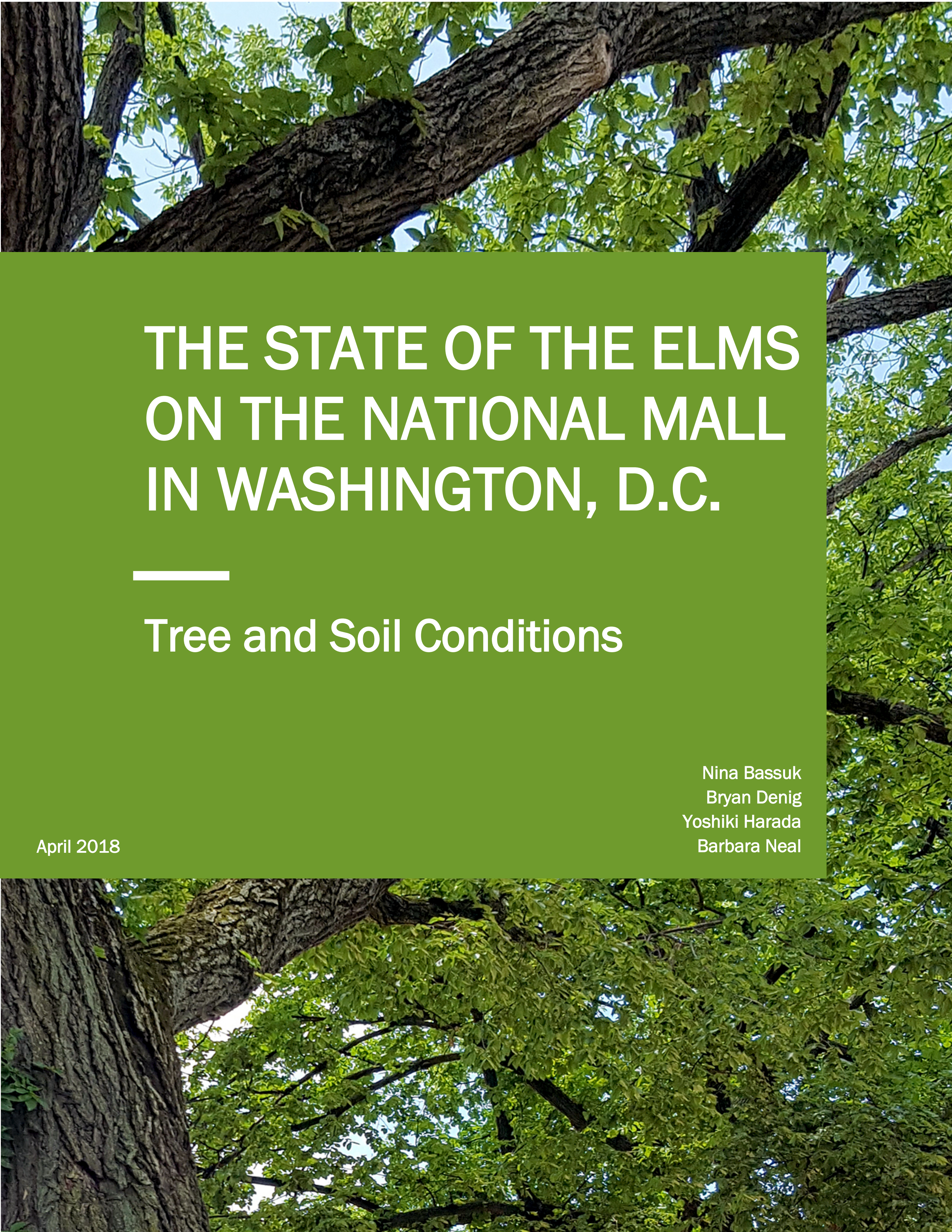

THE STATE OF THE ELMS ON THE NATIONAL MALL IN WASHINGTON, D.C.

Tree and Soil Conditions

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Executive Summary

This report details a study conducted at the request of the National Park Service to examine the current conditions of the trees and soils on the tree panels of the National Mall in Washington, D.C. The National Mall elm trees are an important planting in the monumental core, yet they face several challenges. The soils of the tree panels are very compacted, most likely due to the constant pedestrian use and the numerous large organized events that take place on the Mall. Unevenness in the size and distribution of the tree canopy has resulted from decades of mortality (often due to Dutch Elm Disease) and the planting of certain elm varieties with growth forms that are seen as incompatible with the planting as a whole. Collecting information on each tree (a tree inventory) and analyzing soil conditions provides vital information for making informed decisions and intelligently recommending best practices for future management. During June 17 – 20, 2017, the research team conducted a tree inventory, gathering data on each individual tree, and collected soil data and samples for later analysis. In addition, in November 2017, ground penetrating radar was used to document root growth for seventeen of the trees. This report deals with the current tree and soil conditions, while management recommendations are in a separate report.

Study Objectives

The study detailed in this report involved three major objectives. These are:

- To examine each elm tree on the National Mall for health and risk assessment according to the International Society of Arboriculture Level 2 protocol.
- To sample soils associated with the elms and analyze their physical, chemical and biological characteristics
- To summarize opportunities and limitations to elm management based on tree assessment and soil analysis

Condition of the Trees

Data was collected for each of the 550 elm trees found growing on the National Mall. Thirty-one empty spaces, potential sites for future plantings, were also noted, although at least a few of these have underground utility conflicts that could preclude growing trees. Over 80% of the 550 elm trees were rated as being “excellent” or “good” in condition based on the visual assessment of foliage, branching structure, and insect and disease infestation. The rating of “poor” condition was given to only 3% (18) of trees, for which removal and replanting are recommended. Symptoms of Dutch Elm Disease (DED) was observed in at least four trees, and four additional trees may also have been infected.

Condition of the Soils

Soil is a complex substrate that melds physical, chemical, biological, and hydrologic characteristics to provide an adequate medium for plant growth. Sampling and testing of soils was performed at 49 locations across the Mall in order to study these key components. Soil compaction, a physical characteristic, was found to be the major threat to tree health and will impact any future plantings if not addressed. The high bulk density of the soil severely limits root growth. In over 70% of the soil sampling locations across the Mall, bulk density exceeded 1.3 g/cm^3, which is above the ideal range for a loamy soil. Additionally, none of the sample locations had a usable soil depth of more than 12 inches, and most had much less, resulting in a restricted useable soil volume that is considered inadequate for healthy tree growth. The observed soil compaction had also altered the soil structure in nearly 60% of the sampling locations. These samples showed an aggregate stability below 50%, which reduces drainage, increases soil density, and makes those soils susceptible to erosion.

