicated cavities with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #29 – 90 cm

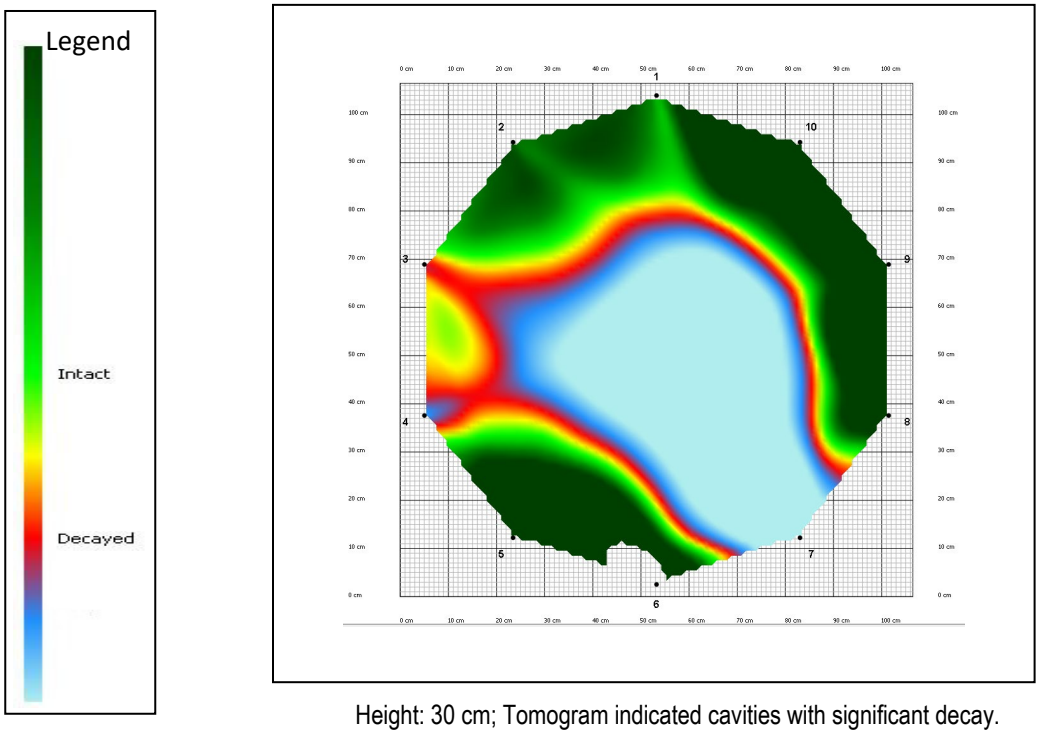


Drilling at 90 cm above grade, the sensor #2 position indicated 32.5 cm (12.8 inches) of sound wood.



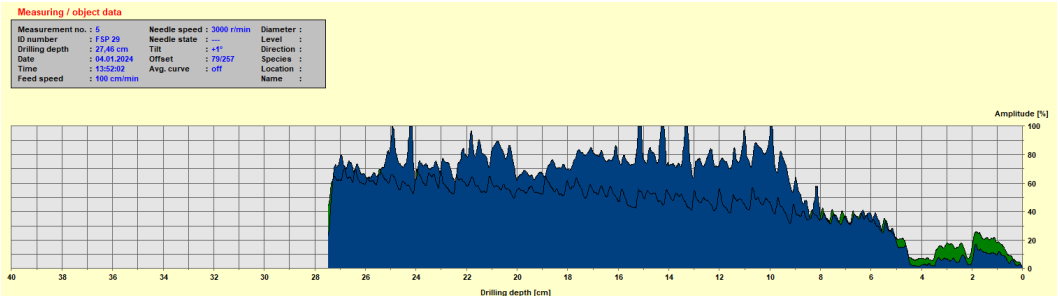
Drilling at 90 cm above grade, the sensor #7 position indicated 30 cm (11.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #29 - 30 cm

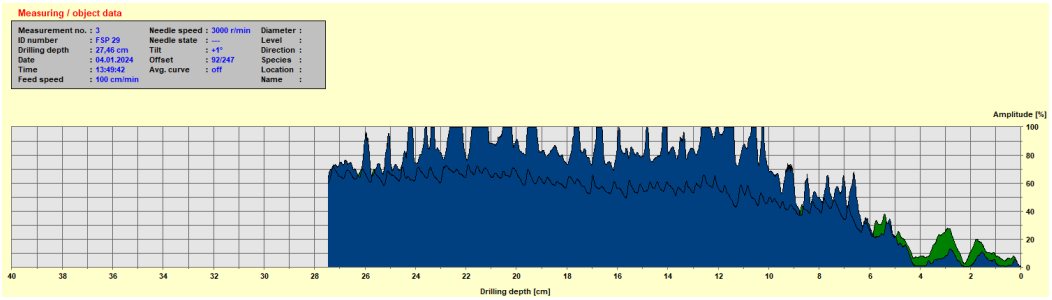


Height: 30 cm; Tomogram indicated cavities with significant decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #29 – 30 cm



Drilling at 30 cm above grade, the sensor #4 position indicated 27 cm (10.6 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 27 cm (10.6 inches) of sound wood.

Live Oak #35

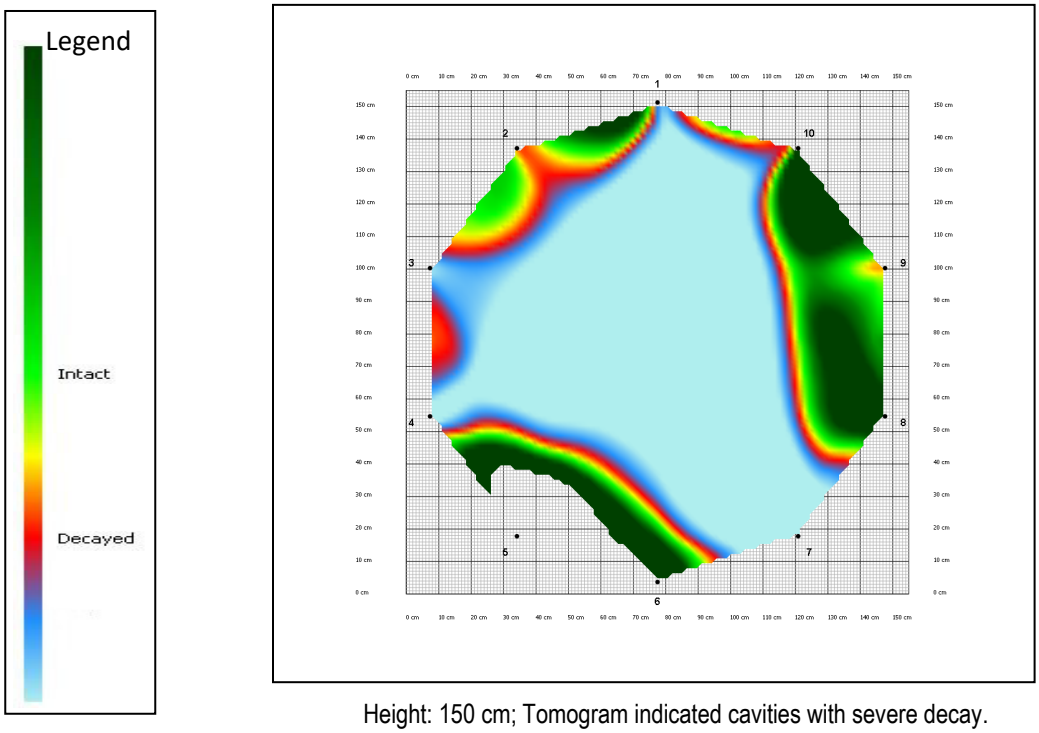
Photo 14: Looking northeast at live oak #35 showing the uneven crown and proximity to the building.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	61 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Uneven crown Stem crack Stem cavity
Targets considered	People using the park, building, overhead lines

Live oak #35 was in poor condition with dead branches throughout the crown, an uneven crown, vertical cracks in the stem, and a cavity in the stem.

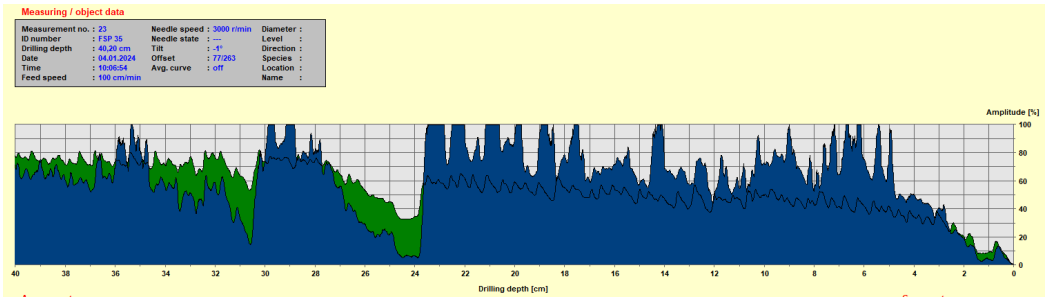
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees and pruning to provide clearance to the overhead lines. The oak grew towards the east as it competed for sunlight.
3. The six foot long vertical crack extended down from the co-dominant stem union down the west side of the trunk, between the north and west stems. A smaller crack extends between the west and south co-dominant stems. The west stem has compromised attachments to the remainder of the trunk.
4. The trunk was assessed for decay at 150 cm (59 inches) and 30 cm (11.8 inches) above grade. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 150 cm was 157.6 cm (60.1 inches) and the 15% threshold would be 23.6 cm (9.3 inches).
        i. the sensor #1 position indicated 30 cm (11.8 inches) of sound wood.
        ii. the sensor #2 position indicated 40 cm (15.7 inches) of sound wood.
        iii. the sensor #3 position indicated 40 cm (15.7 inches) of sound wood.
        iv. the sensor #4 position indicated 32 cm (12.6 inches) of sound wood.
        v. the sensor #5 position indicated 32 cm (12.6 inches) of sound wood.
        vi. the sensor #6 position indicated 38 cm (15 inches) of sound wood.
        vii. the sensor #7 position indicated 36 cm (14.2 inches) of sound wood.
        viii. the sensor #8 position indicated 34 cm (13.4 inches) of sound wood.
        ix. the sensor #9 position indicated 26 cm (10.2 inches) of sound wood.
        x. the sensor #10 position indicated 30 cm (11.8 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 168.8 cm (66.5 inches) and the 15% threshold would be 25.3 cm (10 inches).
        i. the sensor #1 position indicated 34 cm (13.4 inches) of sound wood.
        ii. the sensor #2 position indicated 33 cm (13 inches) of sound wood.
        iii. the sensor #3 position indicated 40 cm (15.7 inches) of sound wood.
        iv. the sensor #4 position indicated 33 cm (13inches) of sound wood.
        v. the sensor #5 position indicated 40 cm (15.7 inches) of sound wood.
        vi. the sensor #6 position indicated 38 cm (15 inches) of sound wood.
        vii. the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.
        viii. the sensor #8 position indicated 32 cm (12.6 inches) of sound wood.
        ix. the sensor #9 position indicated 34 cm (13.4 inches) of sound wood.
        x. the sensor #10 position indicated 32 cm (12.6 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #35 - 150 cm

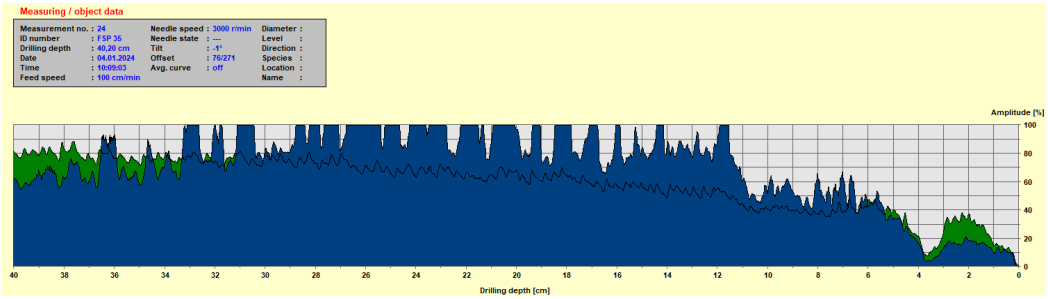


Height: 150 cm; Tomogram indicated cavities with severe decay.

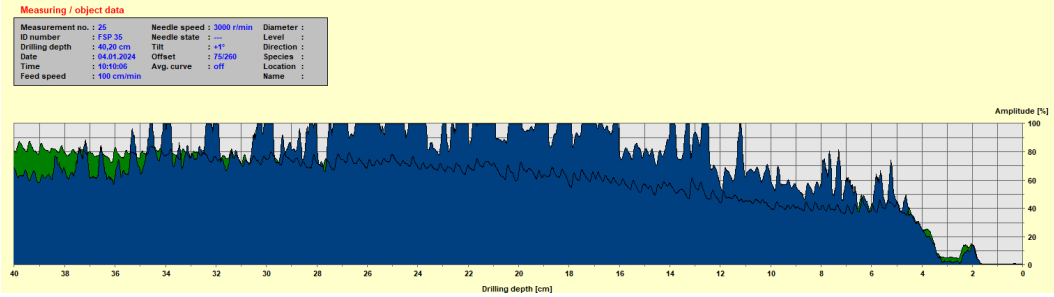
IML Resi-PD 400 Resistance Drill Readings: Live Oak #35 – 150 cm



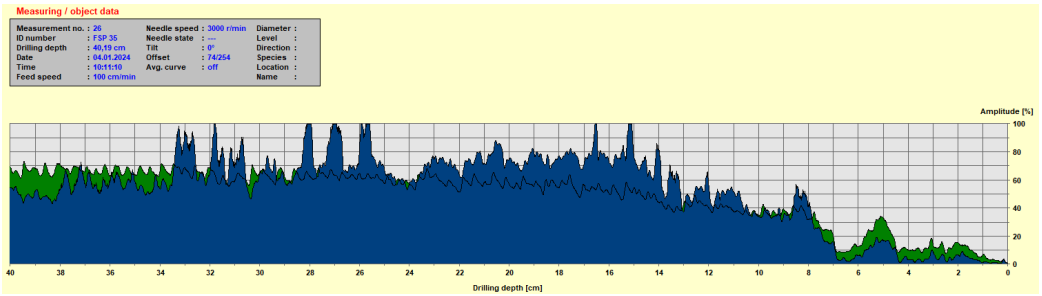
Drilling at 150 cm above grade, the sensor #1 position indicated 30 cm (11.8 inches) of sound wood.



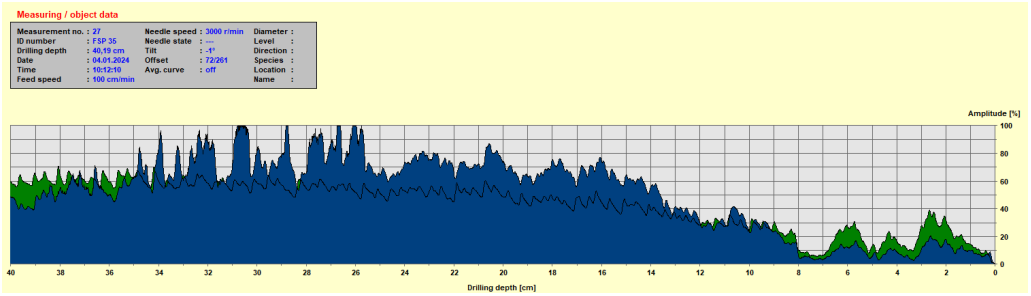
Drilling at 150 cm above grade, the sensor #2 position indicated 40 cm (15.7 inches) of sound wood.



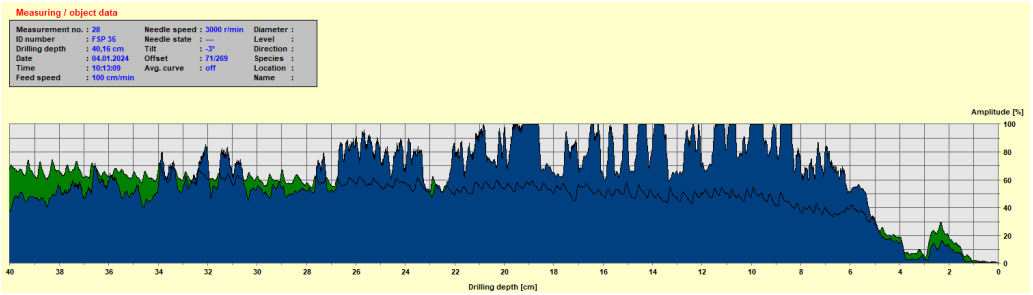
Drilling at 150 cm above grade, the sensor #3 position indicated 40 cm (15.7 inches) of sound wood.



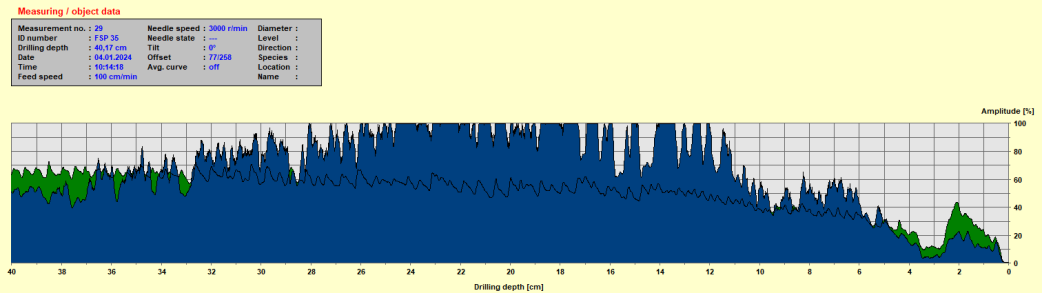
Drilling at 150 cm above grade, the sensor #4 position indicated 32 cm (12.6 inches) of sound wood.



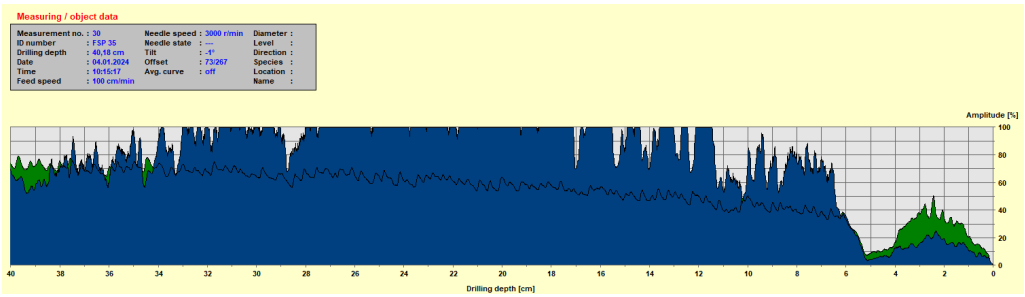
Drilling at 150 cm above grade, the sensor #5 position indicated 32 cm (12.6 inches) of sound wood.



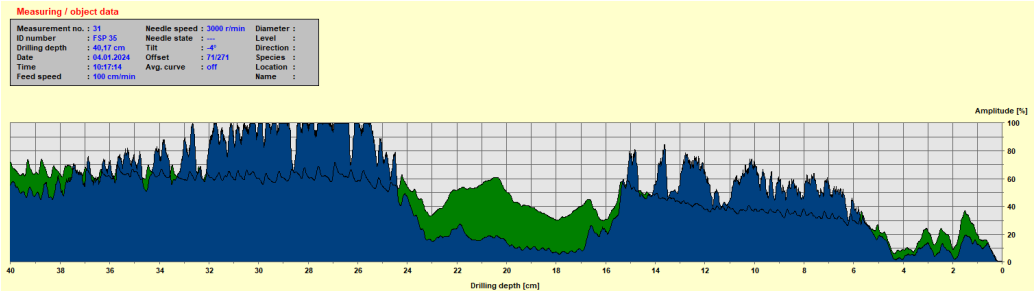
Drilling at 150 cm above grade, the sensor #6 position indicated 38 cm (15 inches) of sound wood.



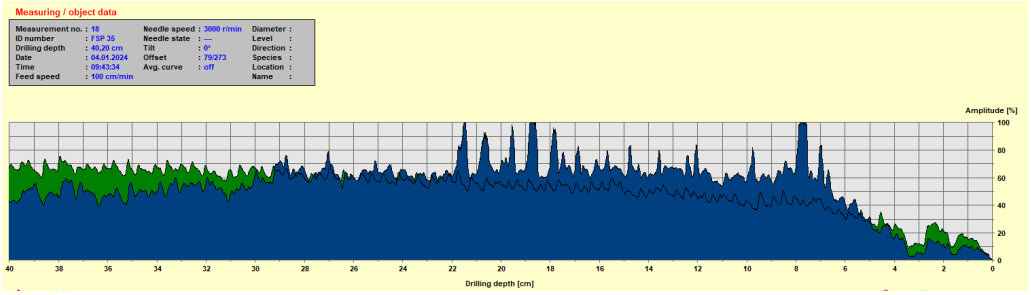
Drilling at 150 cm above grade, the sensor #7 position indicated 36 cm (14.2 inches) of sound wood.



Drilling at 150 cm above grade, the sensor #8 position indicated 34 cm (13.4 inches) of sound wood.

