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August 13, 2021

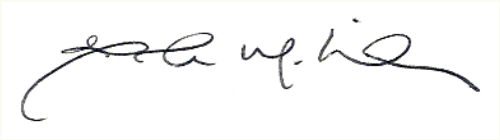
Westley Schroeder
Parks Superintendent
City of Woodland

RE: Level 3 Risk Assessment of Valley Oak, Casa Linda Drive, Woodland

Westley,

Attached is the report you requested. Please do not hesitate to contact me should you have questions.

Sincerely,



John M. Lichter, M.S.
ASCA Registered Consulting Arborist #375
ISA Certified Arborist #863
ISA Qualified Tree Risk Assessor
ASCA Qualified Tree and Plant Appraiser

TREE
ASSOCIATES

ADVANCED (LEVEL 3) RISK ASSESSMENT: VALLEY OAK CASA LINDA DRIVE, WOODLAND, CALIFORNIA

Prepared for
THE CITY OF WOODLAND

Prepared by
TREE ASSOCIATES, INC.
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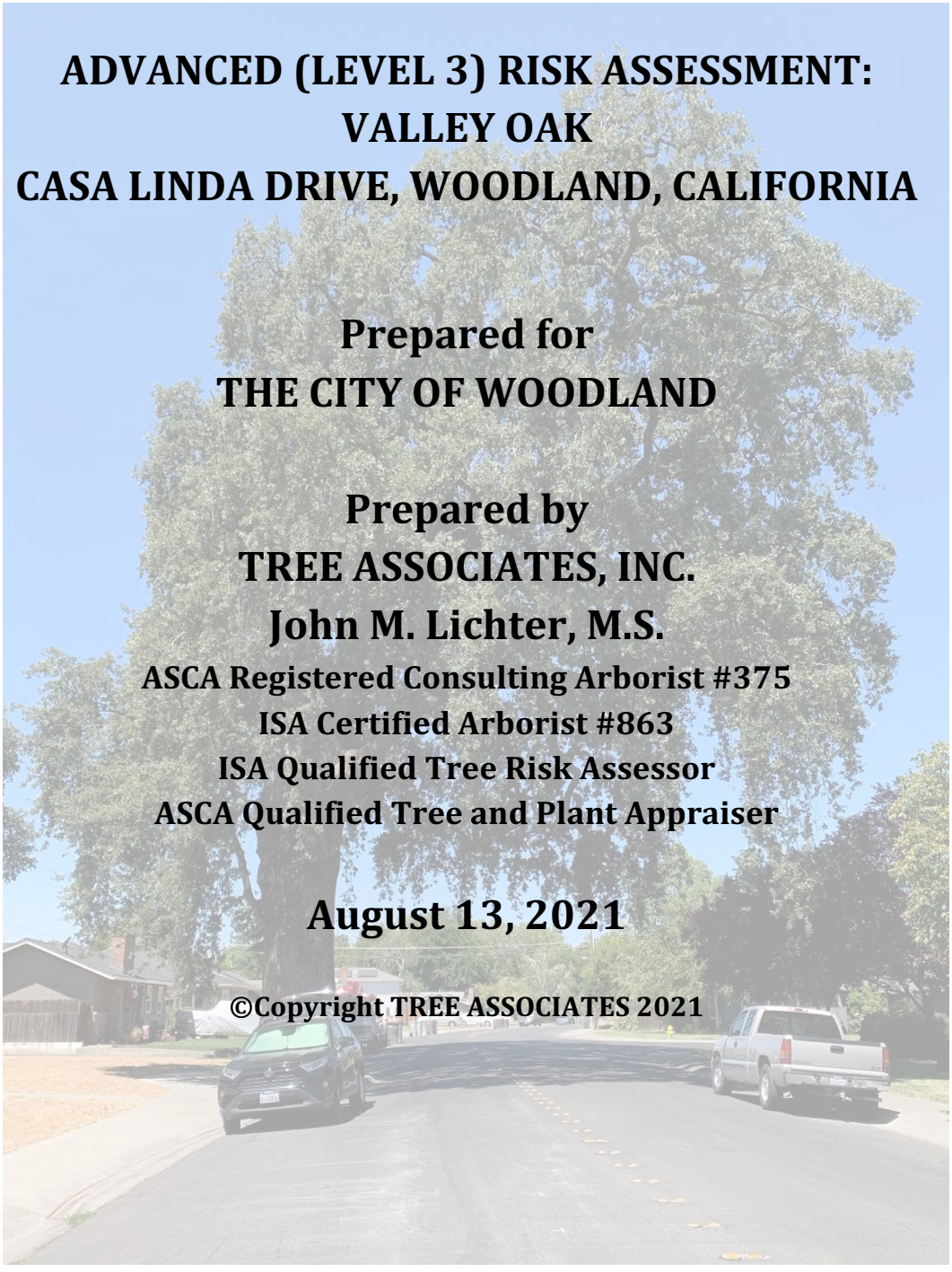