Unlike the issues of soil compaction, the chemical, biological, and other physical properties of the soil were found suitable for tree growth. Among the macro- and micronutrients analyzed, none were deficient. These nutrients can be available to plants at adequate soil moisture levels because the soil pH was within the range between 6.0 and 7.3. It is relatively easy to maintain adequate soil moisture levels because plant available water was generally above 20% of gravimetric water contents. Also, active carbon content, organic matter, and soil respiration rates generally received “fair” or “good” ratings, which are likely to indicate adequate nutrient cycling and sufficient pools of nutrients in the soils at the Mall. The less than excellent ratings for active carbon (the fraction of organic matter used by soil microorganisms) and soil respiration are likely exacerbated by soil compaction. All these soil properties are adequate yet have been underutilized by the trees due to the high levels of soil compaction across the Mall.

Introduction

Located at the center of Washington, D.C., the National Mall is an area well-known for its many prominent monuments, museums, and other cultural institutions. Iconic for its wide swath of lawn and orderly rows of American elm trees, this area is often referred to "America's front yard." As a very large open expanse at the heart of the nation's capital, it is the foremost site for large public gatherings related to presidential inaugurations, protests, and similar events. Chronic wear and tear, as well as many other challenges, are impacting the health of the population of more than 500 elm trees that compose the Mall. This study is being conducted to assess the current conditions of the trees and soils found on the central portion of this iconic landscape. The goals of the study are to create a record of the present-day tree and soil conditions, identify the challenges faced by the trees, and develop a management plan of best practices that will respond to these issues and define the future management objectives. This study is a crucial step for preserving the health of this iconic tree-lined landscape well into the future.

The term "the Mall" can sometimes lead to confusion, as different studies may use differing boundaries to define this area. The National Park Service Cultural Landscape Inventory (CLI) from 2006 depicts clear boundaries for The Mall, and the report also gives an additional internal boundary that defines the study area for that inventory.

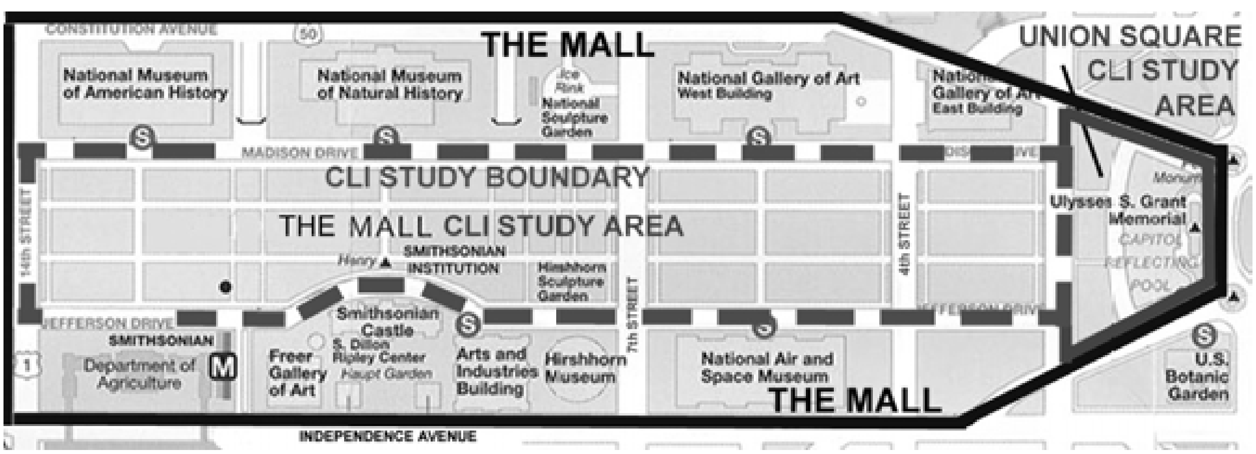

Figure 1. Map from the "The Mall Cultural Landscape Inventory" (2006), which depicts the boundaries of The Mall and the CLI study area.

The current study involving the soils and trees of the Mall shares the same study area as "The Mall Cultural Landscape Inventory." This defined study area – the central, monumental rectangular landscape that stretches between 3rd and 14th Streets and is bounded to the north and south by Madison Drive NW and Jefferson Drive SW, respectively – has historically been a prominent site in Washington, D.C.

In order to identify the smaller areas within this large space, the National Park Service utilizes a simple system where each rectangular "panel" of the Mall has been assigned a number. The data collected for this study utilizes that numbered panel system.

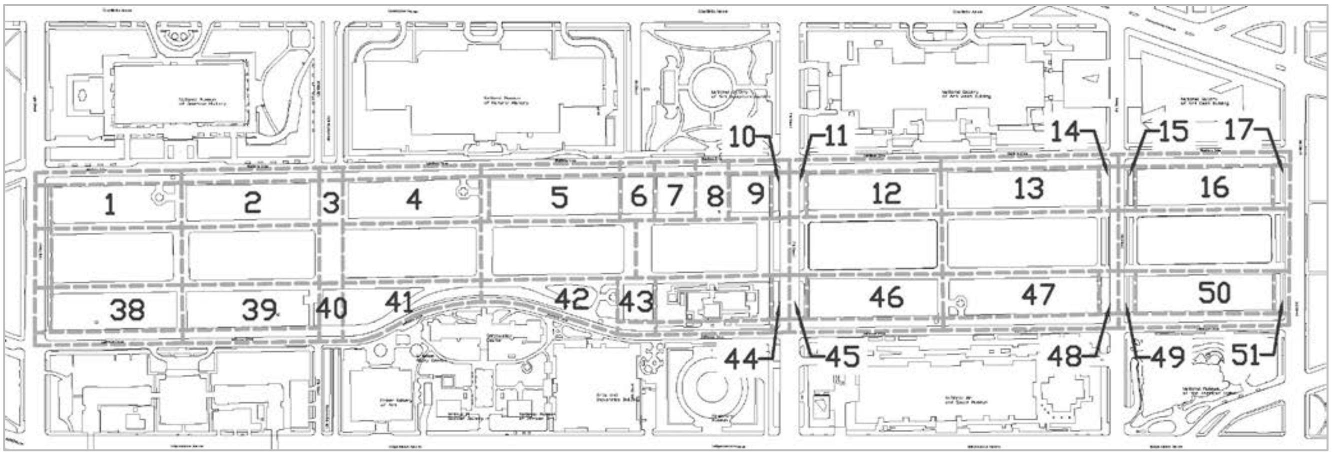

Figure 2. A map depicting the numbered panels of the National Mall. This map does not show the numbers for the central lawn panels, which are not a focus of this study.

History of the Mall

In 1791 President Washington appointed Pierre (Peter) Charles L'Enfant, a French engineer who served in the Continental Army during the American Revolutionary War, to lay out the new city that would become the nation's capital. Borrowing from European precedents, L'Enfant's plan used urban design to symbolize the principles of the Constitution through the designed landscape. Meant to be a symbol of the key role of all citizens in American democracy, the plan features a central public open space known as the "Grand Avenue," which is the predecessor to the current design of the Mall. When this plan was being created, the site of the Mall was undeveloped. The land consisted of a creek running along its northern edge and the adjacent marshland. The 1791 L'Enfant plan proposed to canalize this creek, which was completed in 1815 to support local business activities.