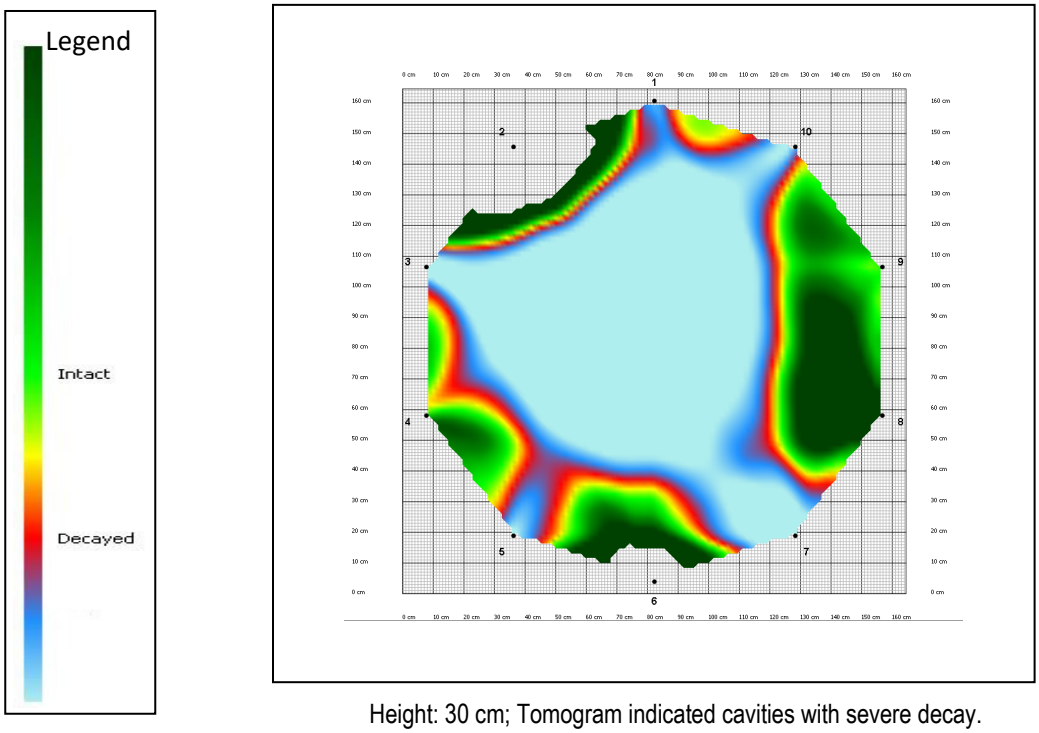


Drilling at 150 cm above grade, the sensor #9 position indicated 26 cm (10.2 inches) of sound wood.



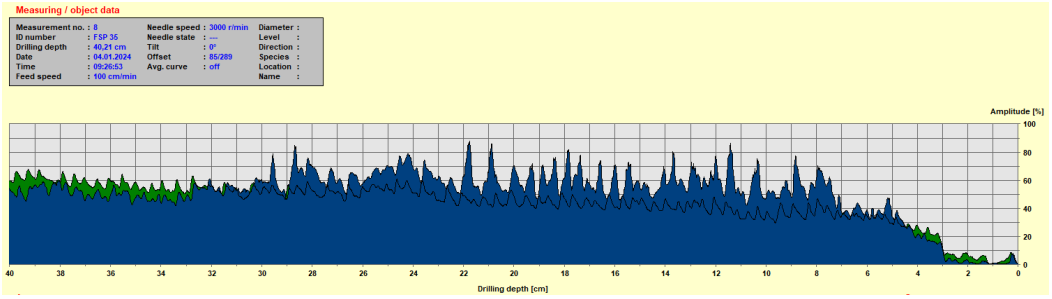
Drilling at 150 cm above grade, the sensor #10 position indicated 30 cm (11.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #35 - 30 cm

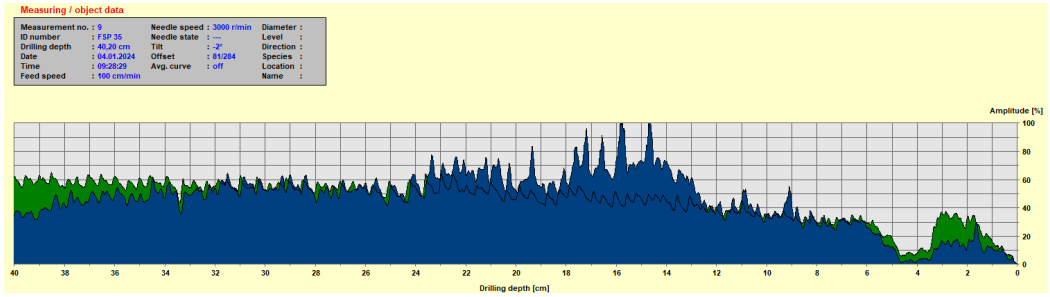


Height: 30 cm; Tomogram indicated cavities with severe decay.

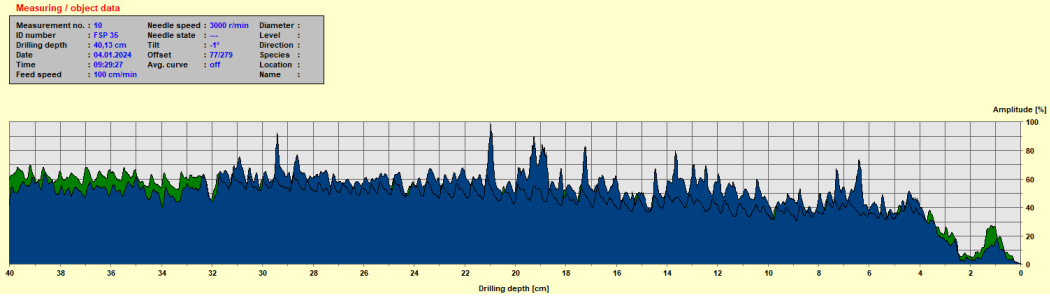
IML Resi-PD 400 Resistance Drill Readings: Live Oak #35 – 30 cm



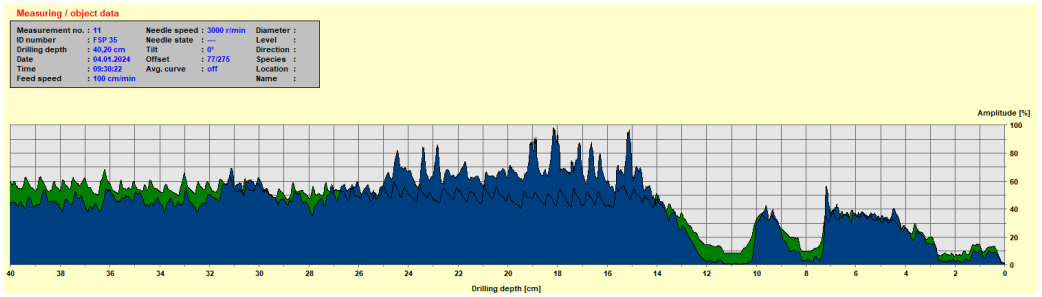
Drilling at 30 cm above grade, the sensor #1 position indicated 34 cm (13.4 inches) of sound wood.



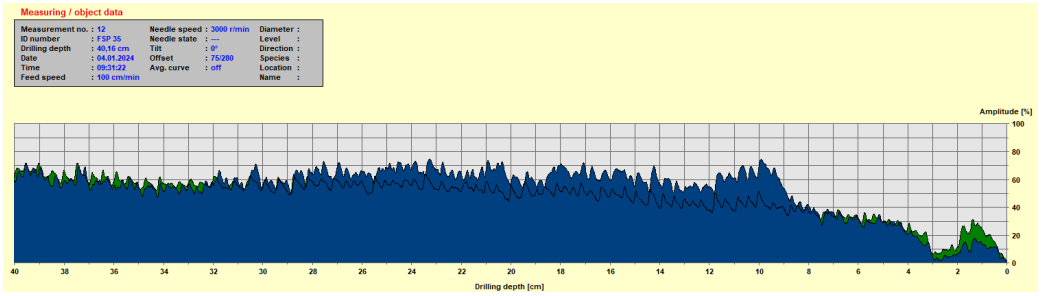
Drilling at 30 cm above grade, the sensor #2 position indicated 33 cm (13 inches) of sound wood.



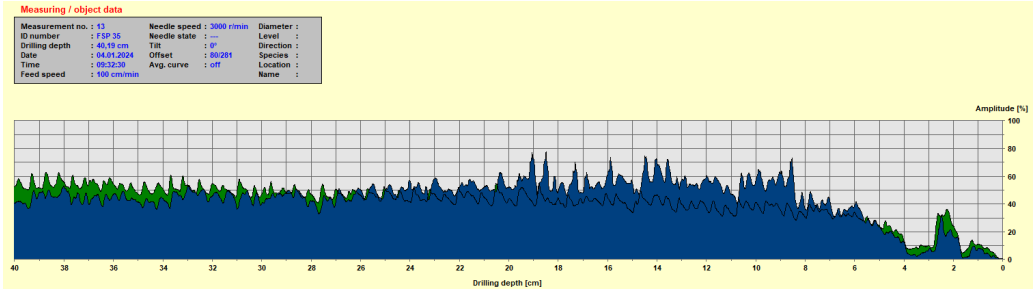
Drilling at 30 cm above grade, the sensor #3 position indicated 40 cm (15.7 inches) of sound wood.



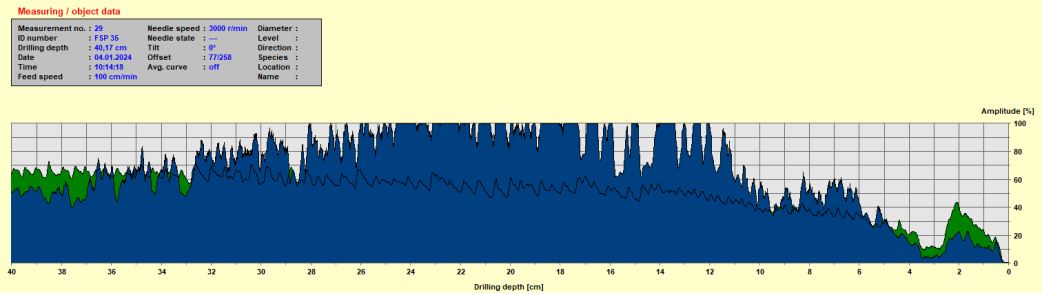
Drilling at 30 cm above grade, the sensor #4 position indicated 33 cm (13 inches) of sound wood.



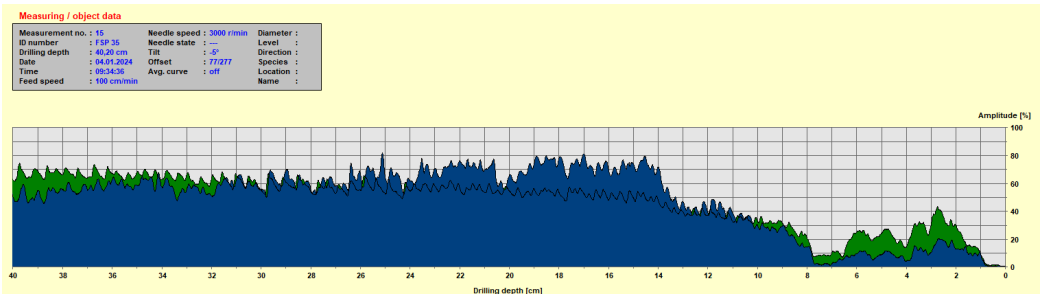
Drilling at 30 cm above grade, the sensor #5 position indicated 40 cm (15.7 inches) of sound wood.



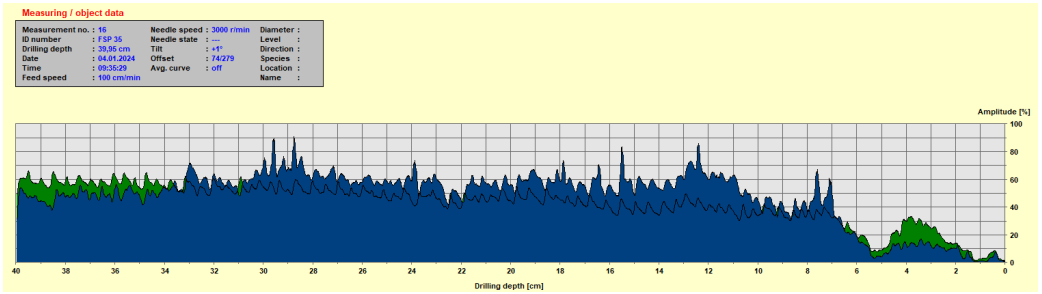
Drilling at 30 cm above grade, the sensor #6 position indicated 38 cm (15 inches) of sound wood.



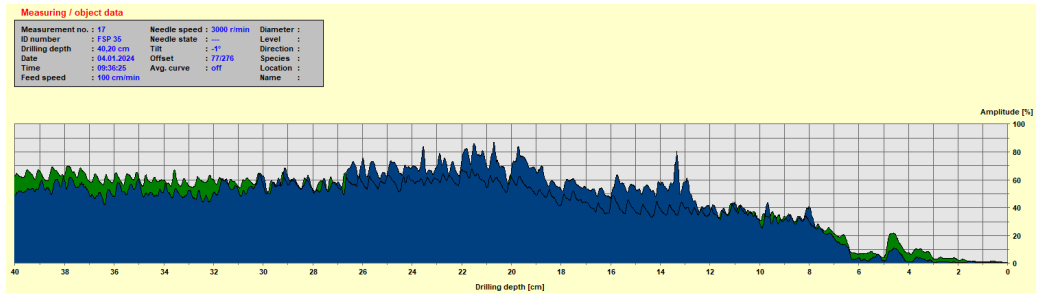
Drilling at 30 cm above grade, the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #8 position indicated 32 cm (12.6 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #9 position indicated 34 cm (13.4 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #10 position indicated 32 cm (12.6 inches) of sound wood.

Live Oak #39

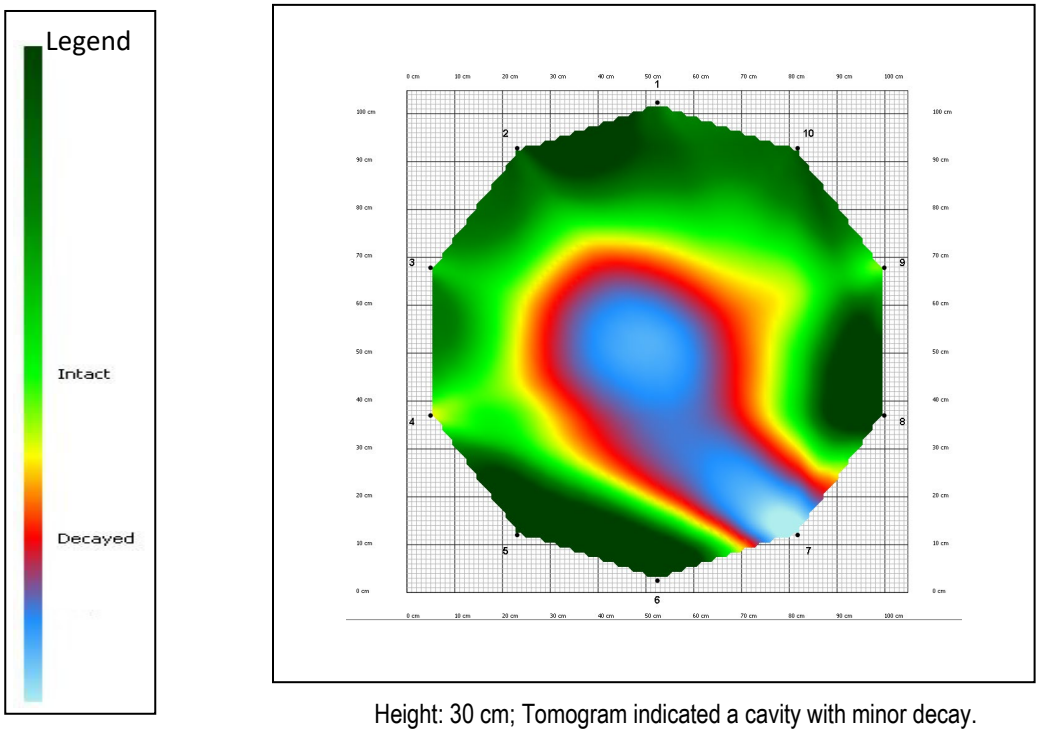
Photo15: Looking north at live oak #39 showing the uneven crown and co-dominant stems.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	40 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Restricted to west
Defects	Dead branches Uneven crown Co-dominant stems Stem decay Pavement damage
Targets considered	People using the park, parked vehicles

Live oak #39 was in fair condition with dead branches throughout the crown, an uneven crown, co-dominant stems, decay in the lower stem, and a buried root collar.

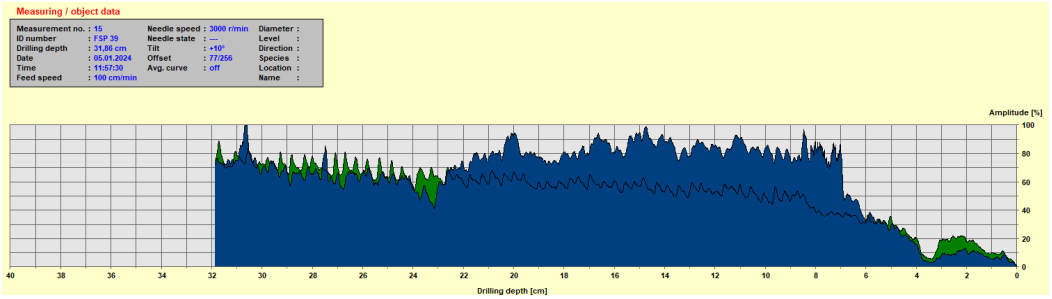
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the south as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately eight feet above grade.
4. The trunk was assessed for decay at 210 cm (82.6 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #7 at both levels, at sensor # 1 at 30 cm. Visual inspection confirmed that there were no cavities at this level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 210 cm was 109.9 cm (43.3 inches) and the 15% threshold would be 16.5 cm (6.5 inches).
        i. the sensor #7 position indicated 31 cm (12.2 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 116.2 cm (45.7 inches) and the 15% threshold would be 17.4 cm (6.9 inches).
        i. the sensor #1 position indicated 32 cm (12.6 inches) of sound wood.
        ii. the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.
5. The west and part of the south sides of the root zone was covered by an asphalt parking lot. The remainder of the south side and the east side were gravel and used for overflow parking or as an exit .

ArborSonic 3D™ Tomogram Live Oak #39 - 210 cm



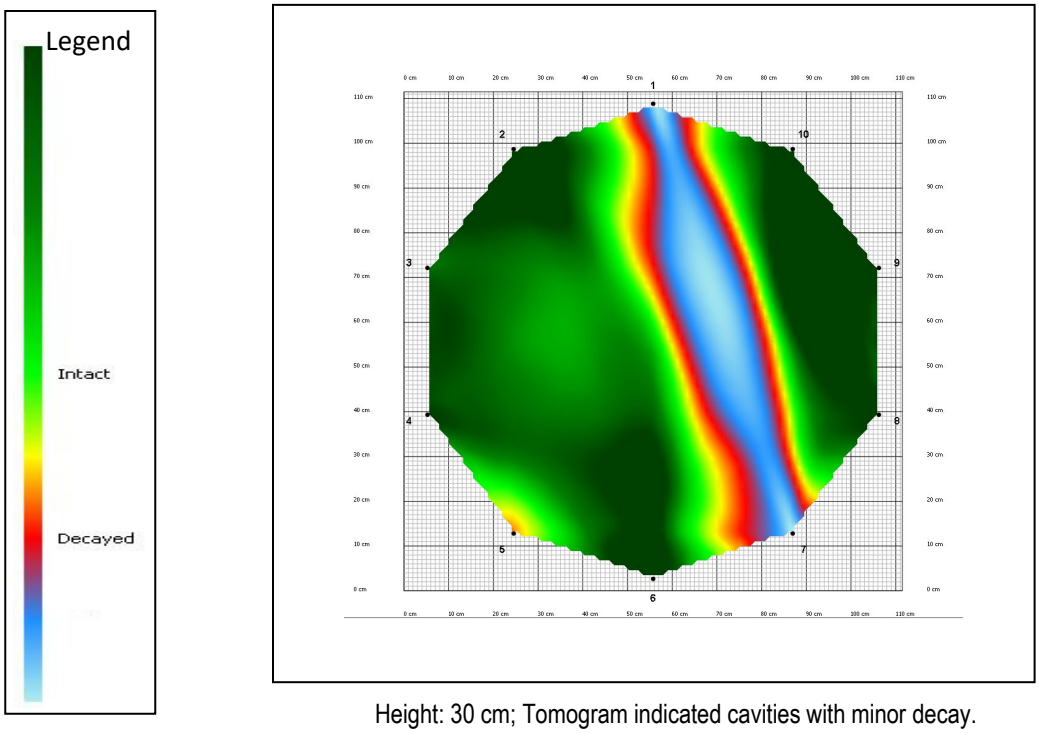
Height: 30 cm; Tomogram indicated a cavity with minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #39 – 210 cm



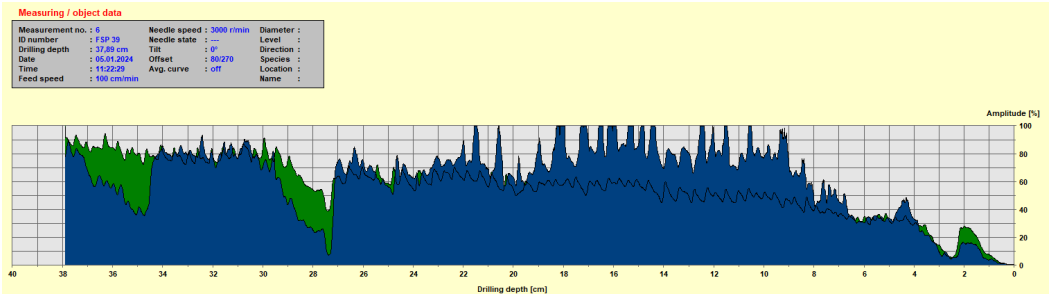
Drilling at 210 cm above grade, the sensor #7 position indicated 31 cm (12.2 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #39 - 30 cm

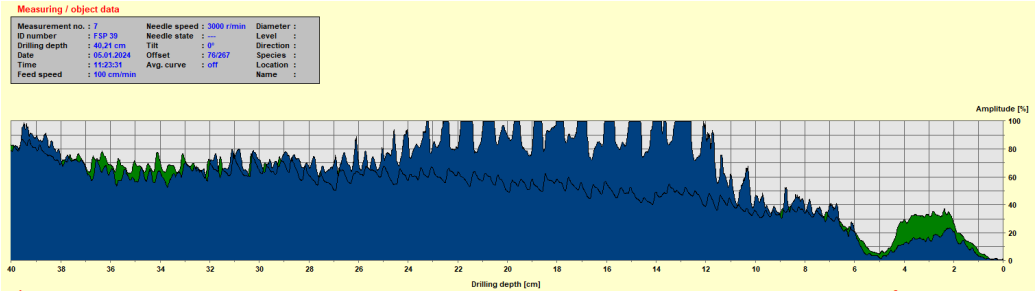


Height: 30 cm; Tomogram indicated cavities with minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #35 – 30 cm



Drilling at 30 cm above grade, the sensor #1 position indicated 32 cm (12.6 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 40 cm (15.7 inches) of sound wood.