Background/History/Assignment

I was contacted by Westley Schroeder, Parks Superintendent with the City of Woodland who asked me to provide an advanced (level 3) risk assessment for a valley oak located in front of a residence at 304 Casa Linda Drive. The assessment was to include ground-level observations, aerial inspection, tomographic scanning of the low trunk and resistance drill testing of the tree's trunk.

The subject tree was designated a "landmark tree" by the city. David Wilkinson's book manuscript, entitled "Gertrude's Oaks" indicates the following.

- The subject tree was estimated to be 400 years old.
- The Casa Linda Park subdivision in which it is located was built in the 1950's. Casa Linda Drive was modified to curve around (rather than through) the trunk of the tree.
- According to assistant city manager Phil Marler, the tree was the inspiration for the oak on the city's official flag.
- In the year 2000, the tree "shed one of its huge, weighty limbs that brutally tore through the roof of the house at 304 Casa Linda Drive, causing major damage." No one was hurt.
- Don Huff, owner of the damaged residence, asked the city to remove the tree, fearing for his family's safety.
- The city voted 3 to 1 to keep the tree, following the city tree commission's recommendation.

On July 20, 2021, I spoke with Don Huff, owner and resident of 304 Casa Linda Drive who expressed the following.

- In September 1970, an 89-foot-long eastward growing limb fell into the front yard of the residence to the east of 304 Casa Linda. The limb fell after midnight and narrowly missed 10 to 15 kids attending a party at that residence.
- The limb which "cut his house in half" fell during June of 2000.[1]
- The sidewalk adjacent to the tree was repaired shortly after the June 2000 failure.

Mr. Schroeder indicated that the city prunes the tree every 3 to 5 years. The tree was last pruned approximately two years ago.

[1] It is unclear which of the two large primary limbs on the south and southeast side of the tree fell in 2000. It is possible that the southeast facing primary limb fell in 1970.

Limits/Assumptions of the Assignment

- This risk assessment was based solely on 1) ground level examination; 2) sonic tomography scanning and analysis; 3) resistance drill testing (with a portable drill and 1/8-inch diameter drill bit) and 4) aerial inspection.
- Additional examination above that performed, including but not limited to root crown excavation and examination and/or other testing or procedures could identify defects which might alter the risk assessment results and mitigation recommendations.
- Sonic tomography and resistance drill testing provides evidence of the presence and location of defects. While these technologies are the only reasonable means of gathering this information in trees, neither provides a complete "picture" of what exists inside a trunk or limb. Therefore, expert interpretation is necessary.
- Current arboricultural knowledge regarding the impact of various defects on the structural stability of trees is imperfect. I utilize my judgement regarding such considering the evidence available, my education and experience.
- This risk assessment considers significant known and/or assigned targets and visible or detectable tree conditions. Not all defects are detectable.
- This risk assessment is limited to the specific risk(s) of interest and does not include all risks.
- This risk assessment considered the condition of the subject trees at the time of my site visit. Tree conditions, the level of risk and recommended mitigation may change.
- Not all tree failures are predictable.

Methodology

Between June 4, 2021 and August 9, 2021 I conducted seven site visits to conduct this assessment. The following is a list of the methods I employed.

- Tree size and location measurements.
- Ground level examination.
- Aerial inspection.
- Sonic tomograph scanning of the lower trunk.
- Resistance drill testing of the low trunk and selected locations in the crown of the tree.

Tree Location

The subject tree was located north of Casa Linda Drive between the curb and curved sidewalk. The center of the trunk of the tree was 42 and 69 feet from the residences to the south and north, respectively (Figure 1).

The front yard of the home to the north of the tree was not being irrigated. The front yard to the southeast of the tree was planted with drought tolerant plants and the front yards to the tree's southwest and north were covered with turf.

Figure 1. October 2020 Google Earth aerial image showing subject tree location (center). North is at the top of the page.