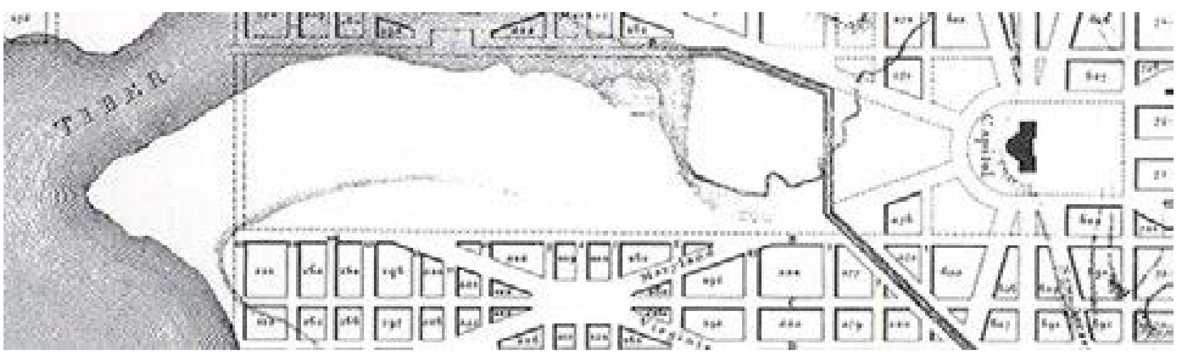

Figure 3. This 1818 map from the "The Mall Cultural Landscape Inventory" (2006), depicts the former extent of Tiber Creek superimposed over the location of the canal.

In 1850, President Fillmore appointed prominent landscape gardener Andrew Jackson Downing to create a new landscape plan for the National Mall. The design is best described as picturesque – romantic curving paths between informal clusters of mixed trees. These plantings obscured what L'Enfant intended to be a clear view corridor between the Capitol and the Washington monument. Downing died in 1852, and his plan was only partially realized. Piecemeal projects and improvements on the Mall continued in the following decades, such as filling in the canal in 1870.

In 1901, the Senate formed a commission to develop a new plan for Washington, D.C. This group, often referred to as the McMillan Commission, would later develop a plan that revisited the design moves of the L'Enfant plan and aligned with the City Beautiful principles of the time. Eventual realization of this plan has led to the Mall as we know it today. The McMillan plan sought to develop their interpretation of L'Enfant's "Grand Avenue" from what was then a picturesque landscape made of discordant gardens and occupied by eclectic buildings. The Commission's report gave a detailed description of its design for the Mall:

> *"The axis of the Capitol and Monument is clearly defined by an expanse of undulating green a mile and a half long and three hundred feet broad, walled on either side by elms, planted in formal procession four abreast. Bordering this green carpet, roads, park-like in character, stretch between Capitol and Monument, while beneath the elms one may walk or drive, protected from the sun. Examples of this treatment abound in England and on the Continent of Europe, and also may be found in our own country in those towns, both North and South, which were laid out during the colonial era. Moreover, these two plantations of elms traversed by paths are similar in character to the Mall in Central Park, New York, which is justly regarded as one of the most beautiful features of that park."*[1]

Although this report was completed in 1902, substantial work on the Mall to realize this plan would not start until the early 1930s. By this time, additional buildings had been constructed on the Mall, such as the temporary military buildings ("tempos") that were built during the first World War. This landscape had little in common with the marshy fields and creek that had previously occupied the site in the 1790s. It was a highly developed urban landscape, and one that likely consisted of degraded soils negatively impacted by human activity.

1. Moore, C. (Ed.). (1902). The improvement of the park system of the District of Columbia: Report of the Senate Committee on the District of Columbia. Report of the Park Commission (No. 166). US Government Printing Office, pg. 44-45

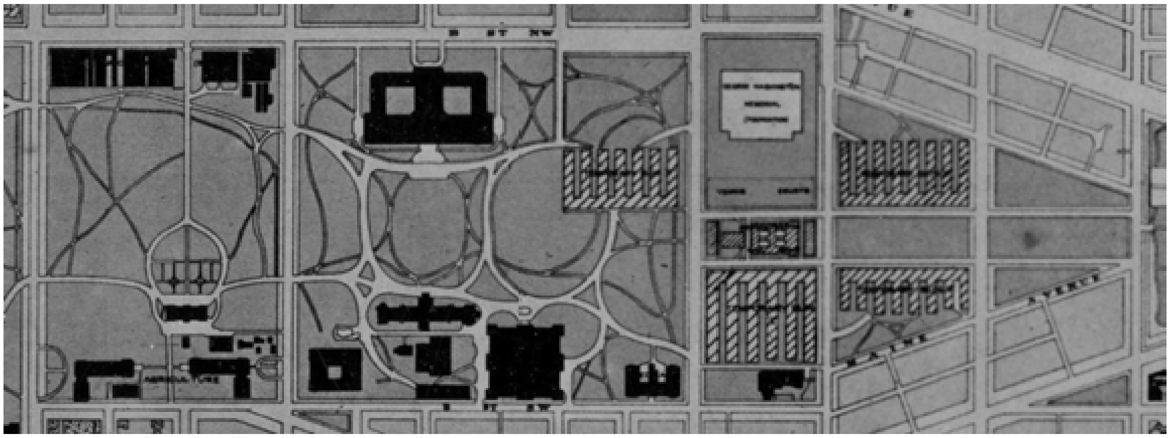

Figure 4. A 1927 map of the Mall from the from the "The Mall Cultural Landscape Inventory"

Use of American Elms

Renowned for its beautiful vase shape and easy-to-grow, forgiving nature, the American elm was a logical choice for the McMillan Commission. As stated in their report;

> *"The American elm was chosen not only because of the architectural character of its columnar trunk and the delicate traceries formed by its wide-spreading branches, but also because in the District of Columbia this tree is at its best, notable examples being found in the city parks and in the grounds of the Capitol."*[2]

Illustrations included in the report depict the design intent for the Mall: a quadruple wall of elms on either side of the central enclosed lawn. The trees are depicted with their branches starting at a consistent trunk height, and a uniform canopy blends seamlessly from one tree to the next.