Live Oak #40

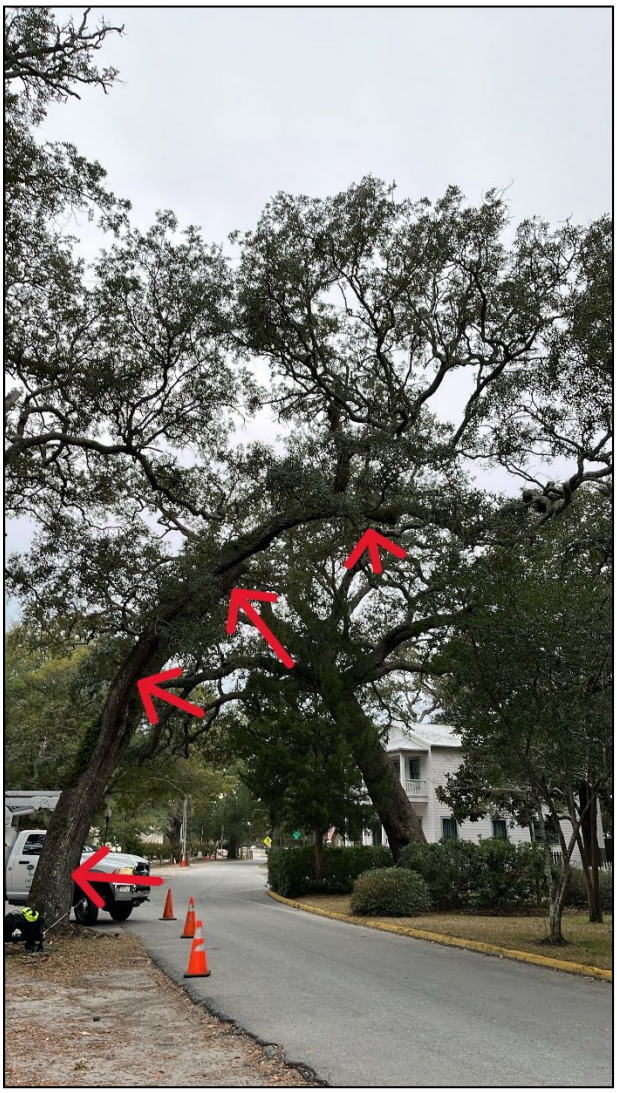


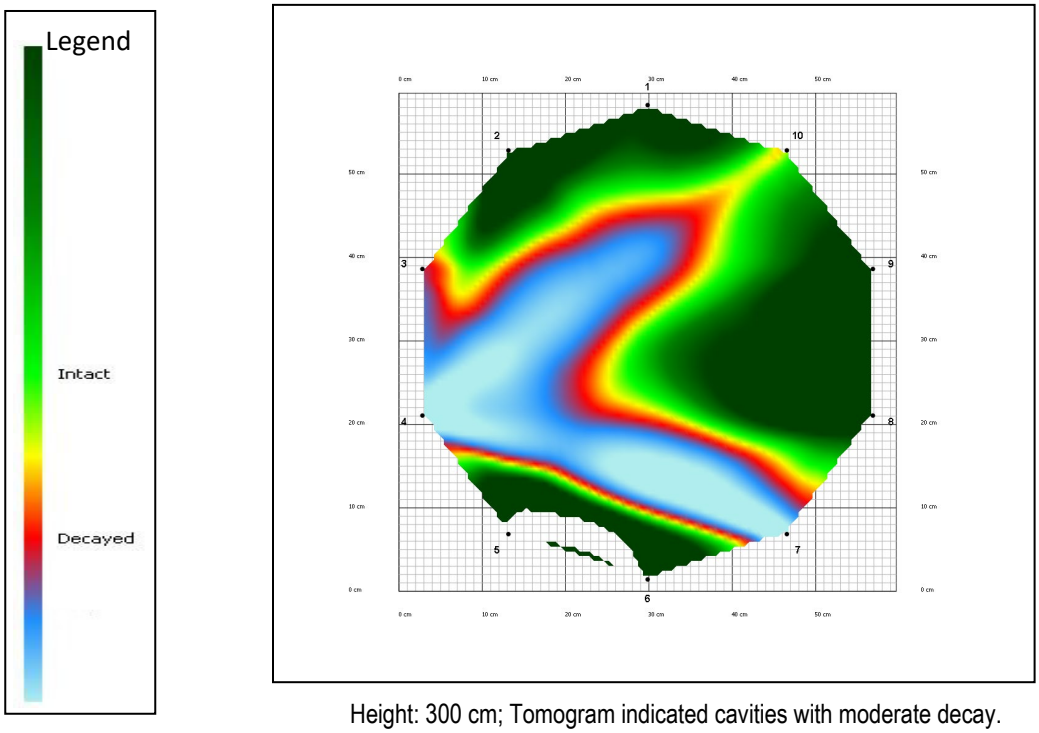
Photo 16: Looking west at live oak #40 showing the uneven crown and pavement restriction to the north.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	28 inches
Height	~45 feet
Condition	Fair
Soil Conditions	Restricted to north and west
Defects	Uneven crown Co-dominant stems Stem cavity Pavement damage
Targets considered	People using the park, vehicles parked and on road

Live oak #40 was in fair condition with an uneven crown, co-dominant stems, decay in the lower stem, and a root zone to the north and west.

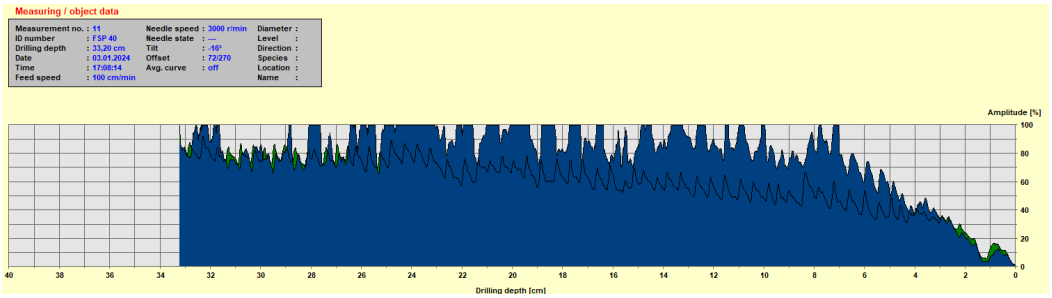
1. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the north as it competed for sunlight.
2. The co-dominant stems bifurcated at approximately 12 feet above grade.
3. The cavity at sensor #4 at 300cm was associated with the storm damage.
4. The trunk was assessed for decay at 300 cm (118.1 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #4 and #7 at 300 cm, at sensor # 7 at 30 cm. Visual inspection confirmed that there were no cavities at sensor #7 on either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 300 cm was 66.9 cm (26.3 inches) and the 15% threshold would be 10 cm (3.9 inches).
        i. the sensor #7 position indicated 33 cm (13 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 81.2 cm (32 inches) and the 15% threshold would be 12.2 cm (4.8 inches).
        i. the sensor #7 position indicated 32 cm (12.6 inches) of sound wood.
5. The west and part of the south sides of the root zone was covered by an asphalt parking lot. The remainder of the east side was gravel and used for overflow parking or as an exit .

ArborSonic 3D™ Tomogram Live Oak #40 - 300 cm



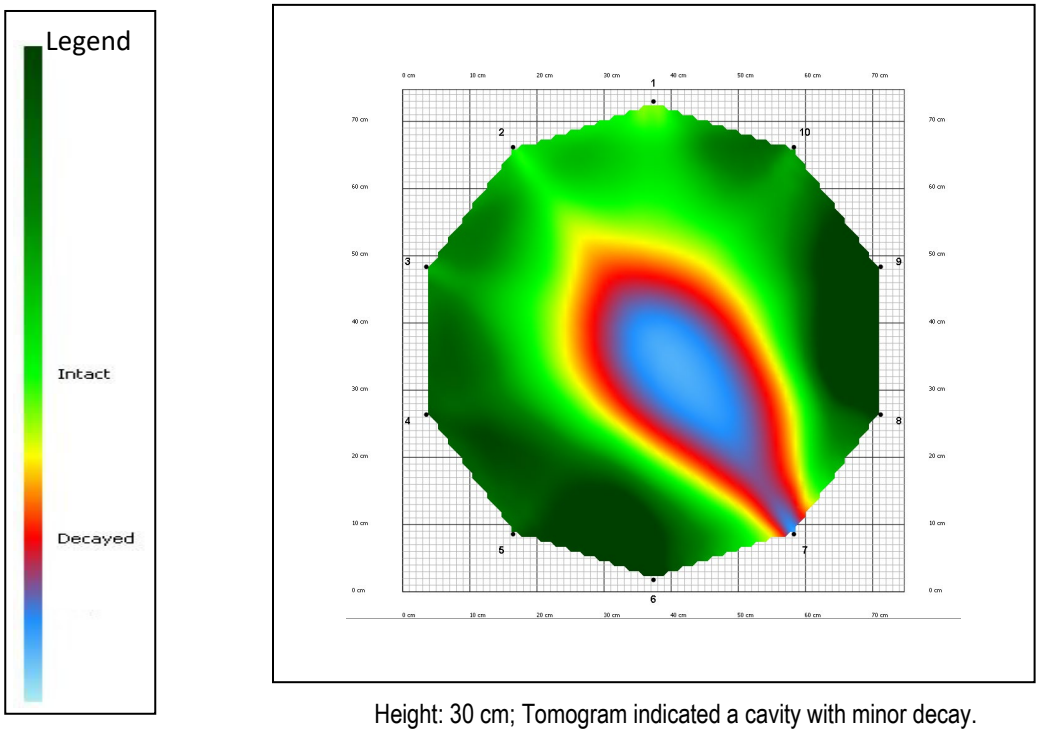
Height: 300 cm; Tomogram indicated cavities with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #40 – 300 cm



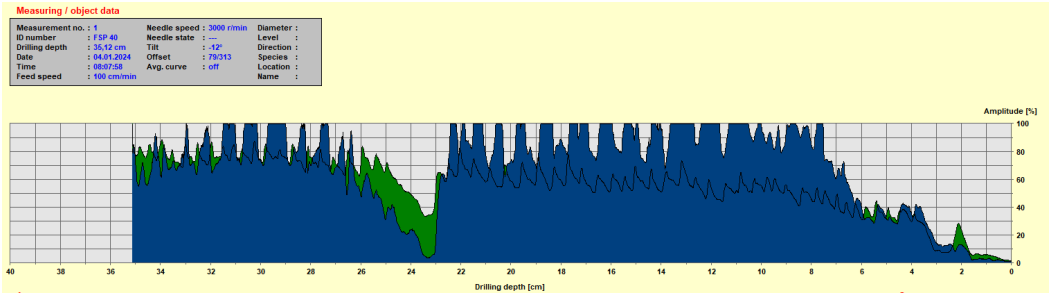
Drilling at 300 cm above grade, the sensor #1 position indicated 33 cm (13 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #40 - 30 cm



Height: 30 cm; Tomogram indicated a cavity with minor decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #40 – 30 cm



Drilling at 30 cm above grade, the sensor #7 position indicated 32 cm (12.6 inches) of sound wood.

Live Oak #43

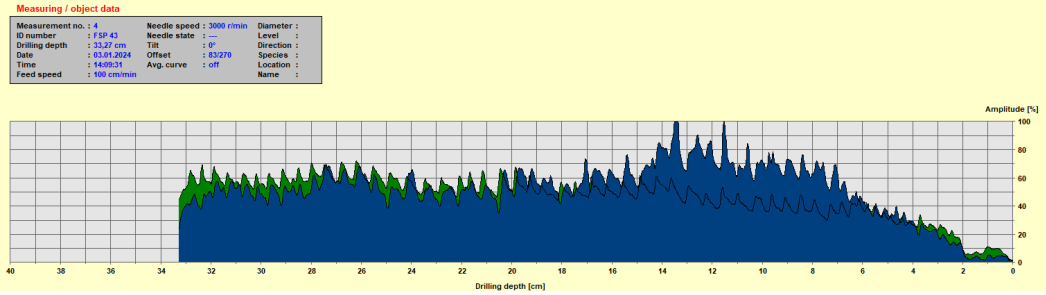
Photo 17: Looking east at live oak #43 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	37 inches
Height	~55 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Moderate crown dieback Uneven crown Trunk lean Stem cavity Decay in lower stem/root collar
Targets considered	People using the park, parked vehicles

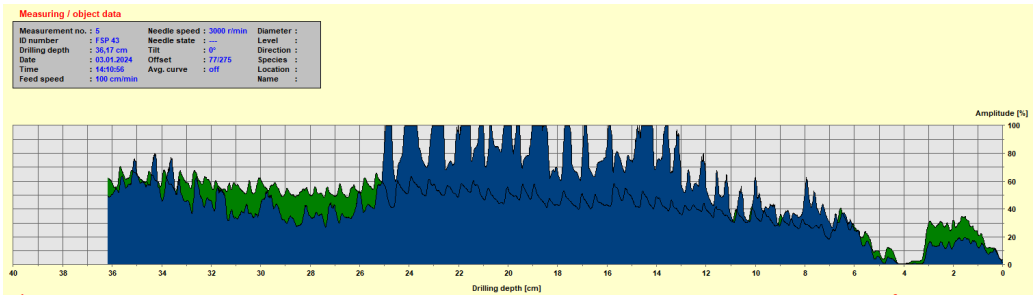
Live oak #43, one of the Sisters Oaks, was in fair condition with moderate crown dieback, an uneven crown, decay in the lower stem, and a root zone to the north and west.

1. The crown exhibited moderate dieback.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the west as it competed for sunlight.
3. A cavity was observed in the west side of the stem at approximately 16 feet above grade.
4. The trunk was assessed for decay at 450 cm (177.2 inches) and 90 cm (35.4 inches) above grade. The tomogram indicated cavities at sensors #2 and #7 at 450 cm, at sensor # 7 at 90 cm. Visual inspection confirmed that there were no cavities at either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 450 cm was 79.6 cm (31.3 inches) and the 15% threshold would be 11.9 cm (4.7 inches).
        i. the sensor #2 position indicated 18 cm (7.1 inches) of sound wood.
        ii. the sensor #7 position indicated 28 cm (11 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 95.5 cm (37.6 inches) and the 15% threshold would be 14.3 cm (5.6inches).
        i. the sensor #3 position indicated 25 cm (9.8 inches) of sound wood.
        ii. the sensor #7 position indicated 16 cm (6.3 inches) of sound wood.
5. The lower stem/root collar was assessed for decay at the east-northeast and northwest.
        i. the east-northeast position indicated 33 cm (13 inches) of sound wood.
        ii. the northwest position indicated 16 cm (6.3 inches) of sound wood.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #43 – Root Collar

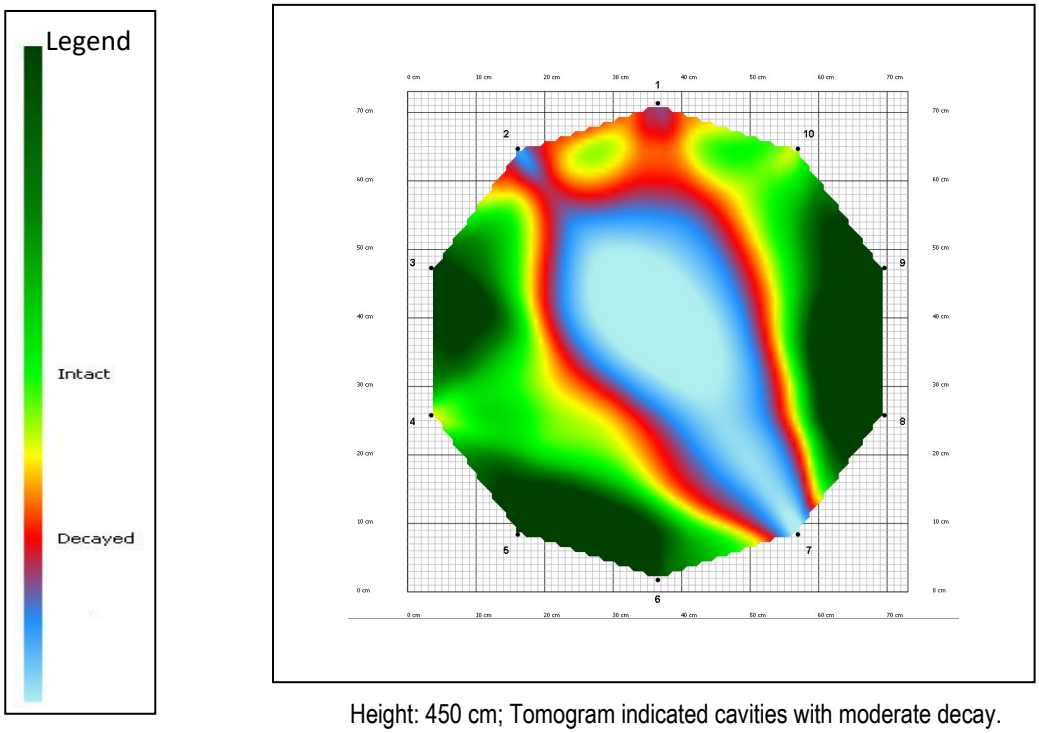


Drilling at the root collar, the east-northeast position indicated 33 cm (13) of sound wood.