Tree Species, Size

The subject tree was a valley oak (Quercus lobata). The trunk diameter was 80 inches at 4.5 feet above grade. The trunk diameter at one foot above grade was 115 inches. The tree's height was 82 feet as measured with a Nikon range finder. With a digital measuring device, I determined that the radius of the canopy was 39,53, 58 and 26 feet to the east, north, west and south, respectively (Figure 2).

Tree Health

Considering the tree's vigor, canopy density, leaf size and color, I rated the overall health of the tree as good (Figure 2). I rate the health and structure of a tree separately. This is because healthy trees can be structurally unsound and unhealthy trees may be structurally sound.

Figure 2. Looking westward at subject tree from Casa Linda Drive.

Canopy Architecture

The following are key features of the tree's architecture. Note primary limbs are those limbs which are attached to the lower trunk or one of the three secondary trunks.

- North facing primary limb attached at 25 feet above grade.
- Northeast facing primary limb attached at 37 feet above grade.
- South facing primary limb attached at 25 feet above grade (failed limb).
- Southeast facing primary limb attached at 34 feet above grade (failed limb).
- West facing primary limb attached at 28 feet above grade.
- Main trunk divides into three secondary trunks at 49 feet (Figure 3).

Figure 3. View of secondary trunks, attached at 49 feet above grade.

Trunk Base Observations

- The north base of the trunk and roots were against the street curb.
- A very large root was cut many years ago adjacent to the north side of the trunk. I'm guessing this was done to install the curb and gutter when the subdivision was developed in the 1950's. The wound created was within the trunk wood and was 15 inches wide by 18 inches tall (Figure 4). I was able to insert a metal probe nine inches into the face of the wound.
- A cavity opening (5 inches wide by 3 inches tall) was present at the base of the north-northeast side of the trunk (Figure 4).
- A basal cavity opening was present on the west side of the trunk with an opening of 5 inches wide by 2 inches tall. I was able to insert a metal probe 24 inches into the trunk at that location (Figure 5).
- A cavity opening was visible at the base of the south-southeast side of the trunk. The opening was 5 inches wide by 2 inches tall. I was able to insert a probe 12 inches into this opening (Figure 6).

Figure 4. Looking southward at base of trunk. Note large old cut of major structural root on north side of trunk between tags 23 and 24. Tags are measuring points from lower trunk scan (discussed below). Another cavity opening was present at the base of the trunk near measuring point 21.

Figure 5. Looking southwestward at trunk base. Note large wounds between tags 3-4 and 5-6. A cavity opening into which I inserted a probe 24 inches was located under tag 6, adjacent to the sonic tomograph field computer (arrow).

Figure 6. Looking north northwestward at trunk base. Note cavity opening below tag 14.

Canopy Observations

- A very large, south facing primary attached at 25 feet previously failed and its stub was removed. The maximum size of the cut was 6 feet tall by 3.5 feet wide. Remnants of the fruiting bodies of a decay fungus (likely *Laetiporus sulfureus*) were visible on cut surface (Figures 7,8).
- A very large southeast facing primary limb attached at 34 feet failed and the stub was removed (Figures 7,9).
- The west facing primary limb attached at 28 feet was previously shortened with a 15-inch diameter reduction cut.[2]
- The north facing primary limb attached at 25 feet divided into northwest and northeast secondary limbs. The northeast secondary limb had been shortened with a reduction cut. I sunk a probe 5 inches deep into the heartwood of this cut. This was not a significant defect.
- The south secondary trunk was previously shortened with a 12 X 16-inch reduction cut at 58 feet. The cut had an insignificant amount of decay (probe inserted 4 inches deep, maximum).
- A bird nesting hole was present at 45 feet on the 16-inch diameter north facing secondary limb off the northeast facing primary limb attached 37 feet above grade. Resistance drilling revealed 1 and 1.75 inches of sound wood on the top and east side of the limb adjacent to the hole.
- The tree had seven cables attached between the secondary codominant trunks and primary limbs.
- Several primary and secondary limbs were overextended.

[2] A reduction cut is a cut back to a lateral branch of at least one-third the diameter of the cut stem.