2. Ibid.

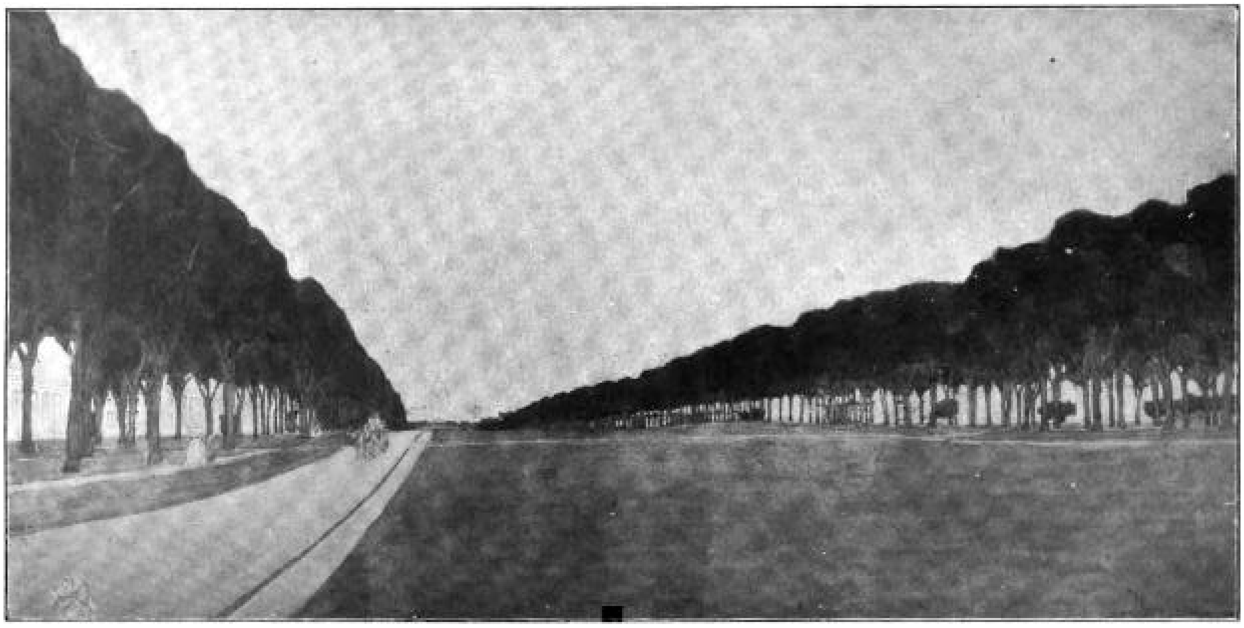

Figure 5. "View of the Mall from Sixth Street"[3]

Construction of the McMillan plan required demolishing a number of buildings, the eventual removal of nearly every existing tree, and extensive grading that involved bringing in tons of fill from offsite. It was a major construction project, and although the first planting of the elm panels began in 1935, with 333 young American elms, the final elm panel planting would not occur until 1975. It is also possible that some elms that had been planted on the Mall in the 1920s worked with the planting design for the McMillan Plan, and were able to be preserved. Given these dates, when tree planting was completed for the Mall in 1975, a few hundred trees were already 40 years old, and there were likely some that were already over 50 years old.

3. Moore, C. (Ed.). (1902). The improvement of the park system of the District of Columbia: Report of the Senate Committee on the District of Columbia. Report of the Park Commission (No. 166). US Government Printing Office, pg. 43 (facing)

Figure 6. Photograph of the Mall in 1935

As described in the 2006 Cultural Landscape Inventory (CLI), a report on the young elm planting in 1945 revealed inconsistencies in tree form:

> *"In developing their shape the branches have grown outward or crossed over and become so irregular that they will by no means support the original idea whereby the trees were to grow in an upright shape so that the gentle arching branches would meet between rows of trees and form a high overhead arch, reminiscent of the nave of a large church or cathedral…The paramount condition in the specifications for obtaining the true type vase shaped elm would be the actual selection of the tree in the nursery row irrespective of whether the tree was grown from seed or asexually propagated. After all it is the way a tree grows that counts and not its ancestry…It is therefore strongly recommended that the elm trees now growing in the Mall as part of the Mall scheme, which show a decidedly averse tendency to growing into the typical shape of a vase shaped elm, shall be removed and replaced with actual vase shaped elms, that they shall be actually selected for their shape from the nursery row, shall be shipped bare rooted about 2½-3" in trunk diameter. With dead and missing trees a total of 80 trees should be purchased."*

Referring to “the true type vase shaped elm” is a bit misguided. A highly regarded horticultural resource, The Standard Cyclopedia of Horticulture by L.H. Bailey, describes the variety of American elm forms in its 1919 edition entry for *Ulmus americana:*

> *“One of the favorite avenue trees in the northeastern states. The elm varies considerably in habit, and the following forms have been distinguished. In the “vase form” the main trunk separates at 15-30 ft. into several almost equal branches, which diverge at first slightly and gradually, but at the height of 50-70 ft. sweep boldly outward and form a broad flat head, with the branches drooping at the extremities. This is the most beautiful and also the commonest form. The “plume form" is much like the foregoing, but the trunk is less divided and the limbs are clothed with short branchlets, thus forming feathery plumes. The “weeping-willow form” usually has a rather short trunk with limbs curving outward more rapidly and with long and very slender pendulous branches, forming usually a broad and round head. The “oak-tree form" is distinguished by its limbs spreading abruptly and in sharp turns and the branches being usually less pendulous. The name “feathery” or “fringed” elm is applied to trees which have the limbs and the main trunk clothed with short somewhat pendent branchlets thrown out usually in clusters at short intervals. This may appear in any of the forms named, but is most conspicuous in trees of the plume form.”*[4]

So while the “vase form” is the most common form of American elm planted, and clearly the form the McMillan Commission desired to be planted on the Mall, it was not the only form commonly seen in the species. It is also clear, given the 1945 report, and the present diversity of tree forms observed on the Mall, that many of its elms do not currently adhere to this “vase-form” ideal.

Figure 7. The elms present on the Mall today display many growth forms.

4. Bailey, L. H. (1919). The Standard Cyclopedia of Horticulture: Macmillan, pg. 3410

Prior Soil Studies

Past soil studies of the National Mall present interesting data. A 1986 study[5] found that bulk density ranged from 1.60 to 1.67 g/cm^3. A separate report,[6] published a few years later, states that the average bulk density 6 inches (15.24 cm) below the soil surface for eight of the panels (panels 21, 33, 35, 36, 39, 43, 50, 51) ranged from 1.55 to 1.66 g/cm^3, whereas the maximum bulk density of each panel ranged from 1.62 to 1.98 g/cm^3, which can limit tree root growth. These findings emphasize the need for an effective management plan established and implemented to restore the soil, while still allowing such an important national landscape to be actively used as is expected. In this context, the present soil study aims to provide: 1) updated information on bulk density and texture classes, 2) other physical properties of soil such as aggregate stability and organic matter contents, and 3) basic chemical and biological properties of the soil.