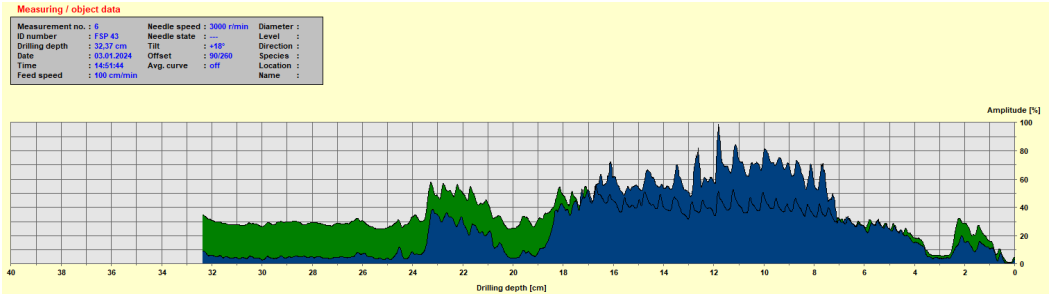
Drilling at the root collar, the northwest position indicated 25 cm (9.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #43 - 450 cm

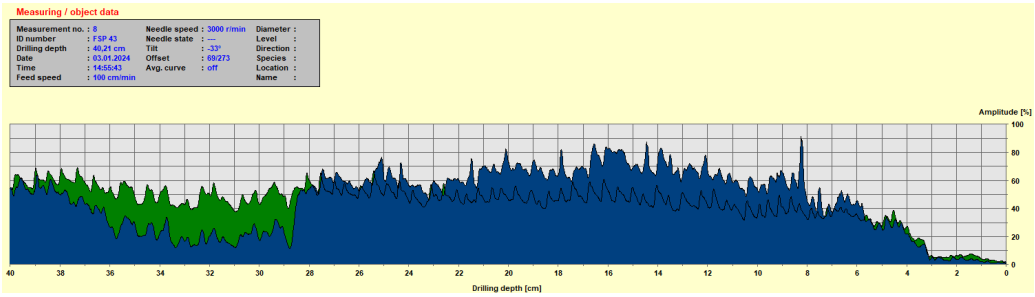


Height: 450 cm; Tomogram indicated cavities with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #43 – 450 cm

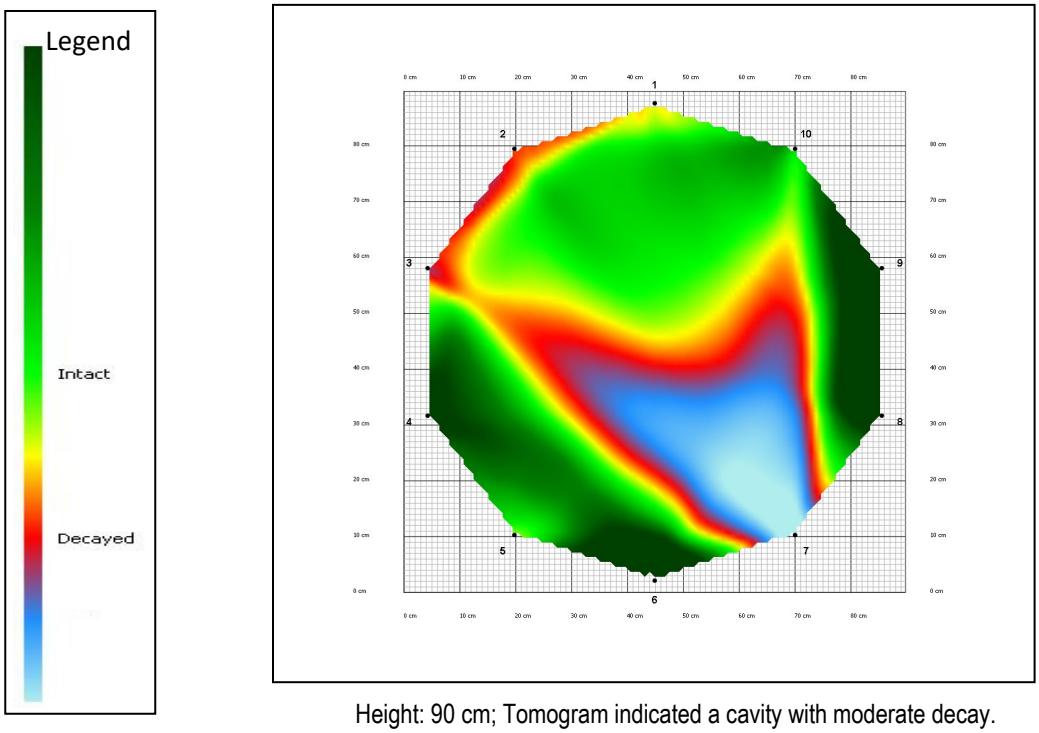


Drilling at 450 cm above grade, the sensor #2 position indicated 18 cm (7.1 inches) of sound wood.



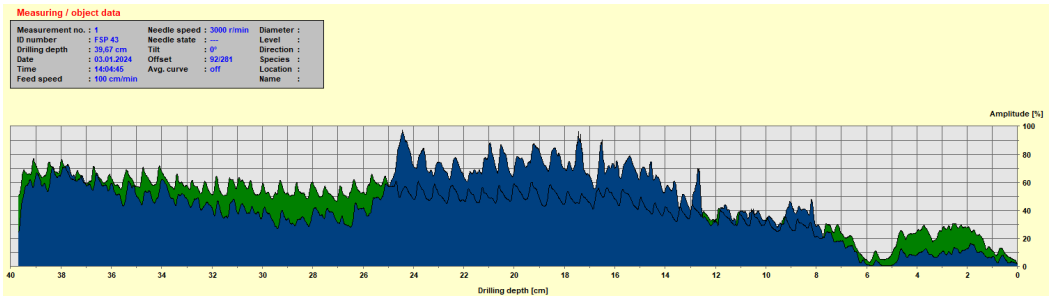
Drilling at 450 cm above grade, the sensor #7 position indicated 28 cm (11 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #43 - 90 cm

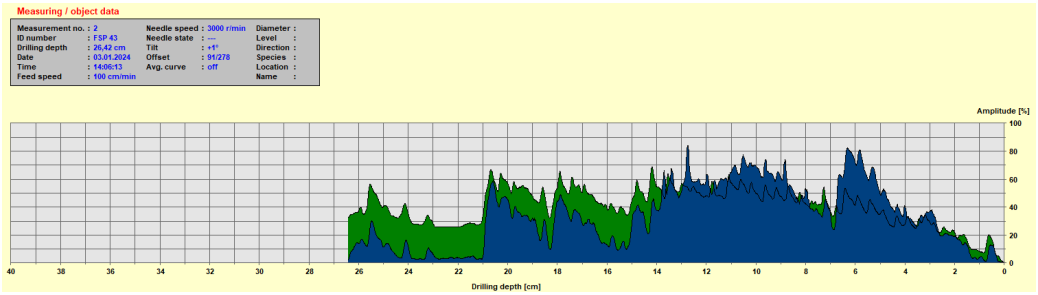


Height: 90 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #43 – 90 cm



Drilling at 90 cm above grade, the sensor #3 position indicated 25 cm (9.8 inches) of sound wood.



Drilling at 90 cm above grade, the sensor #7 position indicated 16 cm (6.3 inches) of sound wood.

Live Oak #44

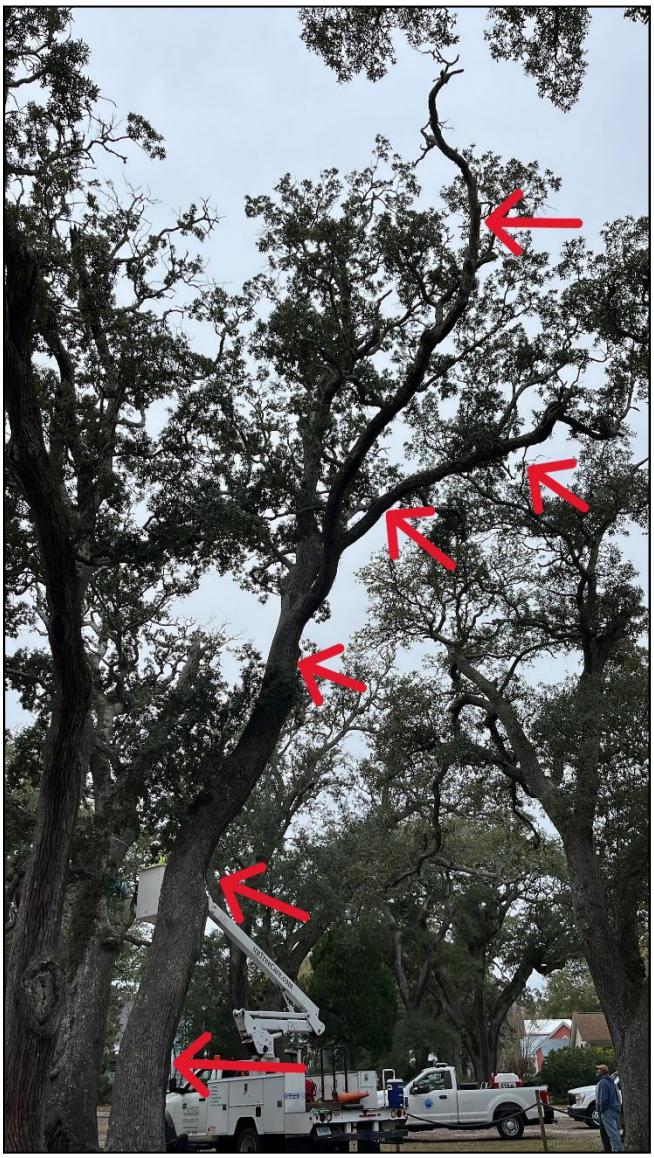


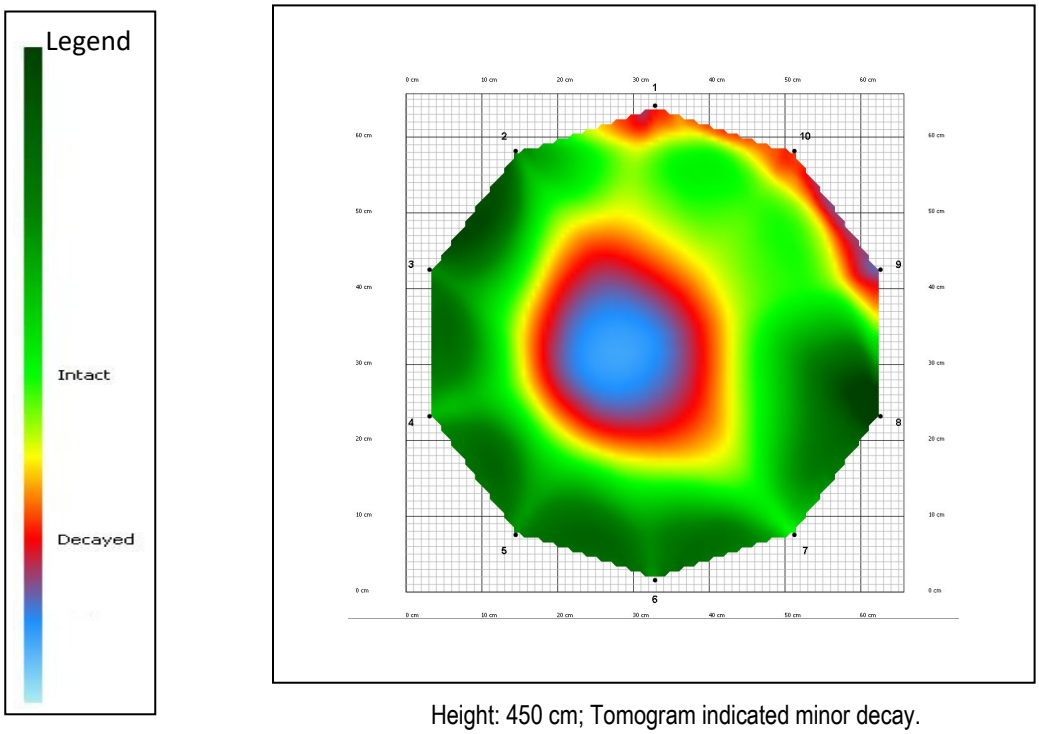
Photo 18: Looking southwest at live oak #44 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	36 inches
Height	~55 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Moderate dieback Uneven crown Stem cavity
Targets considered	People using the park

Live oak #44, one of the Sisters Oaks, was in fair condition with moderate crown dieback, an uneven crown, decay in the lower stem, and a root zone to the north and west.

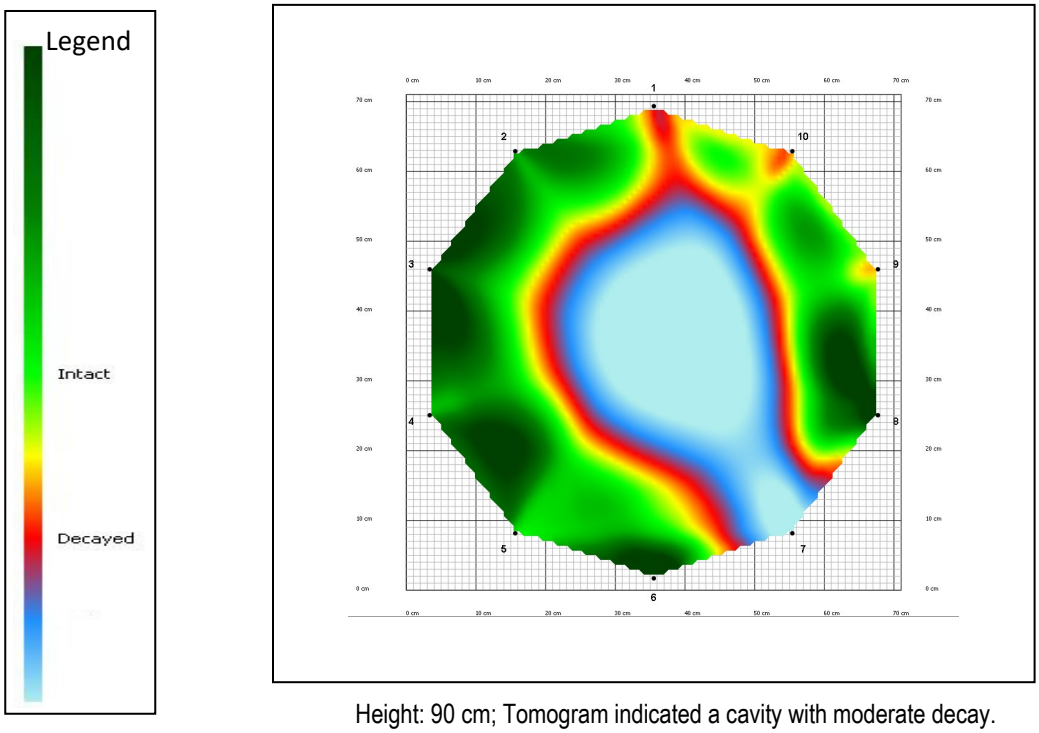
1. The crown exhibited moderate die back.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the west as it competed for sunlight.
3. The two cavities was observed in the northeast and northwest side of the stem at approximately 12 and 16 feet above grade.
4. The trunk was assessed for decay at 450 cm (177.2 inches), 300cm (118.1), and 90 cm (35.4 inches) above grade. The tomogram indicated cavity at sensor #7 at 300 cm. Visual inspection confirmed that there were no cavities at either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 450 cm was 72.6 cm (28.6 inches) and the 15% threshold would be 10.9 cm (4.3 inches). The tomogram did not indicate a need for resistance drilling.
    b. The diameter of the trunk at 300 cm was 71.3 cm (28.1 inches) and the 15% threshold would be 10.7 cm (4.2 inches).
        i. the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.
    c. The diameter of the trunk at 90 cm was 84.7 cm (33.3 inches) and the 15% threshold would be 12.7 cm (5 inches). The tomogram did not indicate a need for resistance drilling.
5. The root collar was inspected with the use of a mallet and did not require further investigation

ArborSonic 3D™ Tomogram Live Oak #44 - 450 cm



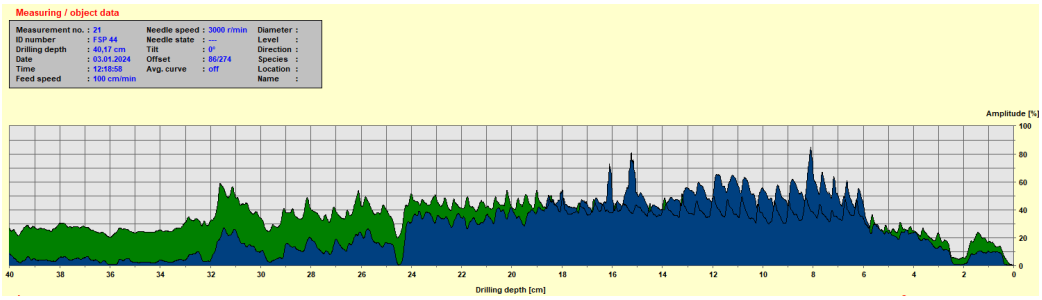
Height: 450 cm; Tomogram indicated minor decay.

ArborSonic 3D™ Tomogram Live Oak #44 - 300 cm



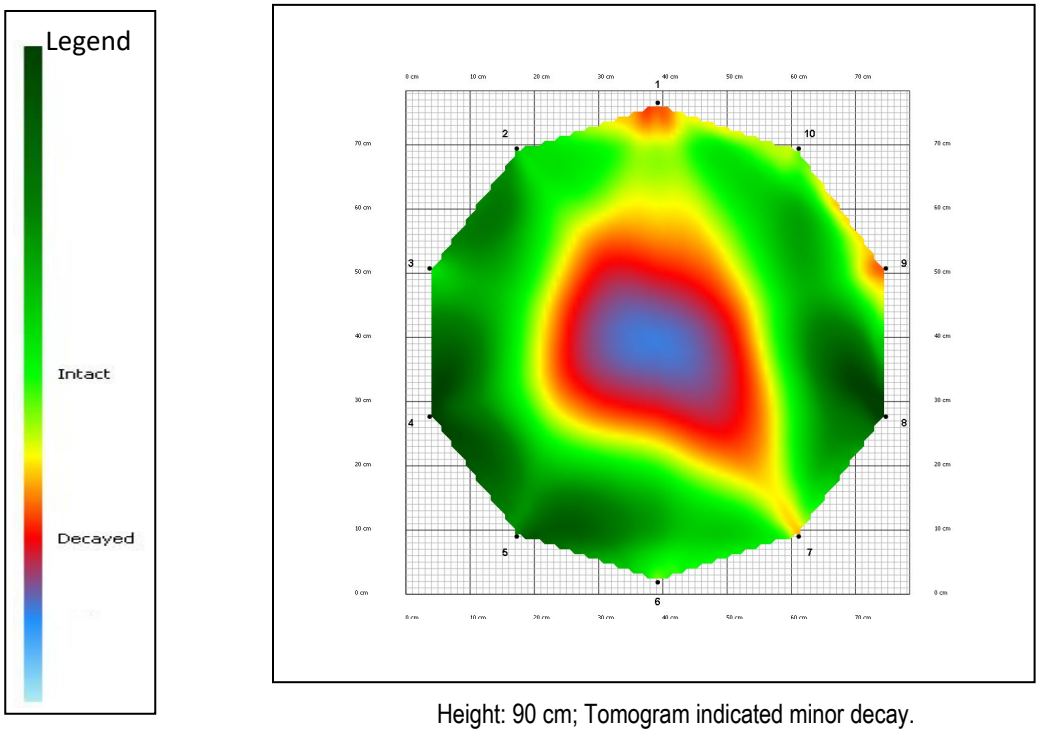
Height: 90 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #44 – 300 cm



Drilling at 300 cm above grade, the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #44 - 90 cm



Height: 90 cm; Tomogram indicated minor decay.

Live Oak #45

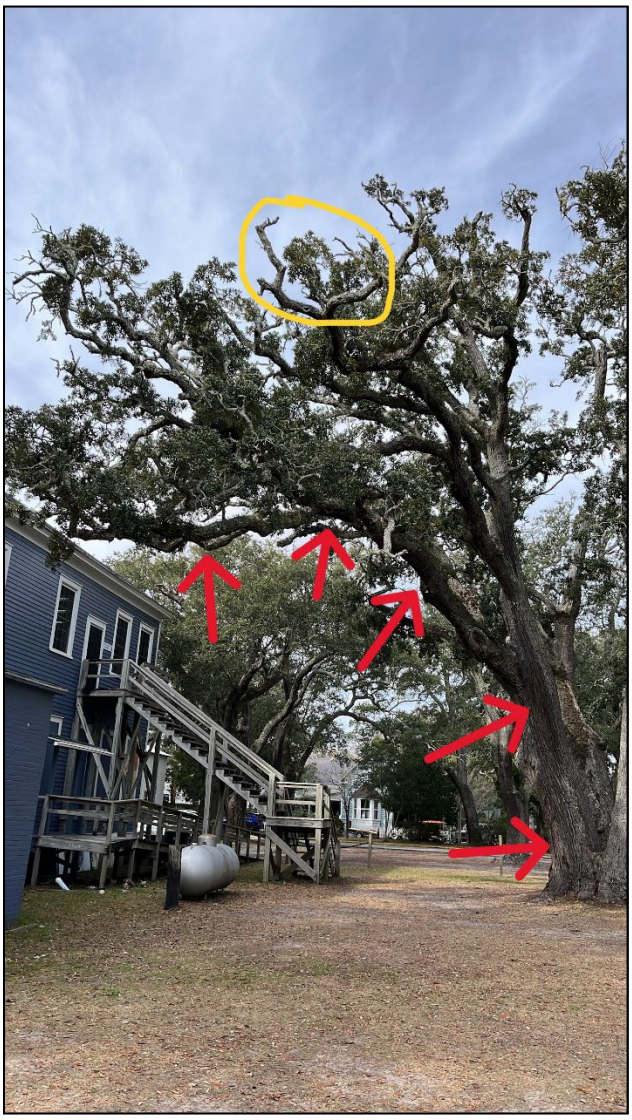


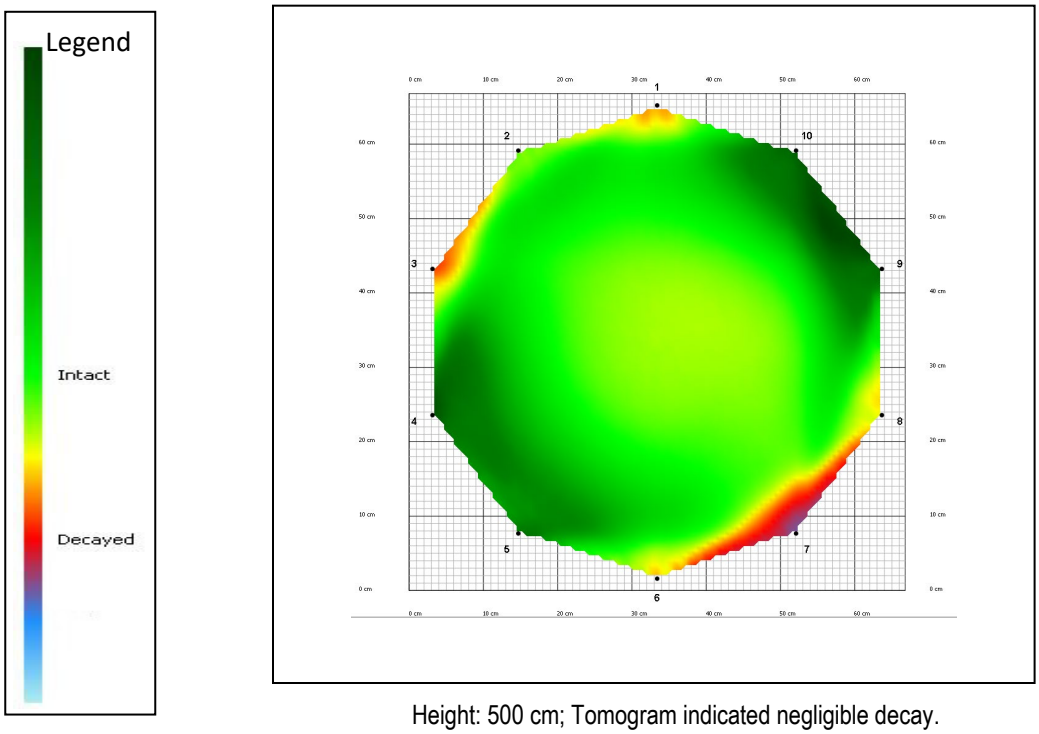
Photo 19: Looking north at live oak #45 showing the uneven crown and crown dieback (yellow circle).