Canopy Resistance Drill Testing Results

I conducted 12 resistance drill tests in selected locations on the trunk between 20 and 32 feet above grade and on and adjacent to the previously failed primary limb attachments. I utilized a portable drill equipped with a 1/8-inch diameter by 10-inch-long drill bit, with an ear plug as a depth gauge, to determine the amount of sound wood present at a given location. These tests revealed the following:

Near failed south facing primary limb at 25 feet above grade:

- East side of limb attachment of previously broken south-facing primary limb at 22 feet: = 3 inches of sound wood.
- West side of limb attachment of previously broken south facing primary limb at 22 feet: = 6.75 inches of sound wood.
- South side of trunk at 20 feet, below broken primary limb: = 8 inches of sound wood.
- East side of trunk at 22 feet: no decay detected, >7.25 inches of sound wood.
- West side of trunk at 22 feet: no decay detected, >8 inches of sound wood.

Near failed southeast facing primary limb at 34 feet above grade:

- East side of limb attachment of previously broken southeast facing primary limb at 34 feet: = 6 inches of sound wood.
- South side of trunk at 32 feet, under previously broken southeast facing primary limb: = 3.75 inches of sound wood.
- East side of trunk at 32 feet: no decay detected, > 7 inches of sound wood.
- East side of trunk at 28 feet: no decay detected, >7.75 inches of sound wood.
- South southwest side of trunk at 32 feet: no decay detected, >8.25 inches of sound wood.
- North side of trunk at 24 feet, below N facing primary: no decay detected, >8 inches of sound wood.

The results of the drill testing adjacent to and below the attachment of the failed primary limbs revealed the presence of decay within the failed primary limb tissue within the trunk. There was between three inches and 8 inches of sound wood adjacent to and below the attachment of the failed south facing primary attached at 25 feet.

Adjacent to and below the failed southeast facing primary limb attached at 34 feet I found between 3.75 and 6 inches of sound wood. I detected no decay and found > 7 inches of sound wood on the east, north and west sides of the trunk near the height of the failed primary limbs.

Figure 7. Looking north northeastward at trunk. South primary limb at 25 and southeast facing primary limb at 37 feet (hidden, see Figure 9) shown with arrows.

Figure 8. Detail of failed south facing primary limb at 25 feet above grade. Note remnants of decay-fungus fruiting bodies or conks (arrows).

Figure 9. Detail of failed southeast facing primary limb failure attachment at 34 feet.

Sonic Tomography Introduction

I conducted sonic tomography testing of the lower trunk of the tree with the use of my PiCUS 3 Sonic Tomograph. By measuring the velocity of sound waves traveling through the tree, this tool provides accurate graphic images of tree cross sections (tomograms) showing areas of different sound velocities. Areas of low velocity, shown as violet or pink indicate areas with internal defects such as cavities, decay or cracks (see Figures X below and Picus 3 demonstration video).

PiCUS tomograms have generally shown a 95% correlation with visual estimates of decay when scanned trees were cut down (Gilbert and Smiley, 2004). Additional information can be found here.

Figure 10. Conducting a sonic tomograph scan at the base of a tree. Tapping on each nail with the electronic hammer generates sound waves, which are received by the sensors placed around the tree. Field computer at trunk base.

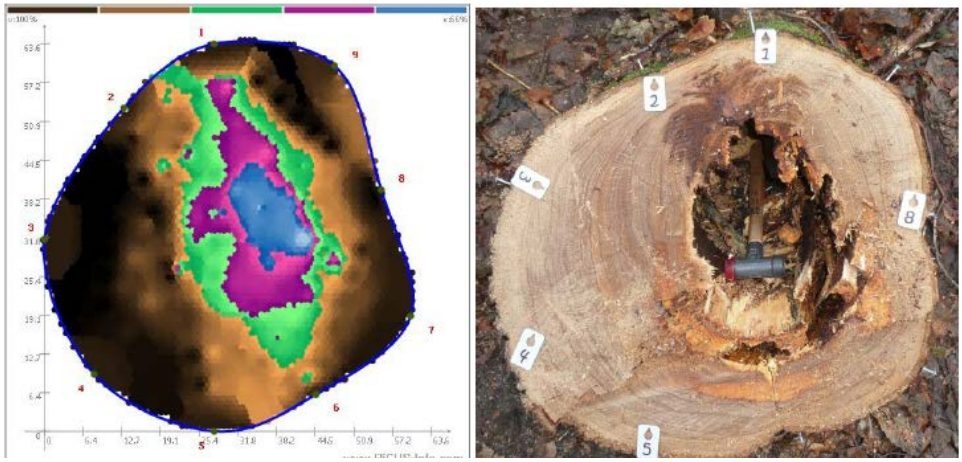


Figure 11. An example of a sonic tomogram (left) with actual scanned trunk section (right).