Current Tree Conditions

Size Distribution

The tree inventory that took place on June 17 – 20, 2017 measured multiple characteristics for each tree. One of these was tree size, and DBH was recorded. DBH, the tree trunk diameter at breast height (4.5' above the ground), is a widely accepted method for measuring tree size. A healthy tree population must necessarily be composed of large numbers of small young trees. It is these young trees that will grow into the large trees that make up the future landscape. Because of the dynamic nature of an urban forest planting, young trees must always represent a significant portion of the tree population to account for the loss of trees over time. Continued, active planting of young trees is crucial to maintaining a sustainable and resilient tree population. In the ideal tree population, there are a large number of small trees, with increasingly fewer trees in larger size classes. The elm population on the National Mall is aging, and each year new trees must be planted to compensate for future loss of the older trees.

[5] Short, J. R., Fanning, D. S., McIntosh, M. S., Foss, J. E., & Patterson, J. C. (1986). Soils of the Mall in Washington, DC. Soil Science Society of America Journal, 50(3), 699-705.

[6] Craul, P. (1990). Report to the Regional Director on the conditions of the soil and vegetation on the National Mall, Washington, D.C. U.S. Dept. of Interior- National Park Service, National Capital Region, pg 46.

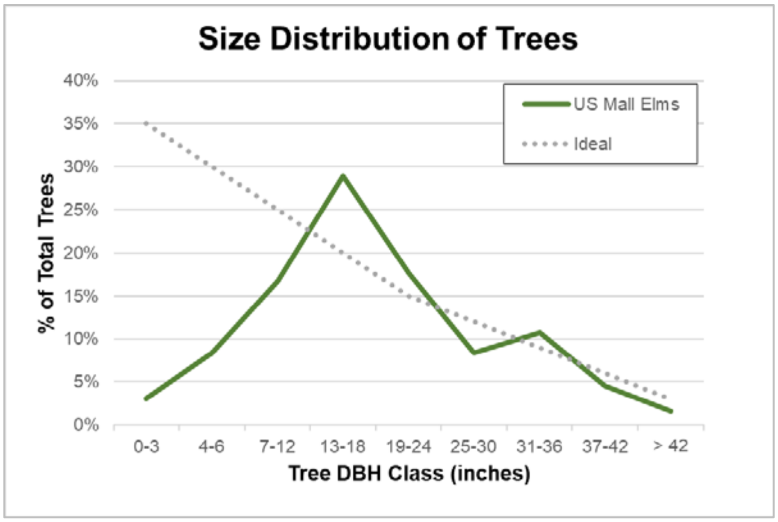

Figure 8. Size Distribution of Trees.

Species Distribution

Maintaining a diverse species composition is a good way to maintain a healthy, resilient tree population. A general guideline in urban forestry suggests that an urban tree population should include no more than 10% of any one species, 20% of any one genus, or 30% of any one family. While it is debatable if this guideline is appropriate for a monumental landscape such as the National Mall, it underscores the importance of tree diversity to reduce the risk of catastrophic loss.

All 550 trees inventoried on the National Mall are elm trees. This number excludes the five bald cypress trees found growing in front of the National Museum of Natural History, as this study is focused specifically on the elm planting. It is a monoculture landscape, and the vast majority of the trees are just one species, the American elm (*Ulmus americana*). While it is possible that a handful of trees are *Ulmus × hollandica,* or newer hybrid elms developed for their DED resistance, *U. americana* dominates. Younger trees tend to consist of American elm cultivars planted because of their resistance to DED, especially 'Princeton' and 'Jefferson.' Another prominent cultivar on the mall is 'Augustine Ascending,' which visually stands out from the other trees due to its markedly upright form.

Figure 9. The tall, narrow form of the 'Augustine Ascending' cultivar makes it easy to spot among the other elms.

Condition Assessment

During the tree inventory, each elm tree was given a qualitative condition rating based on its visual condition. Most of the 550 trees earned a rating of "good". A "good" tree has acceptable foliage quantity and quality characteristics, an appropriate branching structure, little or no disease or insect symptoms or signs, visible root flare, and other visual characteristics that relate to the health and structure of the tree. A few trees seemed far better than acceptable, and these were rated as "excellent." These are the trees that are the most attractive and healthy and have great aesthetic appeal, even to non-tree lovers. Trees that had a sparse canopy or had significant dieback in the crown were given a "fair" rating, and those trees that are clearly in physiological decline were rated "poor." In general, trees that rated "poor" are likely candidates for removal in the near future. Typically, when a tree has declined significantly, it is rarely worth the cost of trying to prune the deadwood, try to fix site issues, or otherwise put time, effort and money into saving the tree—it is better to remove the declining tree, remediate the site, and replant with a new, more vigorous tree.

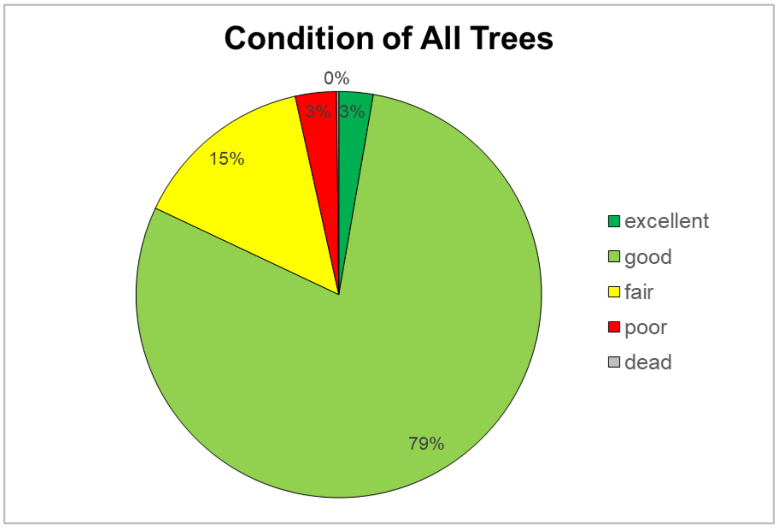

Figure 10. Condition of All Trees

Figure 11. A map showing the condition of all the elm trees

Risk Assessment

The research team utilized the International Society of Arboriculture Level Two Basic Tree Risk Assessment to perform a tree-by-tree assessment for the elms on the National Mall. A Level Two Basic Tree Risk Assessment is a 360-degree visual assessment of the tree, noting major risk factors that might be present in the tree. Risk factors include visual signs of decay in the trunk, roots, or large branches; broken or cracked limbs; larger diameter dead branches; and the like. In addition, we scouted for insect and disease incidence and noted the presence of flagging leaves, an indicator of Dutch elm disease.

A "low" risk rating means there was no significant visual defect in the tree, a "moderate" rating indicated a problem, often a dead or damaged branch that could be remediated by pruning, and "high" indicated that the tree posed a significant risk of either whole tree failure or large branch failure.

A Level Two Basic Tree Risk Assessment cannot guarantee that all trees that pose a threat to public safety are noted by the visual inspection—significant decay can be present in a tree's roots, trunk or branches and not present outward signs or symptoms that would alert the tree risk assessor. However, a Level Two Basic Tree Risk Assessment is considered a reasonable risk management technique for agencies and companies that manage public trees.