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	43 inches
Height	~55 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Moderate dieback Uneven crown Co-dominant stems Stem cavity
Targets considered	People using the park, building, propane tank

Live oak #45, one of the Sisters Oaks, was in fair condition with moderate crown dieback, an uneven crown, decay in the lower stem, and a root zone to the north and west.

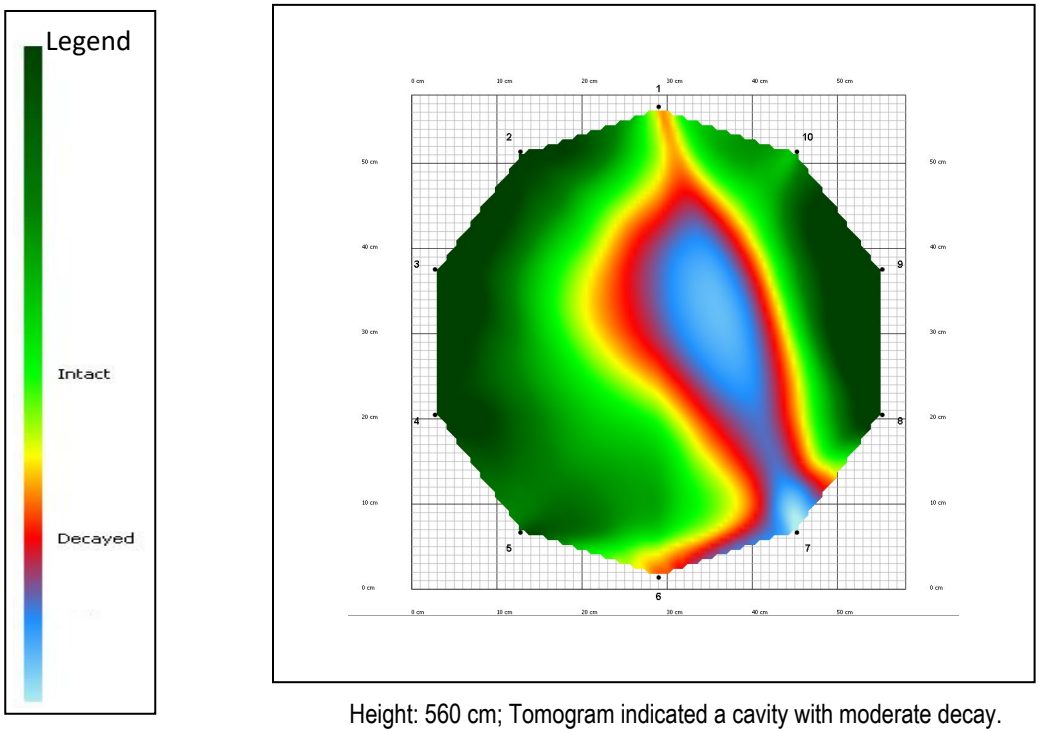
1. The crown exhibited moderate die back.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the west as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 15 feet above grade.
4. The trunk was assessed for decay at 500 cm (196.9 inches) above grade. Visual inspection confirmed that there were no cavities at either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk. The tomogram at this level did not require resistance drilling.
5. The south scaffold branch was assessed for decay at 560cm (220.5 inches) above grade and 60 cm (23.6 inches) out the branch from the union. Visual inspection confirmed that there were no cavities at either level . The cavity in the union of the south scaffold branch had a fungal conk. It was in poor condition and could not be identified. The threshold for sound wood readings is 30% of the diameter of the branch, ideally 15% on opposite side of the branch.
    a. The diameter of the south scaffold branch at 560 cm was 65.3 cm (25.7 inches) and the 15% threshold would be 9.8 cm (3.9 inches).
        i. the sensor #1 position indicated 18 cm (7.1 inches) of sound wood.
        ii. the sensor #7 position indicated 18 cm (7.1 inches) of sound wood
6. The root collar was inspected with the use of a mallet and did not require further investigation.

ArborSonic 3D™ Tomogram Live Oak #45 - 500 cm



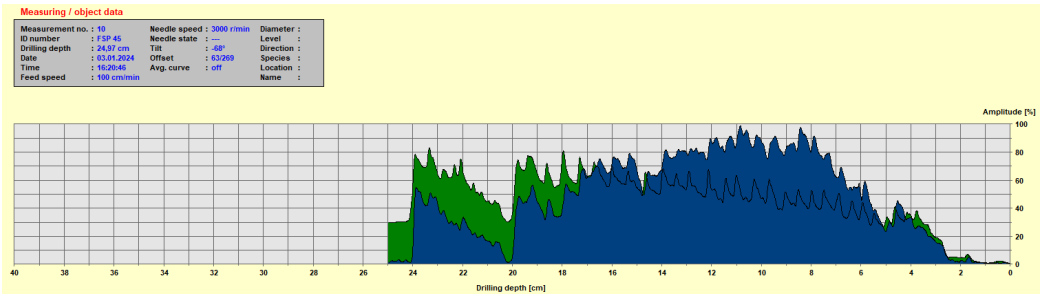
Height: 500 cm; Tomogram indicated negligible decay.

ArborSonic 3D™ Tomogram Live Oak #45 – South Scaffold Branch

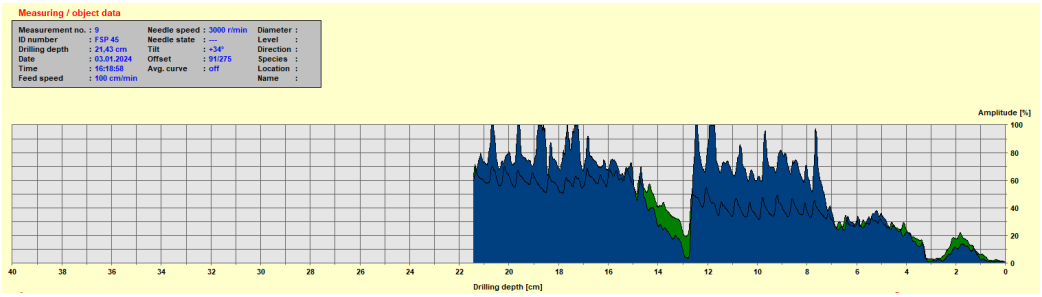


Height: 560 cm; Tomogram indicated a cavity with moderate decay.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #45 – 560 cm



Drilling at 560 cm above grade, the sensor #1 position indicated 18 cm (7.1 inches) of sound wood.



Drilling at 560 cm above grade, the sensor #7 position indicated 18 cm (7.1 inches) of sound wood.

Live Oak #46

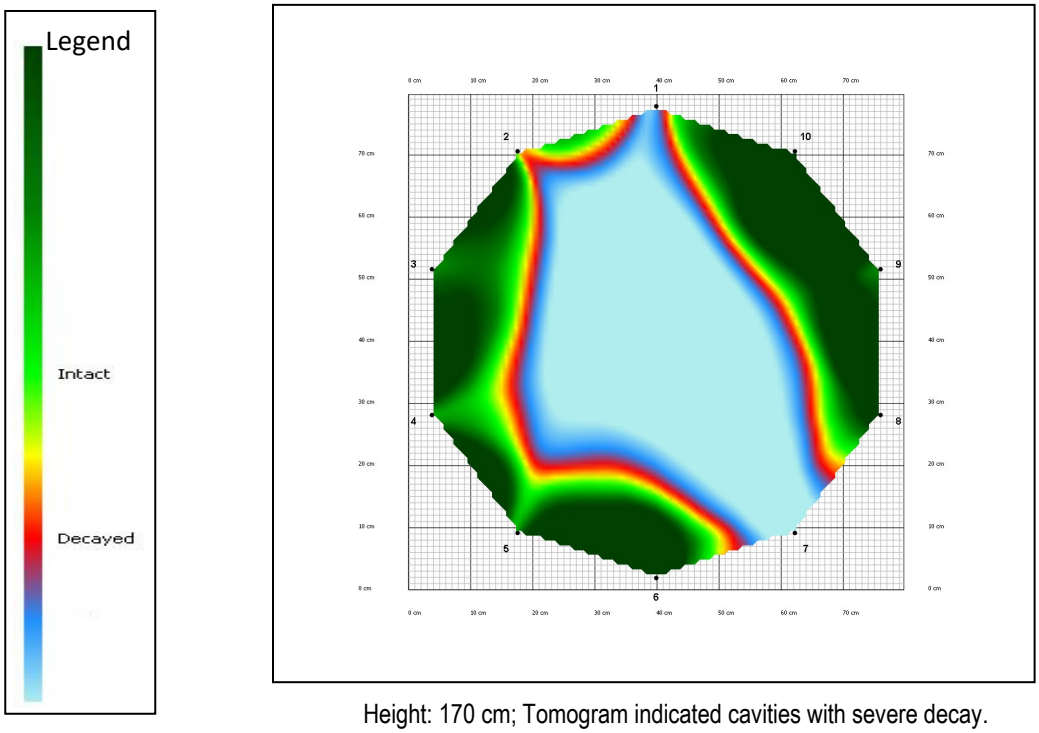
Photo 20: Looking west at live oak #46 showing the uneven crown.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	34 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Moderate dieback Uneven crown Co-dominant stems Stem cavity Fungal conk remnant on root collar
Targets considered	People using the park

Live oak #46, one of the Sisters Oaks, was in fair condition with moderate crown dieback, an uneven crown, decay in the lower stem, and a root zone to the north and west.

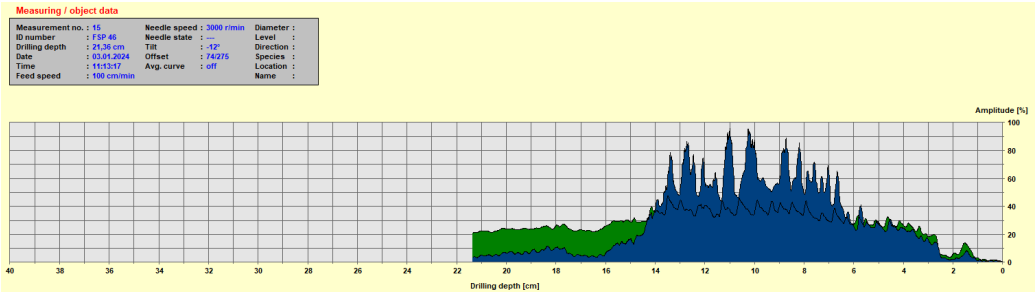
1. The crown exhibited moderate dieback.
2. The uneven crown was most likely the result of growing in close proximity to other large trees. The oak grew towards the east as it competed for sunlight.
3. The co-dominant stems bifurcated at approximately 15 feet above grade.
4. The trunk was assessed for decay at 170 cm (66.9 inches) and 100 cm (43.3 inches) above grade. The tomogram indicated cavities at sensors #1 and #7 at 170 cm and at sensors #2, #7, and #8. Visual inspection confirmed that there were no cavities at either level. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 170 cm was 54.1 cm (21.3 inches) and the 15% threshold would be 8.1 cm (3.2 inches).
        i. the sensor #1 position indicated 14 cm (5.5 inches) of sound wood.
        ii. the sensor #2 position indicated 13 cm (5.1 inches) of sound wood.
        iii. the sensor #3 position indicated 14 cm (5.5 inches) of sound wood.
        iv. the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.
    b. The diameter of the trunk at 110 cm was 87.6 cm (34.5 inches) and the 15% threshold would be 13.1 cm (5.2 inches).
        i. the sensor #1 position indicated 19 cm (7.5 inches) of sound wood.
        ii. the sensor #2 position indicated 10.5 cm (4.1 inches) of sound wood.
        iii. the sensor #3 position indicated 11.5 cm (4.5 inches) of sound wood.
        iv. the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.
        v. the sensor #8 position indicated 21 cm (8.3 inches) of sound wood.
    c. Sensors #2 and #3 in 110 cm level were below the sound wood threshold for sound wood.
5. The lower stem/root collar was assessed for decay at the southeast side where the remnants of a fungal conks was located. The fungal conk could not be identified
        i. the southeast position, above the conk, indicated 31 cm (12.2 inches) of sound wood.
        ii. The southeast position, below the conk, indicated 32 cm (12.6 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #46 – 170 cm

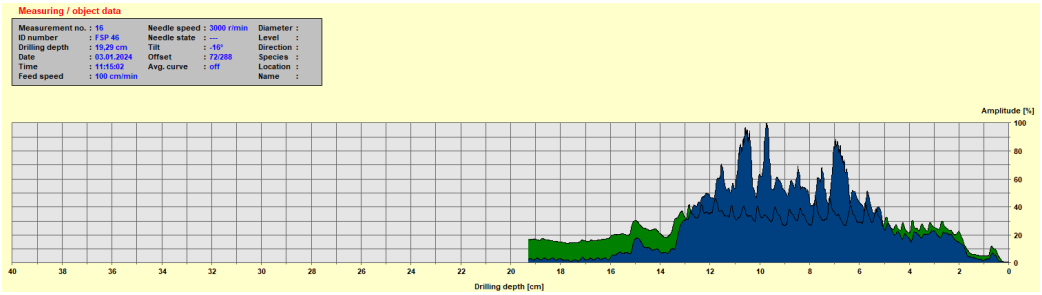


Height: 170 cm; Tomogram indicated cavities with severe decay.

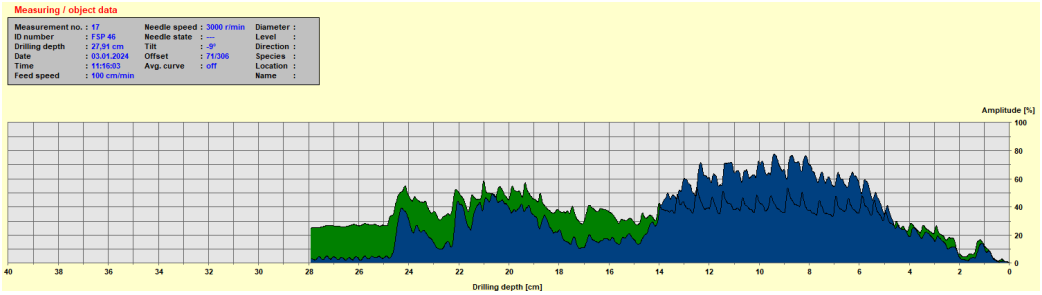
IML Resi-PD 400 Resistance Drill Readings: Live Oak #46 – 170 cm



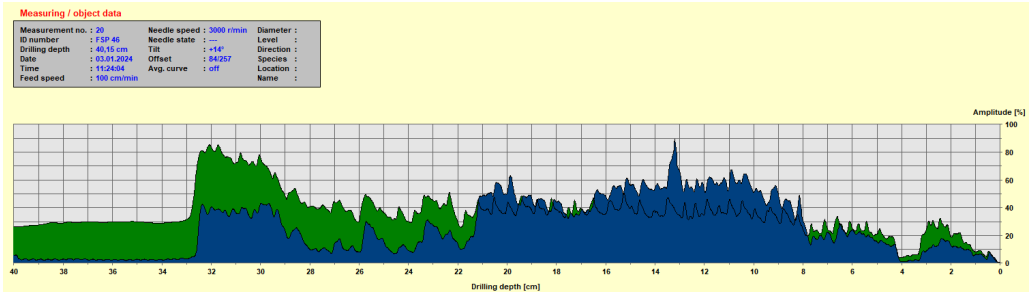
Drilling at 170 cm above grade, the sensor #1 position indicated 14 cm (5.5 inches) of sound wood.



Drilling at 170 cm above grade, the sensor #2 position indicated 13 cm (5.1inches) of sound wood.

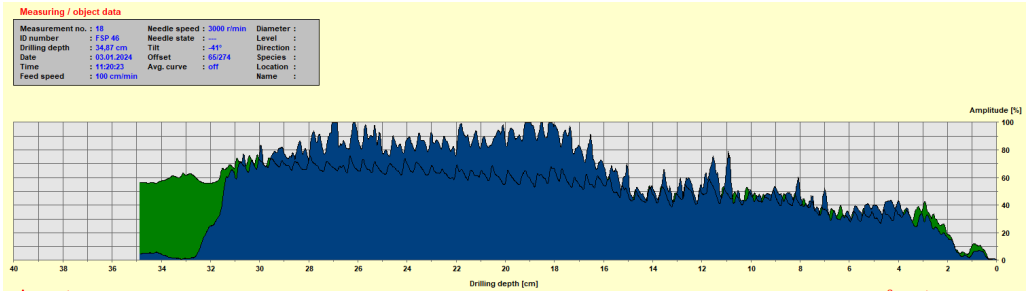


Drilling at 170 cm above grade, the sensor #3 position indicated 14 cm (5.5 inches) of sound wood.

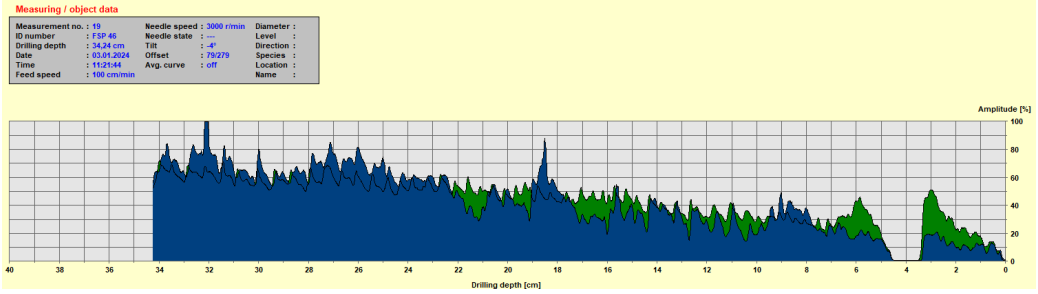


Drilling at 170 cm above grade, the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.

IML Resi-PD 400 Resistance Drill Readings: Live Oak #46 – SE Root Collar

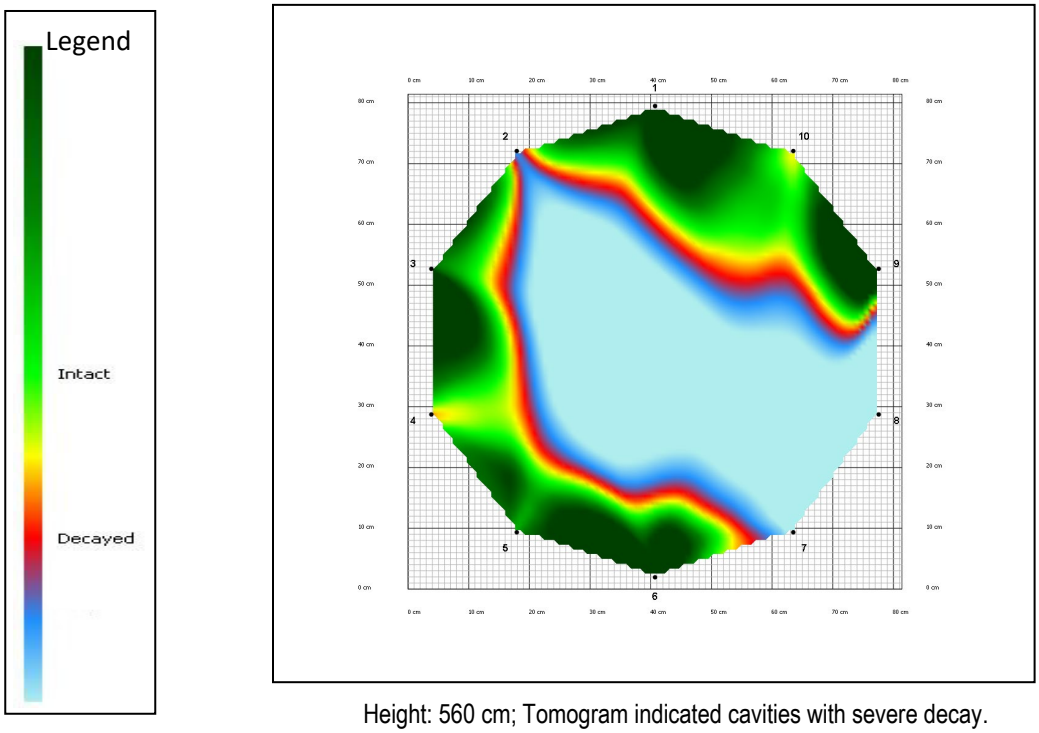


Drilling at the root collar, the positions above the conk indicated 31 cm (12.2 inches) of sound wood.