Sonic Tomography Testing, Results

I scanned the low trunk at two elevations. The first scan, conducted on July 7, 2021 was taken at approximately 30 inches above grade. The second scan was conducted on July 16, 2021 at approximately 12 inches above grade (Figure 12).

Figure 12. Sonic tomography setup for scan at 12 inches above grade (at height of tags). Sensors are on the other side of the tree (they are moved during the scan). The scan height at 30 inches above grade is shown with arrows.

The results of the tomographic scans are presented below (Figures 13,14). Note that the red numbers on the cross-sectional images of each scan represent measuring points. Measuring point number 1 was oriented toward the north in both scans.

Brown and tan colors on the scan are indicative of relatively fast sound velocities which are normally found in sound wood and violet/pink areas indicate slower sound velocities which normally indicate decayed or missing wood, or other defects.

The tomogram from the scan at 30 inches above grade indicated that 96% of the wood at that level of the trunk was solid.

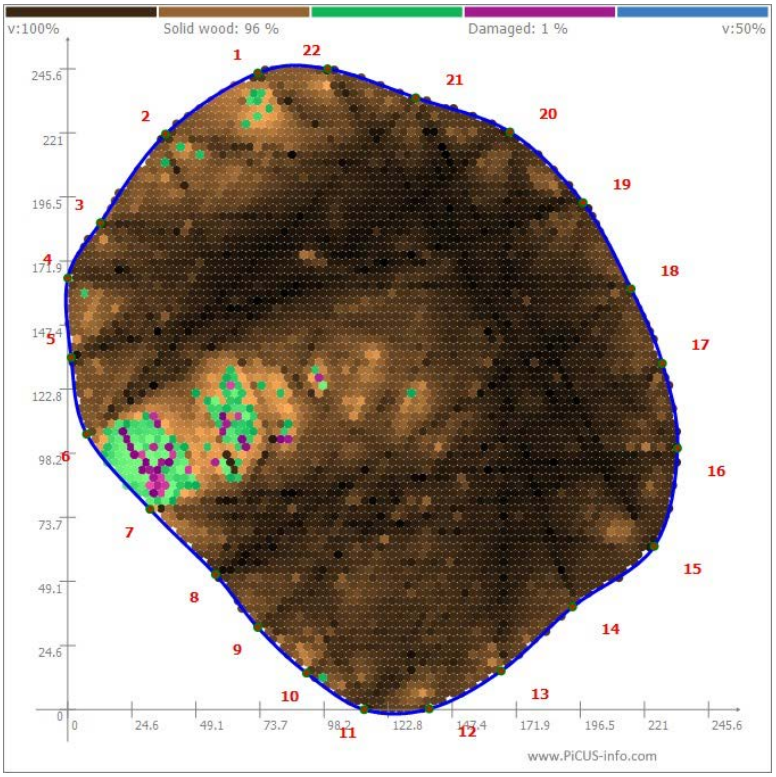


Figure 13. Tomogram from scan of subject tree trunk at 30 inches above grade. Measuring points (MP's) indicated with red numbers; MP 1 is on the north side of the trunk.

The tomogram from the scan at 12 inches above grade, in contrast, indicated that only 29% of the wood at that level was solid (Figure 14). The tomogram revealed that there was essentially no sound wood on portions of the north, west and east sides of the trunk.

Some representative distances between the outside of the wood to the damaged or missing wood as shown by the tomogram are shown in blue in centimeters. The black numbers refer to drill testing results, covered in the next section of the report.

It should be noted that trunk decay usually moves into the tree from below ground and in the vast majority of cases is more pronounced near the base of the tree. Therefore, it is not surprising that the lower scan indicated more damaged wood than the higher scan.