The tree risk assessment team delivered a list of a dozen or so trees we felt needed immediate remediation to the National Park Service. This study identified many more trees that have visual defects that should be more closely inspected by a qualified consulting arborist. We suggest that the National Park Service retain the services of a Registered Consulting Arborist and member of the American Society of Consulting Arborists. The consulting arborist will do a more in-depth risk assessment and make specific recommendations to mitigate risk in the elms. The consulting arborist should adhere to the most recent version of the *American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Tree Risk Assessment a. Tree Structure Assessment)* 2017, as well as the best management practices as outlined in the International Society of Arboriculture's *Best Management Practices: Tree Risk Assessment, Second Edition.*

Dutch Elm Disease

The research team noted the presence of flagging leaves that is a symptom of Dutch Elm Disease. Dutch Elm Disease (DED) is a significant threat to the elms of the National Mall, and efforts to limit the spread of the disease is of paramount importance in the management of the trees. A few trees appeared to have the disease, and a few others may also be infected. A priority task for the National Park Service to manage DED is to regularly scout the trees for flagging leaves, test them for the presence of DED, and remove them as soon as possible if they are infected—ideally within a month of detection. Infected branches initially have wilted leaves, which then turn yellow or brown and drop off. The infection is often apparent in early summer. Pruned wood should be chipped to destroy the insects that vector the disease. Diseased wood should not be allowed to remain near other elm trees, as the beetles that transmit the fungus could infect healthy trees. If wood is too large for the chipper, it should be debarked or buried.

If a tree dies completely from DED, we suggest trenching at least 3' deep around the roots of the diseased tree prior to its removal. The trench will break any root grafts that the diseased tree has with neighboring trees. The trench should be done in a circle with a radius of about 10' around a diseased tree. Typically, root grafts are present in larger trees, so a good practice would be to trench around any tree larger than 12" diameter prior to its removal if DED is suspected.

There are good fungicides that are effective against DED. In the management report, we recommend treating high value trees prophylactically to prevent disease and treat newly infected trees to limit the advance of the infection in the tree.

Figure 12. A tree showing the symptoms of Dutch Elm Disease

Cabling Assessment

As part of the visual assessment of the elms, the research team noted whether the elms had support cables in their canopy. We also noted those trees whose cables had failed or are visibly failing. We recommend that the cables be re-installed using the current ANSI standards (ANSI A300 Part Three-2013: Supplemental Support Systems) and the best management practices as outlined in the International Society of Arboriculture's *Best Management Practices: Supplemental Support Systems*, *Third Edition*. Many of the cables we saw in the tree canopies were placed too low to conform with current cabling practices.

While many tree care companies report that cables will last only ten years, it is our experience that they often can be serviceable for almost twice that. In order to best manage the risk posed by cabled trees, we suggest that a database be maintained that documents when a cable is installed and note periodic visual inspection and planned replacement as the cable reaches the end of its useful life.

Additional Observations

While collecting data, we also made some notes that gave more information or suggested maintenance tasks for some of the trees. For example, we noted girdling roots, co-dominant forks, trunk wounds, and even the presence of rat colonies under trees. We also noted tag numbers where we found them, which can be used to help identify the tree.

Figure 13. The team observed a number of rat holes during the inventory

Current Soil Conditions

Sampling and Testing

During June 17 – 20, 2017, soil samples from 6 inches (15.24 cm) below the soil surface were collected from 49 locations on the Mall, which were distributed among the 23 elm panels and 1 planting area just north of the Smithsonian Institution Building (The Castle). Of those 49 sampling locations, 29 locations were in the middle of each panel or planting area, and 15 locations were just inside the panels' edges facing the central lawn area. Where there were small roadside panels (panels 10, 14, 15, 31, and 48), samples were collected in the center of each area.

All soil samples were analyzed using the Cornell Soil Health Assessment.[7] Historically, soil tests have analyzed just the chemical components of the soil, while the Cornell Soil Health Assessment also examines the physical and biological aspects. Additionally, the research team also separately measured the bulk density of the soil. Because the soil on the Mall originated as 'fill' from unknown sources, and did not resemble a natural soil, the investigators used their own judgement as to interpreting some of the test results.

The Cornell Soil Health Assessment uses a "traffic light" indicator for each soil characteristic. A green color is considered adequate for healthy plant growth, while a yellow color is more challenging for plants, and orange indicates problems with the plants, and red means the soil is outside the parameters for healthy plant growth. In line with this color coding system, a simple green/yellow/red color is given to the soil measurements. For each soil characteristic, the color code is shown, and the tree condition ratings for each tree is shown directly below the soil characteristic. The legends explain the measurements that comprise each color code.

[7] Moebius-Clune, B.N., D.J. Moebius-Clune, B.K. Gugino, O.J. Idowu, R.R. Schindelbeck, A.J. Ristow, H.M. van Es, J.E. Thies, H.A. Shayler, M.B. McBride, K.S.M Kurtz, D.W. Wolfe, and G.S. Abawi, 2016. Comprehensive Assessment of Soil Health – The Cornell Framework, Edition 3.2, Cornell University, Geneva, NY.

Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences, School of Integrative Plant Science, Cornell University, Ithaca, NY 14853. http://soilhealth.cals.cornell.edu

Grower:
Bob S.

Agricultural Service Provider:
Mr. Bob Consulting

Sample ID:	LL8
Field ID:	Caldwell Field- intensive management
Date Sampled:	03/11/2015
Given Soil Type:	Collamer silt loam
Crops Grown:	WHT/WHT/WHT
Tillage:	7-9 inches

Measured Soil Textural Class: **silt loam**

Sand: **2%** - Silt: **83%** - Clay: **15%**

Group	Indicator	Value	Rating	Constraints
physical	Available Water Capacity	**0.14**	**37**	
physical	Surface Hardness	**260**	**12**	**Rooting, Water Transmission**
physical	Subsurface Hardness	**340**	**35**	
physical	Aggregate Stability	**15.7**	**19**	**Aeration, Infiltration, Rooting, Crusting, Sealing, Erosion, Runoff**
biological	Organic Matter	**2.5**	**28**	
biological	ACE Soil Protein Index	**5.1**	**25**	
biological	Soil Respiration	**0.5**	**40**	
biological	Active Carbon	**288**	**12**	**Energy Source for Soil Biota**
chemical	Soil pH	**6.5**	**100**	
chemical	Extractable Phosphorus	**20.0**	**100**	
chemical	Extractable Potassium	**150.6**	**100**	
chemical	Minor Elements Mg: 131.0 / Fe: 1.2 / Mn: 12.9 / Zn: 0.3		**100**	

Overall Quality Score: **51** / Medium

Figure 14. Example of Cornell Soil Health Assessment score sheet. A simple "traffic light" style color coding helps the researcher to identify those soil characteristics that impede healthy plant growth.