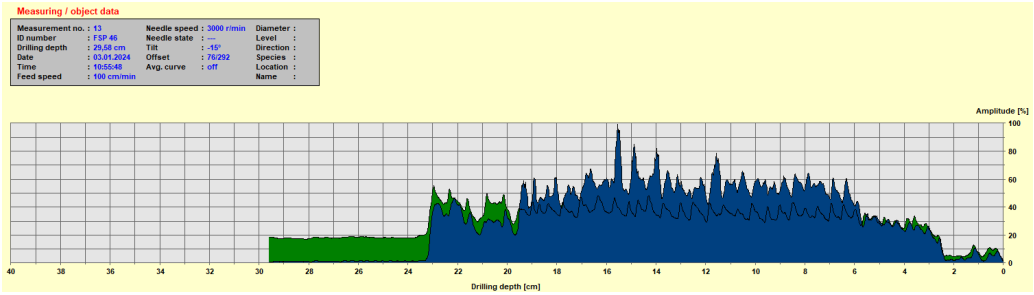
Drilling at the root collar, the positions below the conk indicated 32 cm (12.6 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #46 – 110 cm

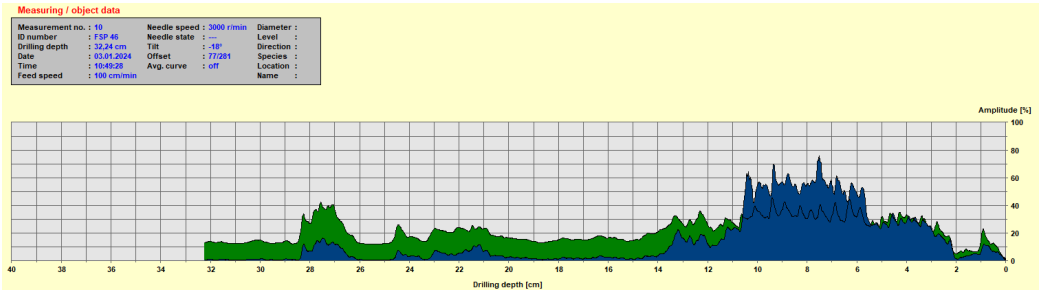


Height: 560 cm; Tomogram indicated cavities with severe decay.

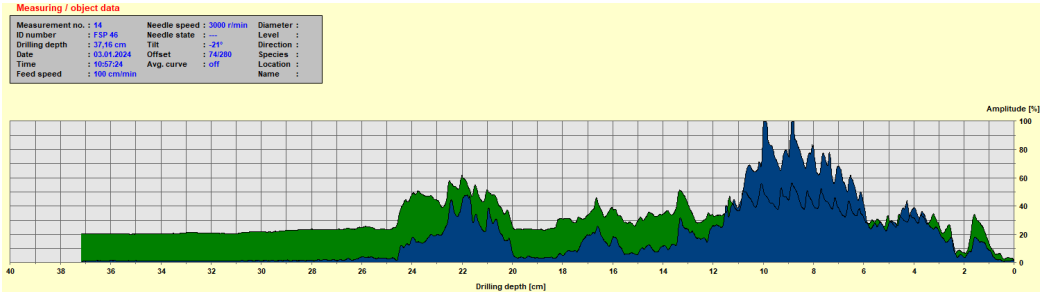
IML Resi-PD 400 Resistance Drill Readings: Live Oak #46 – 110 cm



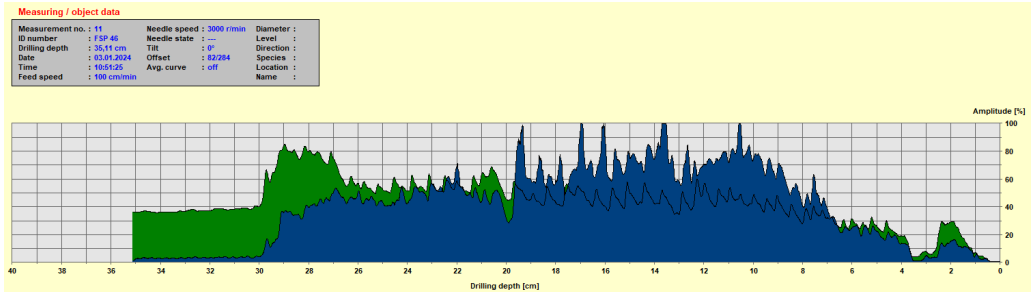
Drilling at 110 cm above grade, the sensor #1 position indicated 19 cm (7.5 inches) of sound wood.



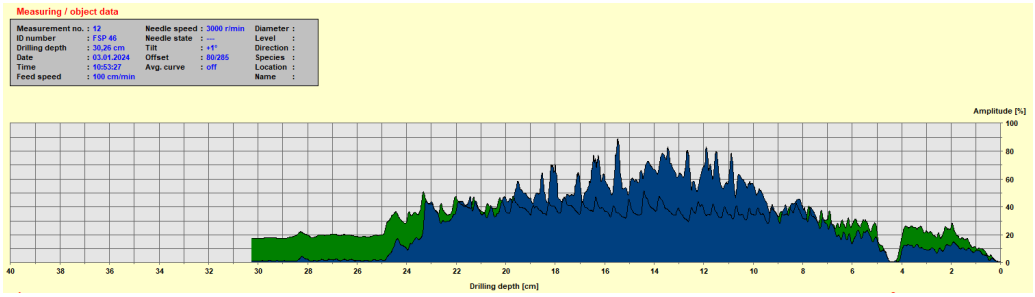
Drilling at 110 cm above grade, the sensor #2 position indicated 10.5 cm (4.1 inches) of sound wood.



Drilling at 110 cm above grade, the sensor #3 position indicated 11.5 cm (4.5 inches) of sound wood.



Drilling at 110 cm above grade, the sensor #7 position indicated 23 cm (9.1 inches) of sound wood.



Drilling at 110 cm above grade, the sensor #8 position indicated 21 cm (8.3 inches) of sound wood.

Sand Live Oak #49

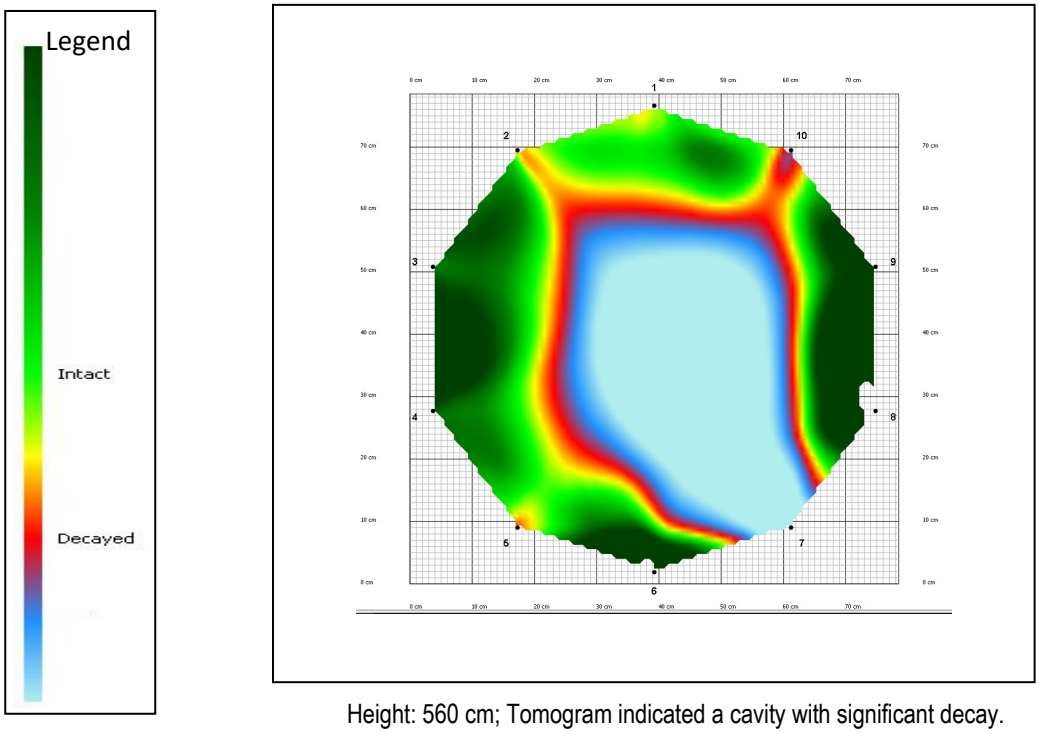
Photo 21: Looking west at live oak #49 showing the raised planting bed.

Observations	
Species	Sand Live Oak (*Quercus geminata*)
Diameter at 54 inches	33 inches
Height	~35 feet
Condition	Fair
Soil Conditions	Restricted in raised bed
Defects	Dead branches Co-dominant stems Stem decay Buried root collar
Targets considered	People using the park, building, vehicles on road and parked

Sand live oak #49 was in fair condition with dead branches throughout the crown, co-dominant stems, a cavity in the trunk, and a buried root collar.

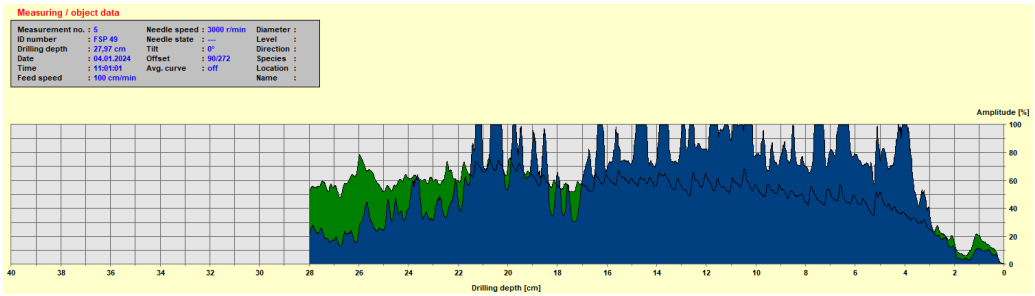
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The co-dominant stems bifurcated at approximately 12 feet above grade.
3. The trunk was assessed for decay at 100 cm (39.3 inches) and 40 cm (15.7 inches) above grade. The tomogram indicated cavities at sensor #7 at both levels. Visual inspection confirmed that there were no cavities. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 100 cm was 82.8 cm (32.6 inches) and the 15% threshold would be 12.4 cm (4.9 inches).
        i. the sensor #2 position indicated 20 cm (7.9 inches) of sound wood.
        ii. the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.
        iii. the sensor #10 position indicated 22 cm (8.7 inches) of sound wood.
    b. The diameter of the trunk at 40 cm was 84.4 cm (33.2 inches) and the 15% threshold would be 12.7 cm (5 inches).
        i. the sensor #1 position indicated 12 cm (4.7 inches) of sound wood.
        ii. the sensor #2 position indicated 15 cm (5.9 inches) of sound wood.
        iii. the sensor #3 position indicated 20 cm (7.9 inches) of sound wood.
        iv. the sensor #7 position indicated 22 cm (8.7 inches) of sound wood.
    c. Sensor #1 at 40 cm was below the sound wood threshold for that level.
4. The root collar was buried with approximately four to six inches of soil and/or mulch. The raise bed also restricted root growth.

ArborSonic 3D™ Tomogram Live Oak #49 – 100 cm

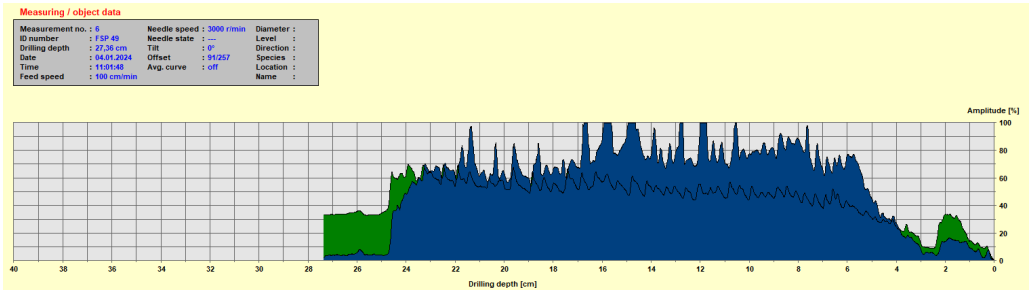


Height: 560 cm; Tomogram indicated a cavity with significant decay.

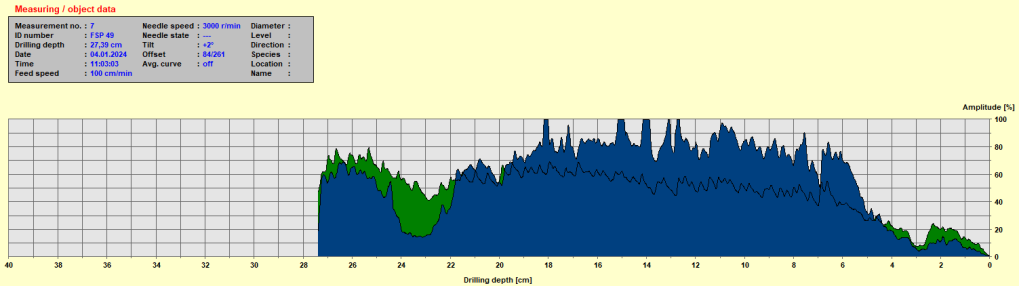
IML Resi-PD 400 Resistance Drill Readings: Live Oak #49 – 100 cm



Drilling at 100 cm above grade, the sensor #2 position indicated 20 cm (7.9 inches) of sound wood.

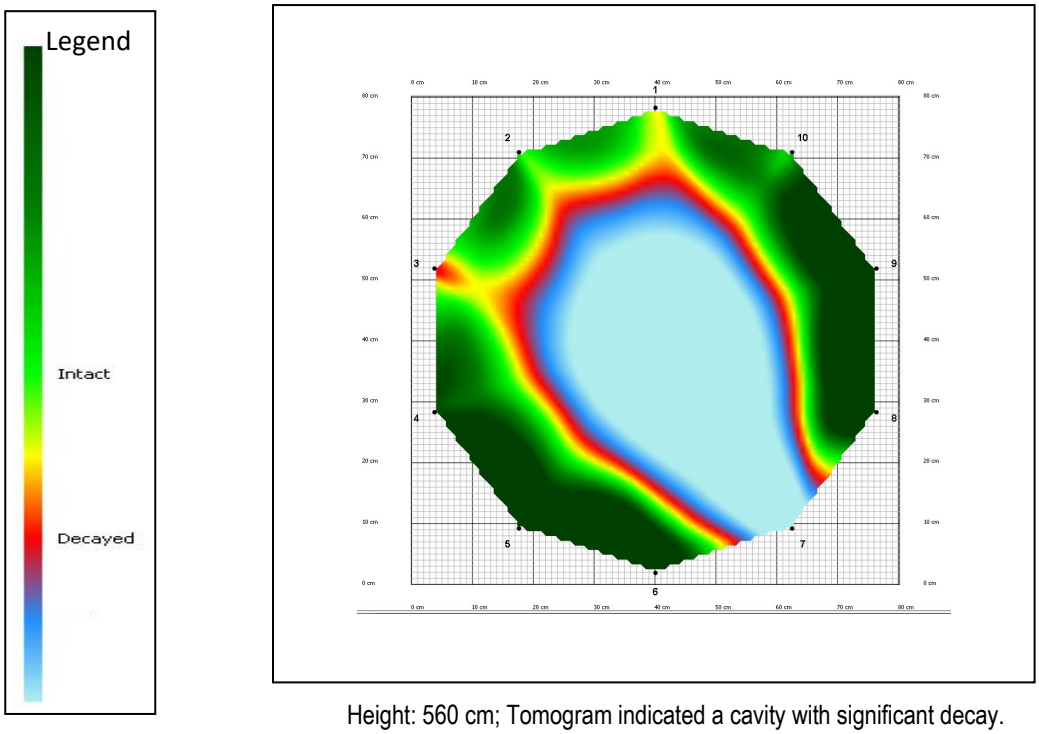


Drilling at 100 cm above grade, the sensor #7 position indicated 24 cm (9.4 inches) of sound wood.



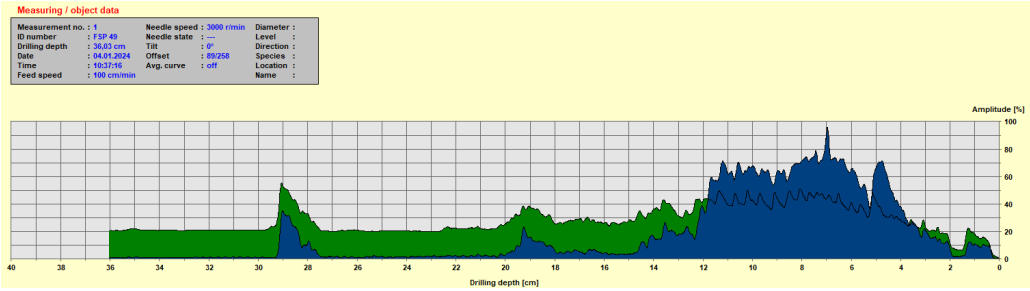
Drilling at 100 cm above grade, the sensor #10 position indicated 22 cm (8.7 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #49 – 40 cm

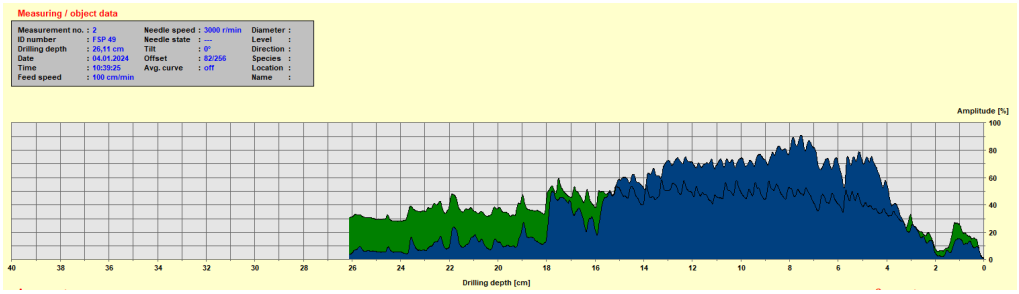


Height: 560 cm; Tomogram indicated a cavity with significant decay.

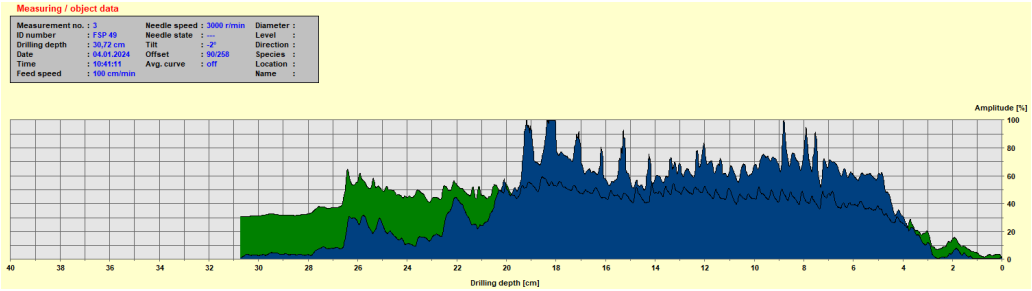
ML Resi-PD 400 Resistance Drill Readings: Live Oak #49 – 40 cm



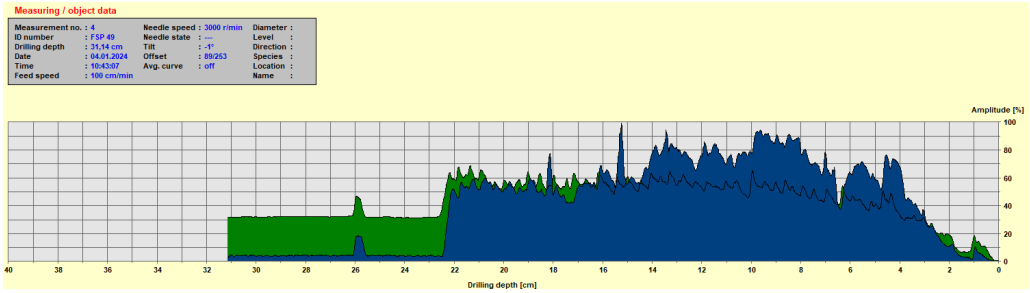
Drilling at 40 cm above grade, the sensor #1 position indicated 12 cm (4.7 inches) of sound wood.



Drilling at 40 cm above grade, the sensor #2 position indicated 15 cm (5.9 inches) of sound wood.