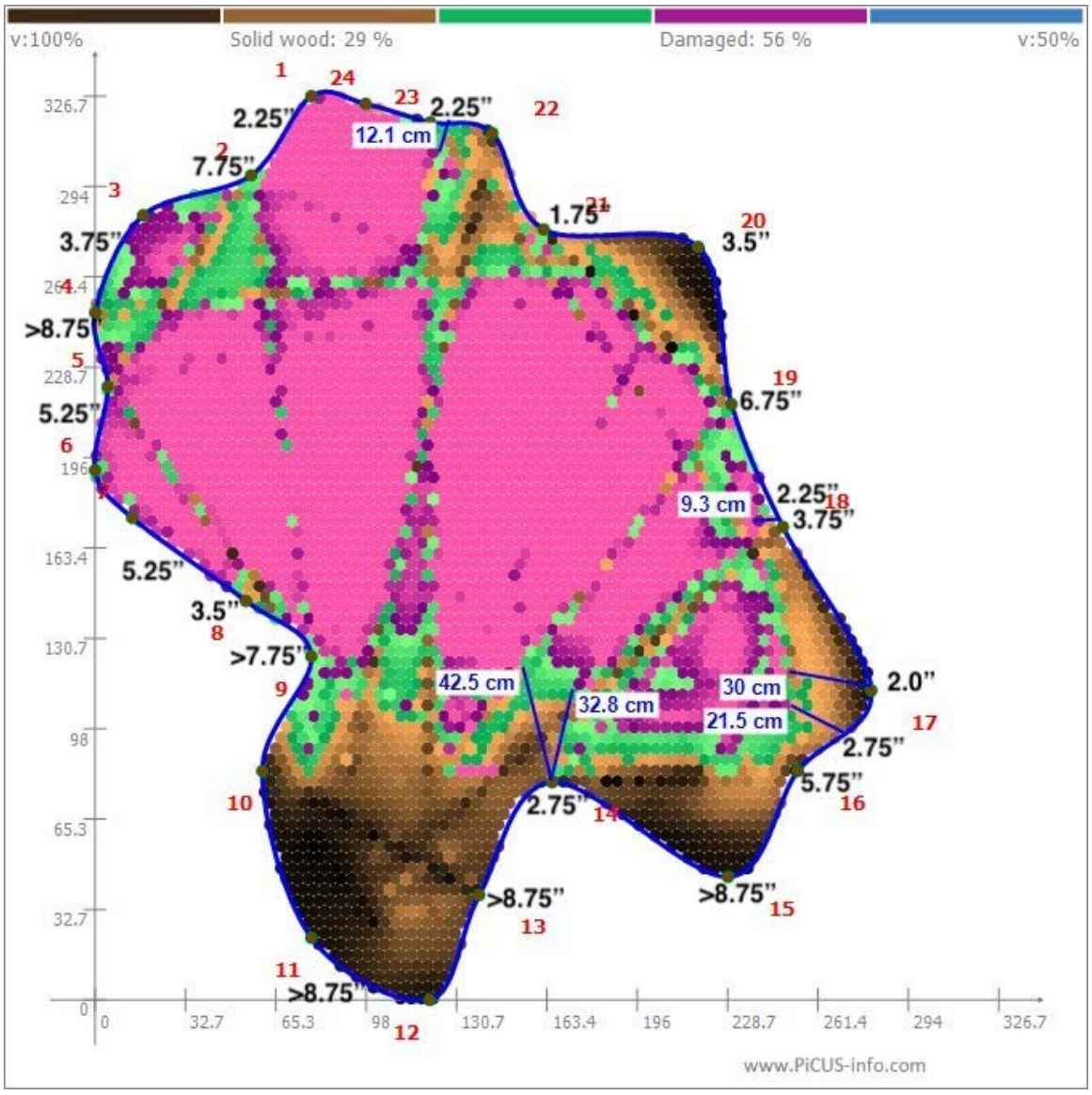


Figure 14. Tomogram from scan of subject tree trunk at 12 inches above grade. Measuring points (MP's) indicated with red numbers; MP 1 is on the north side of the trunk. The black numbers refer to sound wood depths determined by resistance drill testing.

Resistance Drill Testing at Trunk Base

I conducted 30 resistance drill tests (methodology described above) between 2 and 12 inches above grade. All but two of the tests were at 6 inches above grade or lower. Some of the results (the thinnest sound wood in each location) are presented in black in Figure 14. Those results with a ">" preceding the number indicate that no decay was detected to the depth specified.

The testing revealed 3.75 inches of sound wood or less in eleven locations on all sides of the trunk. Sound wood thicknesses of 2.75 inches or less were found in seven of these locations on the north, east and south sides of the trunk. In five locations on the north and east sides of the trunk, 2.25 inches of sound wood or less was measured. Two and 1.75 inches of sound wood were found on the northeast and southeast sides of the trunk, respectively.