Soil pH

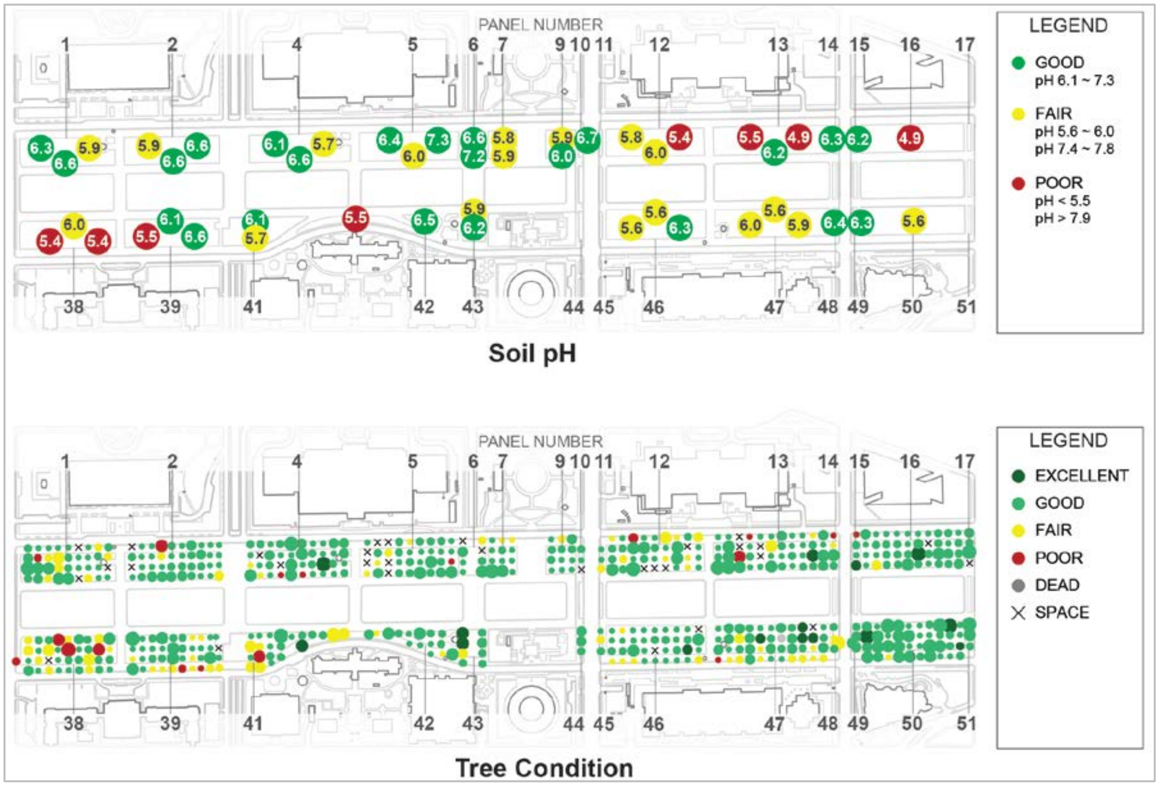

Figure 15. Soil pH and tree condition

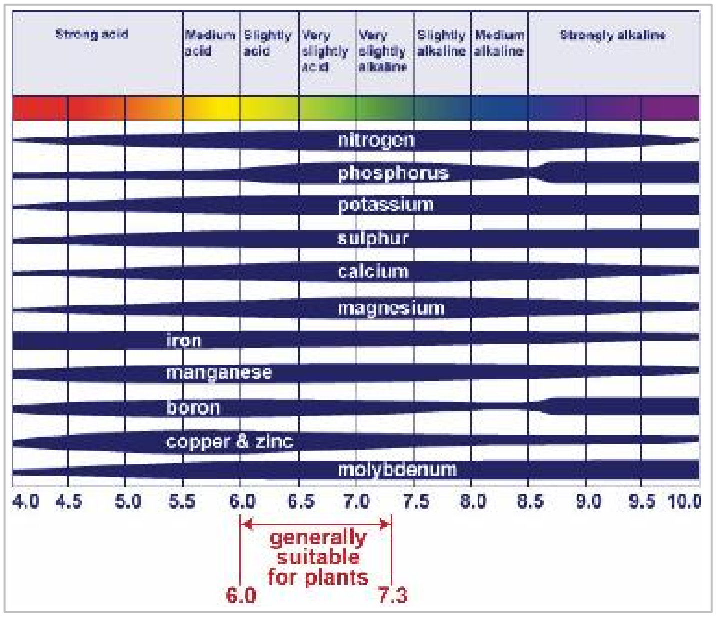

Figure 16. Soil pH and nutrient availability[8]

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8. Roques. R., Kendall. S., Smith. K, Berry. P.M. (2013) "Review of the non-NPKS nutrient requirements of UK cereals and oilseed rape" Review No.78. HGCA, Kenilworth, 2013

Soil pH, a measurement of the acidity or alkalinity of the soil, determines the availability, or solubility, of nutrients in the soil. pH is measured on a scale of 0 – 14, where 7.0 is neutral. Any reading below 7.0 is acid, and those above 7.0 are alkaline. Ideally, most nutrients are at their greatest availability when the soil pH is between 6.1 and 7.3. Some plants are adapted to soils that are beyond this ideal range, and elm trees are known for being tolerant of a wide range of soil pH. For the 49 samples taken on the Mall, pH ranged from 4.9 – 7.3, and the median pH was 6.0. No sample exceeded a pH of 7.4, whereas 18 samples were in a pH range between 5.6 – 6.0, to which "Fair" was given as the pH rating. "Poor" pH ratings were given to 8 samples with a pH below 5.5, of which 2 samples in panel 38, 1 sample in panel 13, and 1 sample in front of the Smithsonian Castle were associated with a poor or fair tree health assessment. In general, except for a few outliers, soil pH values were in a normal range for moderately acid soil types.