Drilling at 40 cm above grade, the sensor #3 position indicated 20 cm (7.9 inches) of sound wood.



Drilling at 40 cm above grade, the sensor #7 position indicated 22 cm (8.7 inches) of sound wood.

Live Oak #50

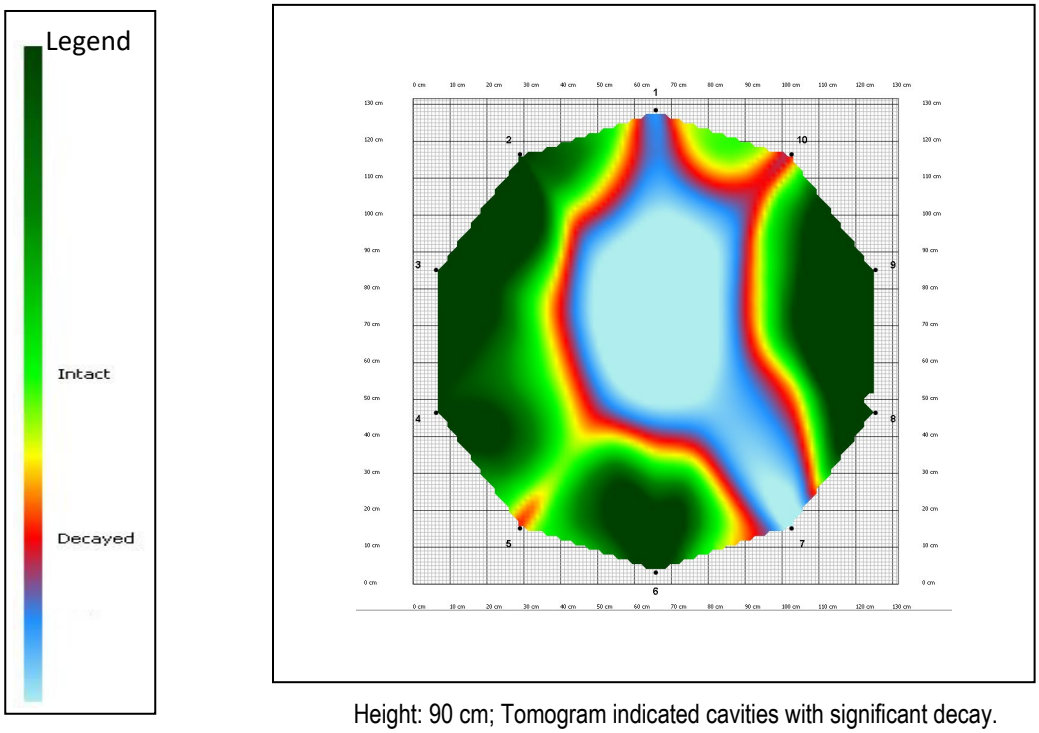
Photo 22: Looking east at live oak #50 showing the co-dominant stems.

Observations	
Species	Live Oak (*Quercus virginiana*)
Diameter at 54 inches	53 inches
Height	~50 feet
Condition	Fair
Soil Conditions	Well-drained
Defects	Dead branches Co-dominant stems Stem cavity
Targets considered	People using the park, vehicles on road, building

Live oak #50 was in fair condition with dead branches throughout the crown, co-dominant stems, and a cavity in the trunk.

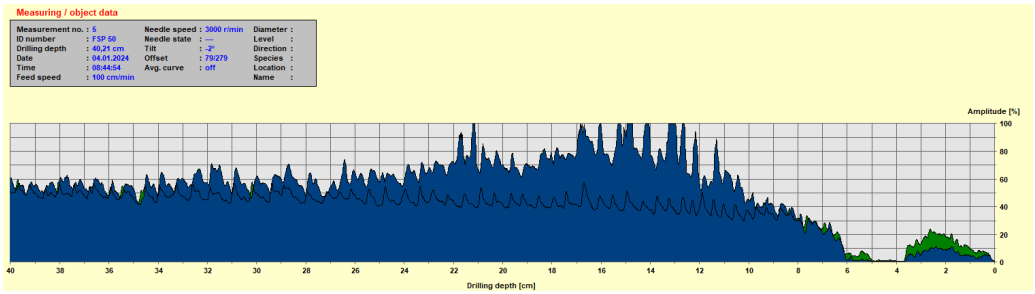
1. The live oak had dead branches estimated to be two to four inches in diameter and larger.
2. The co-dominant stems bifurcated at approximately nine feet above grade.
3. The trunk was assessed for decay at 90 cm (35.4 inches) and 30 cm (11.8 inches) above grade. The tomogram indicated cavities at sensors #1 and #7 at both levels. Visual inspection confirmed a wide shallow cavity associated with the sensor #1 positions. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk.
    a. The diameter of the trunk at 90 cm was 135.4 cm (53.3 inches) and the 15% threshold would be 20.3 cm (8 inches).
        i. the sensor #1 position indicated 38 cm (15 inches) of sound wood.
        ii. the sensor #7 position indicated 36 cm (14.2 inches) of sound wood.
        iii. the sensor #10 position indicated 34 cm (13.4 inches) of sound wood.
    b. The diameter of the trunk at 30 cm was 143.3 cm (56.4 inches) and the 15% threshold would be 21.5 cm (8.5 inches).
        i. the sensor #1 position indicated 31 cm (12.2 inches) of sound wood.
        ii. the sensor #3 position indicated 36 cm (14.2 inches) of sound wood.
        iii. the sensor #10 position indicated 30 cm (11.8 inches) of sound wood.

ArborSonic 3D™ Tomogram Live Oak #50 – 90 cm

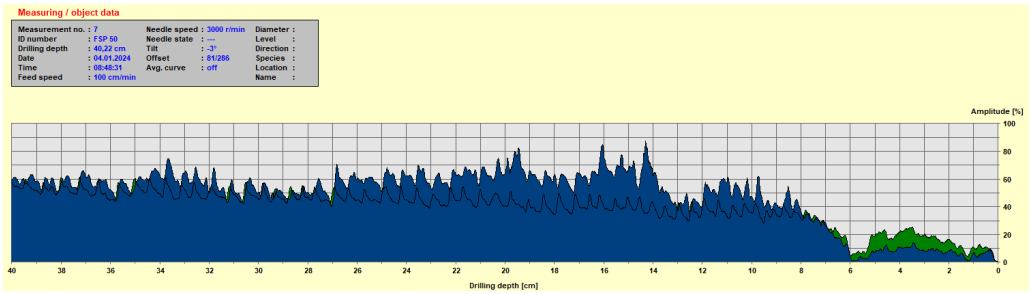


Height: 90 cm; Tomogram indicated cavities with significant decay.

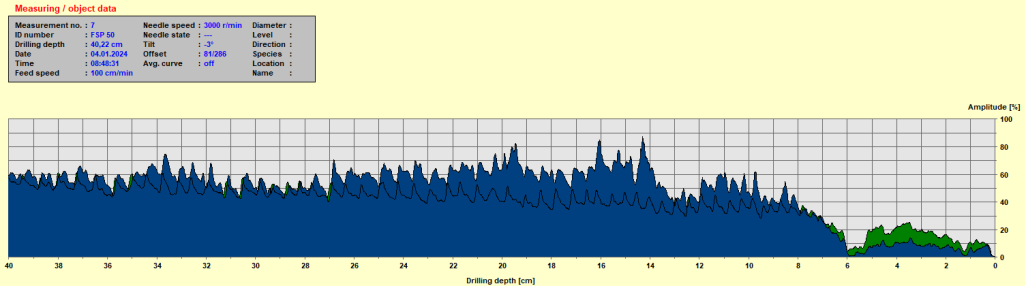
IML Resi-PD 400 Resistance Drill Readings: Live Oak #50 – 90 cm



Drilling at 90 cm above grade, the sensor #1 position indicated 38 cm (15 inches) of sound wood.

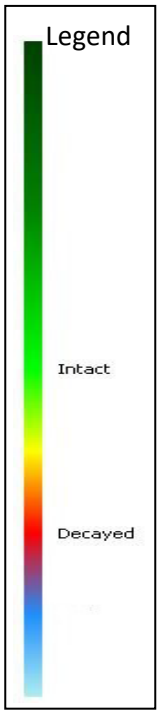


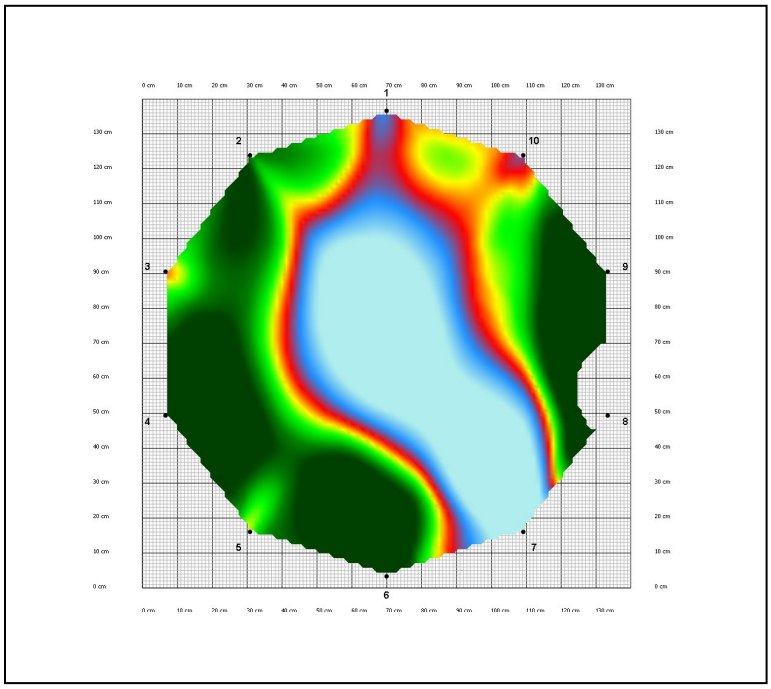
Drilling at 100 cm above grade, the sensor #7 position indicated 36 cm (14.2 inches) of sound wood.



Drilling at 90 cm above grade, the sensor #10 position indicated 34 cm (13.4 inches) of sound wood.

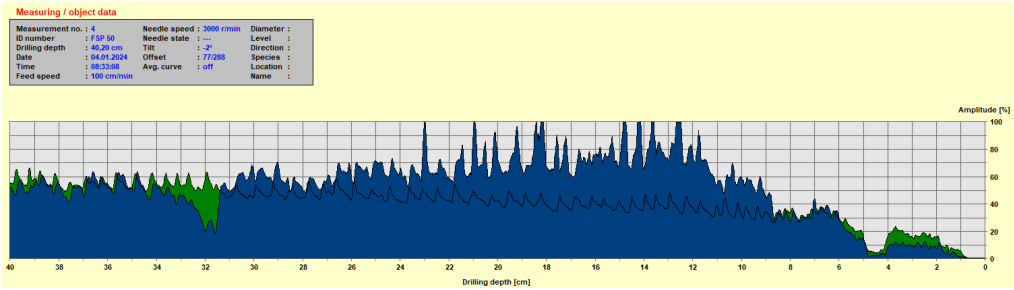
ArborSonic 3D™ Tomogram Live Oak #50 – 30 cm



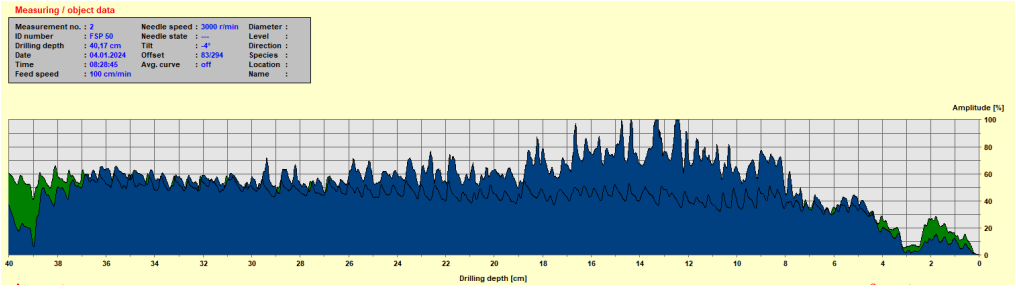


Height: 30 cm; Tomogram indicated cavities with significant decay.

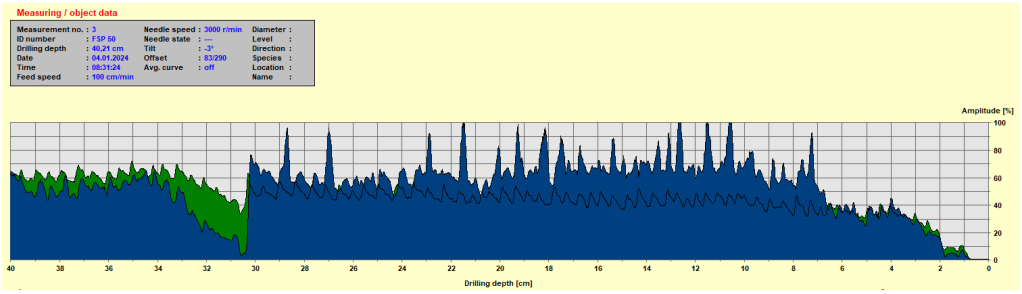
ML Resi-PD 400 Resistance Drill Readings: Live Oak #50 – 30 cm



Drilling at 30 cm above grade, the sensor #1 position indicated 31 cm (12.2 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #7 position indicated 36 cm (14.2 inches) of sound wood.



Drilling at 30 cm above grade, the sensor #10 position indicated 30 cm (11.8 inches) of sound wood.

Tree Risk Assessment

After discussing the site's usage and **occupancy rates** throughout the course of the year with you, combined with my observations during the assessment, we determined that within the tree's **target zone**:

- People were an **occasional** target,
- Vehicles were an occasional target,
- Overhead lines were a **constant**,
- Building were a constant target, and
- Propane tanks were a constant target.

In determining the risk ratings, I considered a tree or tree part failure impacting a person to have one of the highest consequences, either **significant** or **severe**. I considered a tree or tree part failure impacting the overhead lines and the propane tanks as having significant consequences. I considered a tree or tree part failure impacting vehicles or a building as having moderate or significant consequences.

I used a time frame of three years when I assessed the likelihood of tree or tree part failure. Following industry standards, the time frame is one factor used in the equation to determine tree risk. Trees and sites change on a daily basis. You should not consider this time frame a "guarantee period" for the risk assessment or that the tree will not fail or is safe within this time frame.

The concerns observed during the assessment that resulted in the highest risk rating for each tree are provided in the Tree Risk Assessments and Ratings table in the Attachments.

Using the methods outlined in this report and the results of the assessments of the 22 live oaks, it is my professional judgment that:

- Live oak #8 and #45 had a *moderate* risk rating for trunk failure within the next three years,
- Live oaks #1, #3, #5,#10,#14, #15, #16, #18, #22, #24, #25, #29, #35, #39, #40, #43, #44, #46, #49 and #50 had a *low* risk rating for trunk failure within the next three years.

If these levels of risk are not acceptable to you, then mitigation actions should be taken as soon as practical to reduce the risk to an acceptable level.

Discussion

The 22 live oaks had various deficiencies that increased their likelihood of failure. The location of the trees, growing in a tightly spaced grove, buffers winds and helps to mitigate some of the strength lost to the defects. It is one of the main reasons they have not yet failed.

A majority of the live oaks had dead branches found throughout the interior of the crown. These are a naturally occurring part of a tree's life cycle and commonly found in trees of this size. They do not indicate poor health and are a result of diminished sunlight reaching the foliage on these branches.

Live oaks #43, #44, #45, and #46, The Sisters, had moderate crown dieback which differs from

naturally dying branches in that it starts at the tips and proceeds down into the crown. It is a symptom of a plant health issue adversely affecting the vascular system of the tree.

Live oaks are deciduous trees that rely on tension wood to keep their trunks vertical and their scaffold branches horizontal.

A majority of the live oaks had an unbalanced crown. Trees with an unbalanced crown will have significantly more foliage and branches growing to one side. This increases the stress on, and the likelihood of failure of the lower trunk and root system, especially in windy conditions and saturated soil.

A majority of the live oaks had co-dominant stems. Co-dominant stems are stems or large branches of a similar diameter the originate at the same point in a tree. Due to this competition, the tree cannot produce alternating layers of trunk wood and branch wood. The alternating layers give the trunk and branch unions their strength. Trees with co-dominant stems are structurally weaker than those with a single stem.

A lean of more than 7° off vertical, as live oaks #16 and #43 have, is considered a severe lean. A severe trunk lean increases the stress on, and the likelihood of failure of the lower trunk root system, especially in windy conditions and saturated soils.

All 22 trees had either cavities or indications of decay in their stems. Trees can survive and be structurally sound even with cavities and/or decay depending on their ability to resist the spread of decay. Live oaks resist the spread of decay very well in the trunk. The threshold for sound wood readings is 30% of the diameter of the trunk, ideally 15% on opposite side of the trunk. Live oaks #16 and #24 had readings below the sound wood thresholds for those levels. Live oaks #24 and #35 had vertical cracks in their trunks. These act in a similar way as cavities reducing structural stability.

Four of the live oaks had fungal conk on their stems or roots. The conks on live oak #5 were identified a *Inonotus hispidus and Fomitiporis dryophila*. These wood decay organisms are associated with white rot in trees. They break down the cellulose and lignin in the cells and leave soft, spongy, whitish colored tissue. Live oaks #3, #16, and #46 had remnants of conks that could not be identified.

Live oaks #39, #40, and #49 had restricted root zones for either asphalt parking lots and/or a raised bed. These restrictions reduce the available area for roots to spread out to provide support and nutrient/water uptake for the trees.

Live oak #15 had a stem girdling root. These roots compress the root collar and/or lower trunk. This reduces the translocation of water and nutrients from the roots through the trunk and branches to the leaves.

Risk Mitigation Options

Options to mitigate the risk associated with the live oaks are listed below. Please make sure the estimated overall residual risk rating is acceptable to you before deciding on a specific option.

- Option One:
  I recommend removing live oaks #3, #24, and #25 entirely to remove the risk of root, root collar, trunk, crown, and branch failure. Grind the resulting stumps and back fill the

holes. There will be no residual risk for these three trunks, crowns, or branches, but there may be a tripping hazard with the remaining roots, stump, or grindings that you will need to address for all three trees.

I recommend the remaining 18 trees be pruned to remove dead branches 2 inches and larger in diameter, reduce the spread and weight of their crowns, and thinned so that winds easily move through their canopies, reducing the likelihood of branch, stem, or root failure. Completing the pruning would resulting maintaining the low overall risk rating and reducing the likelihood of failure.

I recommend installing cables in the live oaks #35, #43, #44, #45,and #46 to provide support to co-dominant stems. Completing the installation of cables would aid in maintaining an overall risk rating and likelihood of failure.

I recommend installing lightning protection systems in live oak #5, #8, #16, #22, #35, #43, #44, #45, and #46 to reduce the likelihood of these trees being damaged by lightning strikes.

I recommend for the 18 live oaks not identified for removal implementing a soil management program based on soil testing to try and correct nutrient deficiencies and/or toxicities that may be detrimental to plant health.

- Option Two:
  If you elect to not remove the trees, the risk of trunk failure will remain low for live oaks #3, #24, and #25. Pruning to reduce the relative size of the crown on each tree may result in an estimated residual risk of ***low*** for branch or crown failure. These four trees should have root collar excavations performed if they are to remain on site.

- Option Three:
  If you elect to not to remove the trees, or prune to remove dead branches and reduce the relative size of the crowns, the risk of trunk failure will remain *moderate* for live oak #8 and #45 and low for stem failure for the other 20 live oaks. Each tree's risk may increase in the future as a result of not performing mitigation.

For all live oaks that remain, I recommend an inspection interval of every 12 months and after major storm events.

All recommended work should be performed by qualified arborists and in accordance with industry accepted standards and best management practices set forth by the *American National Standards Institute* and the *International Society of Arboriculture.*

Limitations

Assignment

My ground based and aerial assessments of the designated tree on the Franklin Square Park were based on site visits on January 2,3,4,and 5, 2023. All photographs, samples, and readings, if applicable, were taken at the time the assessment was performed.

The assessment was limited to visible and accessible portions of the root collar and canopy.

Sonic Tomography

Sonic tomography devices can provide sophisticated results related to tree structure. This is

done by using sound wave technology that is directed through the tree and recorded. However, as with any higher-level technology, the amount of structural integrity loss shown can vary based on the version of the program software used. Therefore, this technology can be limited and should not be used by the tree owner/manager as the sole decision-making criteria, but rather one of many factors used in the decision-making process.

Resistance Drilling

Resistance drilling devices can provide sophisticated results related to tree structure. This is done by measuring the amount of resistance the drill bit encounters. However, as with any higher-level technology, the amount of structural integrity loss shown can vary based on the version of the program software used. Therefore, this technology can be limited and should not be used by the tree owner/manager as the sole decision-making criteria, but rather one of many factors used in the decision-making process.

Tree Risk Assessments

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 outlined in the *International Society of Arboriculture's Best Management Practices for Tree Risk Assessment* and *Assessment* and *American National Standards Institute A300 Tree Risk Assessment Standard*, as well as the information available at the time of the inspection. However, the overall tree 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.