The reason for the discrepancy between the sonic tomography results and drill testing is likely due to the following: 1) the drill testing was at a different and lower level than the tomographic scan; 2) drill testing tests only a single point on the stem whereas sonic tomography "encompasses" the entire cross section at a given level; 3) a decay column is typically uneven in shape as well as outline; 4) sonic tomography may identify areas that are less decayed whereas the drill testing identifies where wood is significantly decayed or missing; and 5) the means to measure the depth to decayed or missing wood is relatively rough (the drill is inserted repeatedly and after each pass of the drill the distance from the tip of the drill to the earplug is measured with a measuring tape).

Risk Categorization

The following is a categorization of risk for various types of failure *over the next five years*. The risk ratings consider the information above as well as my education and professional experience. The categorization and ratings follow ANSI A300 standards and ISA Best Management Practices for tree risk assessment (Smiley et al., 2017).

Target	Failure Type	Likelihood of Failure[3]/ Time Frame	Likelihood of Impact	Likelihood of Failure and Impact	Potential Consequences	Risk Rating
Homes, People, Vehicles	Trunk	Probable/20 years	Medium	Somewhat Likely	Severe	Moderate/High
People, Vehicles	Live Primary or Secondary Limbs	Possible/5 years	Medium	Unlikely	Severe	Low/Moderate

Risk Mitigation Discussion, Recommendations [4]

While a tree can compartmentalize or stem the spread of decay, there is no way to replace the wood lost to decay. Trees can grow new wood in response to damage or additional loads (termed response growth). However, in all likelihood, this tree's annual trunk growth rate is very low, due to its advanced age. It is also possible that the trunk decay will continue to spread.

Reducing the height and spread of the tree would reduce the wind load and amount of stress on the trunk. However, it is difficult to the know how much pruning would be necessary to significantly reduce the likelihood of failure. I am not comfortable recommending pruning as a risk mitigation for this tree due to the extent of decay and the age of the tree.

Due to the extent of trunk decay, the likelihood of trunk failure and lack of adequate risk mitigation strategies, I recommend that this tree be removed.

[3] Likelihood of failure rating on a scale of improbable, possible, probable, or imminent.
[4] All tree work recommended in this report should be performed by or under the direct supervision of an ISA Certified Arborist or Tree Worker.

References

Gilbert, E., T. Smiley, 2004. Picus Sonic Tmomography for the Quantification of Decay in White Oak and Hickory. Journal of Arboriculture 30(5).

Smiley, E., N. Matheny and S. Lilly. Best Management Practices, Tree Risk Assessment, 2nd Edition ©2017. International Society of Arboriculture, Champaign Illinois. 86p.

Arborist Disclosure Statement

The following statement pertains to my work and this report.

Arborists are tree specialists who use their education, knowledge, training and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of the Arborist, or to seek additional advice.

Arborists cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that fail in ways we do not fully understand. Conditions are often hidden within trees and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments, like any medicine, cannot be guaranteed.

Treatment, pruning and removal of trees may involve considerations beyond the scope of the Arborist's services such as property boundaries, property ownership, site lines, disputes between neighbors, and other issues. Arborists cannot take such considerations into account unless complete and accurate information is disclosed to the Arborist. An Arborist should then be expected to reasonably rely upon the completeness and accuracy of the information provided.

Trees can be managed, but they cannot be controlled. To live near trees is to accept some degree of risk. The only way to eliminate all risk associated with trees is to eliminate all trees.

Glossary[5]

Bow – the gradual curve of a branch or stem.

Callus – growth resulting from and found at the margin of wounds.

Canker – a localized area of dead tissue on a stem or branch, caused by fungal or bacterial organisms.

Central Leader – the main stem of the tree.

Chlorotic – yellow.

Codominant – equal in size and relative importance.

Crown – parts of the tree above the trunk.

Crown Clean – the removal of dead, dying, diseased, broken, and weakly attached branches and watersprouts from a tree's crown.

Decay – process of degradation of woody tissues by fungi and bacteria.

Dieback – death of shoots and branches, generally from tip to base.

Dropcrotch – the process of shortening trunks or limbs by pruning back to dominant lateral limbs.

End Weight – the concentration of foliage at the distal ends of branches.

Epicormic – shoots which result from adventitious or latent buds; often indicates poor vigor.

Included bark – pattern of development at branch junctions where bark is turned inward rather than pushed out.

Primary limb – limb attached directly to the trunk.