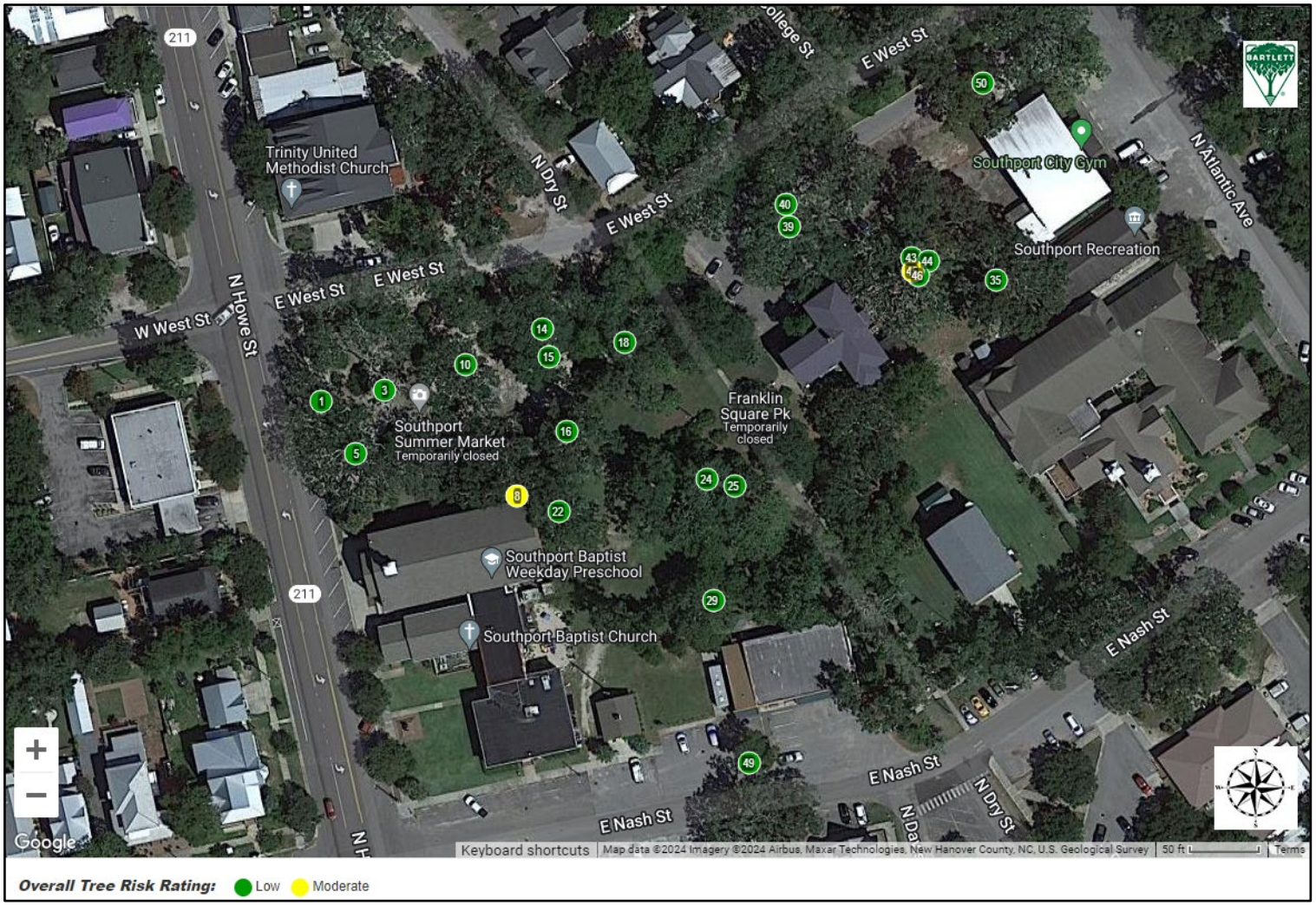
Bartlett Tree Experts can make no warranty or guarantee whatsoever regarding the safety of any tree, trees, or parts of trees, regardless of the level of tree risk assessment provided, the risk rating, or the residual risk rating after mitigation. The information in this report should not be considered as making safety, legal, architectural, engineering, landscape architectural, 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.

Thank you for the opportunity to provide this information. Please contact me if you wish to review these results or discuss the next steps to take with mitigation, or if I can be of any other service in the management of your landscape.

John Colavecchio

John Colavecchio
Southeast Division Consulting Arborist
ASCA Registered Consulting Arborist #649
ISA Certified Arborist NE-1070A
ISA Tree Risk Assessment Qualified
Encl. **Site Map**
Tree Risk Assessments and Ratings
Tree Risk Assessment Vocabulary

Site Map


211
Trinity United Methodist Church
N Dry St
E West St
Southport City Gym
N Atlantic Ave
Southport Recreation
W West St
N Howe St
Southport Summer Market
Temporarily closed
Franklin Square Pk
Temporarily closed
Southport Baptist Weekday Preschool
Southport Baptist Church
E Nash St
Google
Keyboard shortcuts
Map data ©2024 Imagery ©2024 Airbus, Maxar Technologies, New Hanover County, NC, U.S. Geological Survey
50 ft
Terms
Overall Tree Risk Rating:
Low
Moderate

Tree Risk Assessments and Ratings

TABLE 1. TREE RISK ASSESSMENTS AND RATINGS

Tree ID	Common Name	DBH	Condition	*Overall Tree Risk Rating*	Primary Target	Tree & Shrub Work Phase	Recommendation	Defect(s) or Observation(s)
45	Oak-Live	43	Fair	Moderate	Building	ASAP	• Prune: Reduce risk of branch stem and/or root failure • LP • Cable: New 2	• Cavity-stem • Dead branches >2 • Uneven crown
8	Oak-Live	53	Fair	Moderate	Building	1	• Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends • LP	• Cavity-stem • Co-dominant stems • Dead branches <=2
10	Oak-Live	32	Fair	Low	Bench	ASAP	• Prune: Reduce risk of branch stem and/or root failure	• Cavity-branch • Dead branches >2 • Wound-stem
35	Oak-Live	61	Fair	Low	Building	ASAP	• Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends • LP • Cable: New 4 • Brace Rod: New 1	• Cavity-stem • Co-dominant stems • Crack-stem • Dead branches >2

Tree ID	Common Name	DBH	Condition	*Overall Tree Risk Rating*	Primary Target	Tree & Shrub Work Phase	Recommendation	Defect(s) or Observation(s)
43	Oak-Live	37	Poor	Low	Parking	ASAP	• Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends • Cable: New 2	• Cavity-stem • Dieback (severe) • Lean
44	Oak-Live	36	Fair	Low	Play area	ASAP	• Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends • Cable: New 2	• Cavity-stem • Dead branches >2
46	Oak-Live	34	Fair	Low	Play area	ASAP	• Prune: Reduce risk of branch stem and/or root failure • Cable: New 2	• Cavity-stem • Dead branches >2 • Uneven crown
3	Oak-Live	40	Poor	Low	Walking path	ASAP	• Removal	• Cavity-stem • Co-dominant stems • Dead branches >2 • Lion tailing
24	Oak-Live	35	Fair	Low	Walking path	ASAP	• Removal	• Cavity-stem • Crack-stem • Uneven crown
25	Oak-Live	23	Fair	Low	Walking path	ASAP	• Removal	• Cavity-branch • Co-dominant stems • Dead branches >2 • Uneven crown
1	Oak-Live	32	Fair	Low	Sidewalk	1	• Prune: Reduce risk of branch stem and/or root failure	• Cavity-root flare • Cavity-stem • Co-dominant stems • Dead branches >2

Tree ID	Common Name	DBH	Condition	*Overall Tree Risk Rating*	Primary Target	Tree & Shrub Work Phase	Recommendation	Defect(s) or Observation(s)
4	Oak-Live	39	Good	Low	Parking	1	• Prune: Reduce risk of branch stem and/or root failure	• Co-dominant stems • Dead branches >2 • Uneven crown
5	Oak-Live	47	Fair	Low	Sidewalk	1	• Prune: Reduce risk of branch stem and/or root failure • LP	• Co-dominant stems • Crack-stem • Dead branches >2 • Fungi/conks
14	Oak-Live	47	Fair	Low	Walking path	1	• Prune: Reduce risk of branch stem and/or root failure • LP • RCX	• Cavity-suspected • Co-dominant stems • Dead branches >2
15	Oak-Live	29	Fair	Low	Walking path	1	• Prune: Reduce risk of branch stem and/or root failure	• Co-dominant stems • Dead branches >2 • Fungi/conks
16	Oak-Live	42	Fair	Low	Walking path	1	• Prune: Reduce risk of branch stem and/or root failure • LP • RCX	• Cavity-stem • Co-dominant stems • Dead branches >2 • Uneven crown
18	Oak-Live	28	Fair	Low	Walking path	1	• Prune: Reduce risk of branch stem and/or root failure	• Co-dominant stems • Dead branches >2 • Uneven crown
22	Oak-Live	33	Fair	Low	Building	1	• Prune: Reduce risk of branch stem and/or root failure • LP	• Cavity-suspected • Co-dominant stems • Dead branches >2
29	Oak-Live	40	Fair	Low	Walking path	1	• Prune: Reduce risk of branch stem and/or root failure	• Buried root collar • Co-dominant stems • Dead branches >2

Tree ID	Common Name	DBH	Condition	*Overall Tree Risk Rating*	Primary Target	Tree & Shrub Work Phase	Recommendation	Defect(s) or Observation(s)
39	Oak-Live	40	Fair	Low	Parking	1	• Prune: Reduce risk of branch stem and/or root failure	• Co-dominant stems • Dieback (moderate) • Pavement/curbing damage
40	Oak-Live	28	Fair	Low	Street	1	• Prune: Reduce risk of branch stem and/or root failure • Prune: Reduce weight of branch ends • RCX	• Fungi/conks • Storm damage • Wound-stem
49	Oak-Sand Live	33	Fair	Low	Parking	1	• Prune: Reduce risk of branch stem and/or root failure	• Buried root collar • Co-dominant stems • Dead branches >2
50	Oak-Live	53	Fair	Low	Street	1	• Prune: Reduce risk of branch stem and/or root failure	• Cavity-stem • Co-dominant stems • Dead branches >2

Tree Risk Assessment Vocabulary

Tree risk assessment has a unique set of terminology with specific meanings. A complete list of tree risk vocabulary and procedures may be found in the International Society of Arboriculture's (ISA) *Best Management Practice (BMP) for Tree Risk Assessment* or the American National Standards Institute (ANSI) *A300 Tree Risk Assessment Standard*. The following information is provided to assist the owner/client with understanding some of the common industry phrases or language, and some of the procedures and methodologies associated with the industry language used in the proposal and/or report.

Vocabulary Used Throughout Proposals and Reports

Inspection interval is the recommended amount of time between inspections or assessments.

Occupancy rates categorize the estimated time a target is physically within a target zone. Occupancy rate is classified as rare, occasional, frequent, or constant.

Overall risk rating is the highest individual risk identified for the tree.

Residual risk is the estimated level of risk that will remain after the recommended mitigation efforts to reduce the risk have been made. This estimate is provided to help the client understand that some level of risk may still exist and plan appropriately for future risk management.

Risk is the likelihood of an event and its consequences.

Risk rating for a tree or tree part is the combination of the likelihood of failure, the likelihood of impact, and the consequences.

Time frame is the period the assessor uses in which to estimate the likelihood of failure in all categories except the "imminent" category. The use of a time frame is meant solely to help the assessor better determine the portions of the risk analysis which are time dependent. The owner/client should never consider the time frame a "guarantee period" for the risk assessment or that the tree will not fail or is safe within the stated time frame.

Targets are people, property, or activities that could be injured, damaged, or disrupted by a tree or tree part failure.

Target occupancy rates are typically identified based on information obtained from the owner/client prior to conducting the assessment, as well as information gained during the limited time the assessor evaluates the tree and site. Targets, target zones, and occupancy rates may be adjusted based on observations during the assessment.

Target zones are the areas where a tree or tree part is likely to land if it were to fail. The target zone(s) is determined in the field at the time of the assessment.

Trees can generally be defined as a woody perennial plant with a single trunk, defined crown, and will reach a minimum height of 15 feet at maturity.

Tree parts include branches, fruit, and trunks.

Tree risk is the likelihood of a tree failure impacting a target and the severity of the consequences.

Vocabulary Used Throughout Proposals and Reports

Tree risk assessment is the systematic process used to identify, analyze, and evaluate tree risk. Tree risk assessments are conducted to assist the tree owner or client in better understanding the risk their trees pose so they can make management decisions to reduce or minimize those risks. Tree risk assessments focus on evaluating the structural integrity of the tree crown, branches, trunks, and roots and root collar.

Tree risk assessors are trained arborists or qualified professionals with experience in performing tree risk assessments.

Vocabulary Used to Communicate Occupancy Rates

Constant indicates a target is present in the target zone at nearly all times, 24 hours a day, seven days a week.

Frequent indicates a target is present in the target zone for a large portion of the day or week.

Occasional indicates a target is present in the target zone infrequently or irregularly.

Rare indicates a target zone that is not commonly used by people or other mobile/movable targets.

Vocabulary Used to Communicate the Likelihood of Failure

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

Probable indicates that failure may be expected under normal weather conditions within the specified time frame.

Possible indicates that failure could occur, but is unlikely under normal weather conditions within the specified time frame.

Improbable indicates that failure is not likely during normal weather conditions, and it may not fail in extreme weather conditions within the specified time frame.

Vocabulary Used to Communicate the Likelihood of Impacting a Target

High indicates that a failed tree or tree part will most likely impact a target.

Medium indicates the failed tree or tree part could impact the target but is not expected to do so.

Low indicates that the failed tree or tree part is not likely to impact a target.

Very low indicates that the likelihood of a failed tree or tree part impacting the specified target is remote.

Vocabulary Used to Communicate the Likelihood of a Failure Impacting a Target

Very likely to impact a target is reached by an imminent likelihood of failure and high likelihood of impact.

Likely to impact a target can be reached by an imminent likelihood of failure and medium likelihood of impact; or probable likelihood of failure and high likelihood of impact.

Somewhat likely to impact a target can be reached by one of the following combinations; an imminent likelihood of failure and low likelihood of impact; probable likelihood of failure and medium likelihood of impact; or possible likelihood of failure and high likelihood of impact.

Vocabulary Used to Communicate the Likelihood of a Failure Impacting a Target

Unlikely to impact a target can be reached by one of the following combinations; a possible or probable likelihood of failure and low likelihood of impact; possible likelihood of failure and medium likelihood of impact; improbable likelihood of failure with any likelihood of impact rating; or any likelihood of failure rating with very low likelihood of impact.

Vocabulary Used to Communicate the Consequences of Failure and Impact

Severe consequences could involve serious personal injury or death, high-value property damage, or major disruption to important activities.

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

Minor consequences are those that are believed will only cause minor personal injury, low-to-moderate-value property damage, or small disruption of activities.

Negligible consequences are those that are believed will not result in personal injury, will only involve low-value property damage, or disruptions that can be replaced or repaired.

Vocabulary Used to Communicate Overall Risk Ratings

Extreme risk applies in situations in which failure is imminent, there is a high likelihood of impacting the target, and the consequences of the failure are severe.

High risk situations are those for which consequences are significant and likelihood is very likely or likely; or consequences are severe and likelihood is likely.

Moderate risk situations are those for which consequences are minor and likelihood is very likely or likely; or likelihood is somewhat likely and consequences are significant or severe.

Low risk situations are those for which consequences are negligible and likelihood is unlikely; or consequences are minor and likelihood is somewhat likely.

Explanation of Tree Risk Levels

The three levels of tree risk assessment defined in the *ANSI A300 Tree Risk Assessment Standard* are:

I. Level 1: Limited Visual Assessment

This level of assessment provides a visual assessment from a defined perspective (e.g., from the sidewalk, street, or aerial view) of an individual tree or population of trees to assess risk to specified targets from obvious defects or specified conditions.

Level 1 assessments are typically performed to quickly assess large populations of trees or conduct a rapid assessment of an individual tree. The assessor views only one side of the tree while walking on a sidewalk, being unable to access a neighboring property, looking from a slow-moving car, or from above with a drone, helicopter, or airplane.

A Level 1 assessment requires the client to identify the location and/or selection criteria of trees to be assessed. The assessor will:

1. Determine the most efficient route and document the route taken.

2. Assess the tree(s) within the area from the defined perspective (e.g., walk-by or drive-by).
3. Record the location of trees that meet the defined criteria (e.g., significant defects or other conditions of concern).
4. Evaluate the risk (risk rating is optional).
5. Identify trees requiring a higher level of assessment (Level 2 or Level 3) and/or prompt action.
6. Submit risk mitigation recommendations and/or a report.

Limitations: Level 1 assessments are the least thorough means of assessment. They are typically from one perspective, such as a walk-by, a drive-by, or aerial view. This level of assessment is most commonly used to prioritize higher-risk trees within larger groups of trees when there are budgetary, time, or other management constraints. Some defects or conditions will not be visible to the inspector, nor will all conditions visible at all times of the year; therefore, not all higher-risk trees will be accurately identified. In addition, the assessment may not provide enough information to assign a risk rating, make a risk mitigation recommendation, or determine residual risk.

II. Level 2: Basic Assessment

A Level 2 assessment is a detailed visual inspection of a tree and its surrounding site and a synthesis of the information collected. It requires a 360° ground-based inspection around a tree, including the site conditions, visible buttress roots, trunk, branches, and crown.

The Level 2 assessment may include using tools such as binoculars, mallet, or probe at the discretion of the assessor or at the request of the owner/client.

At this level, the assessor will:

1. Locate and identify the tree or trees to be assessed.
2. Determine the targets and target zone for the tree or tree part(s) of concern.
3. Review the site history and conditions, and species failure profile.
4. Assess potential load on the tree and its parts.
5. Assess general tree health.
6. Inspect the tree visually which may include the use of common tools such as binoculars, mallet, probes, and/or shovels, as specified in the Scope of Work.
7. Record observations of site conditions, defects, indicators of internal defects, and response growth.
8. If necessary, recommend a Level 3 advanced assessment.
9. Analyze data to determine the likelihood of failure, likelihood of impact, and consequences of failure to evaluate the degree of risk.
10. Develop mitigation options and estimate residual risk for each option.
11. Recommend a re-inspection interval.
12. Prepare and submit a report.

Limitations: Level 2 assessments only include conditions and defects that can be detected from a ground-based visual inspection on the day of the assessment. Below-ground, internal, or upper-crown conditions, decay, and defects may not be detected.

III. Level 3: Advanced Assessment

A Level 3 assessment is performed to provide detailed information about specific tree parts, defects, targets, or site conditions. These are usually conducted in conjunction with or after a Level 2 assessment with owner/client approval. Specialized equipment, data collection and analysis, and/or expertise are usually required for Level 3 assessments.

At this level, the assessor will:

1. Locate and identify the tree or trees to be assessed.
2. Determine the targets and target zone for the tree or tree part(s) of concern.
3. Review the site history and conditions, and species failure profile.
4. Assess potential load on the tree and its parts.
5. Assess general tree health.
6. Inspect the tree and/or site using advanced techniques as specified in the Scope of Work.
7. Record results from advanced techniques.
8. Analyze data to determine the likelihood of failure, likelihood of impact, and consequences of failure to evaluate the degree of risk.
9. Develop mitigation options and estimate residual risk for each option.
10. Recommend a re-inspection interval.
11. Recommend other advanced assessments, if necessary.
12. Prepare and submit a report.

*Items 1-5 may be included in the associated Level 2 assessment.

Procedures and Methodologies Often Used for Level 3 Assessments

Level 3 procedures and methodologies, which are referred to as technologies, may include:

Procedure	Methodology
Aerial inspection and evaluation of structural defects in upper stems and branches	• visual inspection from within the tree crown or from a lift • unmanned aerial vehicle (UAV) photographic inspection • decay testing of branches
Detailed target analysis	• property value of anything potentially impacted by tree failure • use and occupancy statistics • potential disruption of activities such as road blockage or an electrical outage
Detailed site evaluation	• history evaluation • soil profile inspection to determine root depth • soil mineral and structural testing
Decay and wood analysis	• increment boring • drilling with small-diameter bit • resistance-recording drilling • single path sonic (stress) wave • sonic tomography • electrical impedance tomography • radiation (radar, X-ray) • advanced analysis for pathogen identification
Health evaluation	• tree ring analysis (in temperate zone trees) • shoot length measurement • detailed health/vigor analysis

Procedure	Methodology
	• starch assessment
Root inspection and evaluation	• root and root collar excavation • root decay evaluation • ground-penetrating radar
Storm/wind load analysis	• detailed assessment of tree exposure and protection • computer-based estimations according to engineering models • wind reaction monitoring over a defined interval
Measuring and assessing the change in trunk lean	• visual documentation • digital level
Load testing	• hand pull • measured static pull • measured tree dynamics

Limitations: Level 3 assessments that include specialized technologies may have uncertainty and require qualified estimations. Exact measures may not be feasible.

Conclusion

Regardless of the level of assessment conducted, every assessment is limited to the trees identified in the scope of work, conditions detectable at the time of the assessment, the level of communication with the owner/client, and other conditions that affect the assessor's ability to collect information. Not all defects and conditions are detectable, and not all tree failures can be predictable. Trees are living organisms, and as such, every tree's structural conditions change over time.