Reduction cut – shortening the length of a branch or stem by cutting it back to a lateral branch of at least one-third the diameter of the cut stem.

Root crown – area at the base of a tree where the roots and stem merge.

Secondary limb – limb attached directly to a primary limb.

Sound wood – undecayed wood.

Suppressed – trees which have been overtopped and whose crown development is restricted from above.

Target – people or property potentially affected by tree failure.

Topped – Pruned to reduce height by cutting large branches back to stubs.

Train – to prune a young tree to establish a strong structure.

Vigor – overall health.

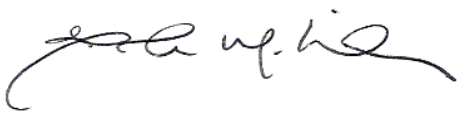
Watersprouts – vigorous, upright, epicormic shoots that grow from latent buds in older wood.

5 Definitions from author or Matheny and Clark, Evaluation of Hazard Trees in Urban Areas, 2nd Edition c 1994, ISA.

Certification of Performance

I, John M. Lichter, certify:

- That I have personally inspected the tree(s) and/or the property referred to in this report, and have stated my findings accurately. The extent of the evaluation and/or appraisal is stated in the attached report and the Terms and Conditions;
- That I have no current or prospective interest in the vegetation or the property that is the subject of this report, and I have no personal interest or bias with respect to the parties involved;
- That the analysis, opinions and conclusions stated herein are my own, and are based on current scientific procedures and facts;
- That my compensation is not contingent upon the reporting of a predetermined conclusion that favors the cause of the client or any other party, nor upon the results of the assessment, the attainment of stipulated results, or the occurrence of any subsequent events;
- That my analysis, opinions, and conclusions were developed and this report have been prepared according to commonly accepted Arboricultural practices;
- That no one provided significant professional assistance to the consultant, except as indicated within the report.



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ASSUMPTIONS AND LIMITING CONDITIONS: TREE ASSOCIATES, INC.

1. Any legal description provided to the consultant/appraiser is assumed to be correct. Any titles and ownerships to any property are assumed to be good and marketable. No responsibility is assumed for matters legal in character. Any and all property is appraised or evaluated as though free and clear, under responsible ownership and competent management.

2. It is assumed that any property is not in violation of any applicable codes, ordinances, statutes or other governmental regulations.

3. Care has been taken to obtain all information from reliable sources. All data has been verified insofar as possible; however, the consultant/appraiser can neither guarantee nor be responsible for the accuracy of information provided by others.

4. The consultant/appraiser shall not be required to give testimony or to attend court by reason of this report unless subsequent contractual arrangements are made, including payment of an additional fee for such services as described in the fee schedule and contract of engagement.

5. Unless required by law otherwise, possession of this report or a copy thereof does not imply right of publication or use for any purpose by any other than the person to whom it is addressed, without the prior expressed written or verbal consent of the consultant/appraiser.

6. Unless required by law otherwise, neither all nor any part of the contents of this report, nor copy thereof, shall be conveyed by anyone, including the client, to the public through advertising, public relations, news, sales or other media, without the prior expressed written or verbal consent of the consultant/appraiser -- particularly as to value conclusions, identity of the consultant/appraiser, or any reference to any professional society or institute or to any initialed designation conferred upon the consultant/appraiser as stated in his qualifications.

7. This report and any values expressed herein represent the opinion of the consultant/appraiser, and the consultant's/appraiser's fee is in no way contingent upon the reporting of a specified value, a stipulated result, the occurrence of a subsequent event, nor upon any finding to be reported.

8. Sketches, drawings, and photographs in this report, being intended as visual aids, are not necessarily to scale and should not be construed as engineering or architectural reports or surveys unless expressed otherwise. The reproduction of any information generated by architects, engineers, or other consultants on any sketches, drawings, or photographs is for the express purpose or coordination and ease of reference only. Inclusion of said information on any drawings or other documents does not constitute a representation by John M. Lichter or TREE ASSOCIATES as to the sufficiency or accuracy of said information.

9. Unless expressed otherwise: 1) information contained in this report covers only those items that were examined and reflects the condition of those items at the time of inspection; and 2) the inspection is limited to visual examination of accessible items without dissection, excavation, probing, or coring. There is no warranty or guarantee, expressed or implied, that problems or deficiencies of the plants or property in question may not arise in the future.

10. Loss or alteration of any part of this report invalidates the entire report.