Organic Matter Content

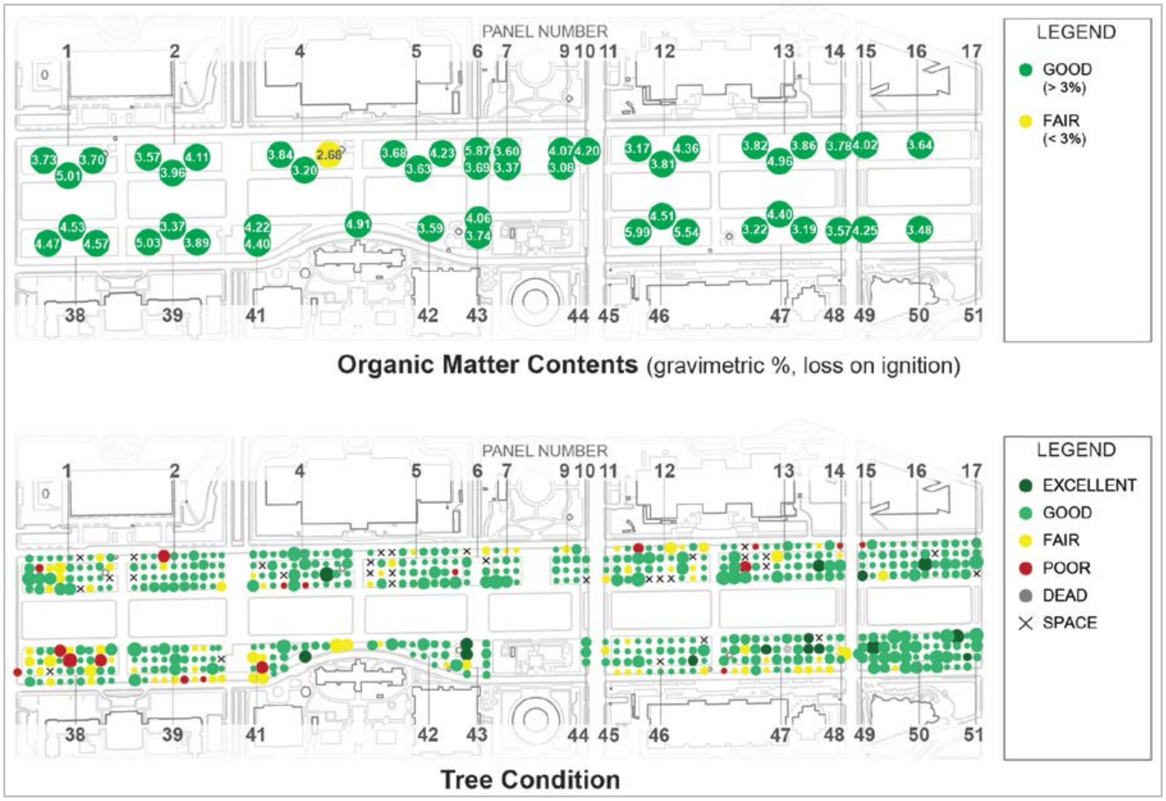

Figure 17. Soil organic matter content and tree condition

Soil organic matter measures the fraction of the soil that was derived from living organisms. It is measured by loss on ignition where dried soils are weighed before and after being combusted in a 500°C furnace. The loss of weight after combustion is the total organic matter content. On the Mall, organic matter ranged between 2.68% – 5.99%, and the overall average of all samples was 4.03%. For street tree plantings, it is advised to maintain organic matter content above 3%, to which a "good" rating was given. Samples had organic matter contents above 3%, except one sample (2.68%) in panel 4. Organic matter contents can indicate the size of a long-term slow-release pool of nutrients, modify the plant-available water, and make soil less prone to compaction. Although organic matter was not particularly high in the Mall soils, there was nothing that indicated a problem.

Aggregate Stability

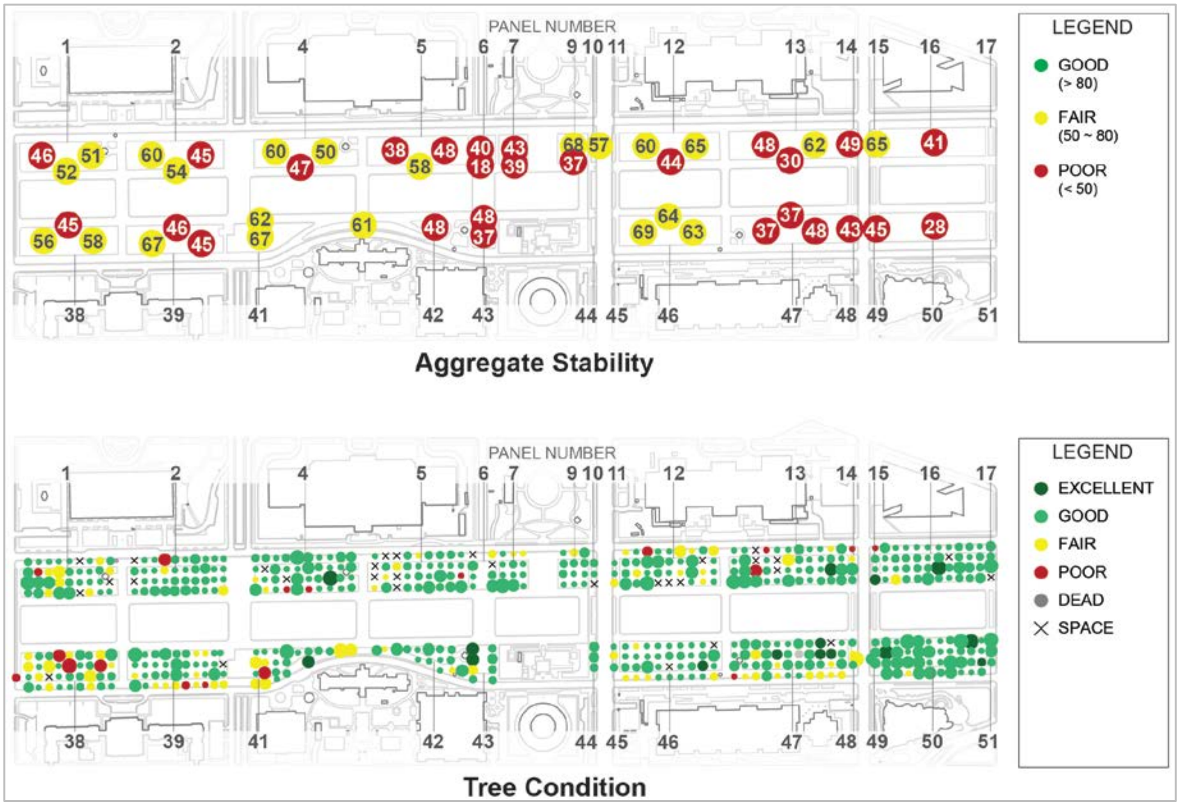

Figure 18. Aggregate stability and tree condition

Aggregate stability measures how well soil peds, aggregated primary soil particles, resist slaking or disintegration after a rainfall event. In the Cornell Soil Health Assessment, a rainfall simulator is used to expose soil particles between 0.25 and 2.0mm on a sieve to a rainfall event. The weight of those soil particles that remain on the sieve after the rainfall event determines the percent aggregate stability of the soil. Aggregate stability ranged between 18 – 69%, and the overall average of all samples was 50%. Of 49 samples, no sample was rated “good” (> 80%) and 43% of samples (21 samples) were rated “fair” (50 – 80%), whereas 57% of samples (28 samples) were rated “poor” (< 50%). A well-aggregated soil implies good soil structure, and good particle aggregation can reduce bulk density and erosion, while facilitating aeration, infiltration, water storage and root penetration.

Plant Available Water (PAW)

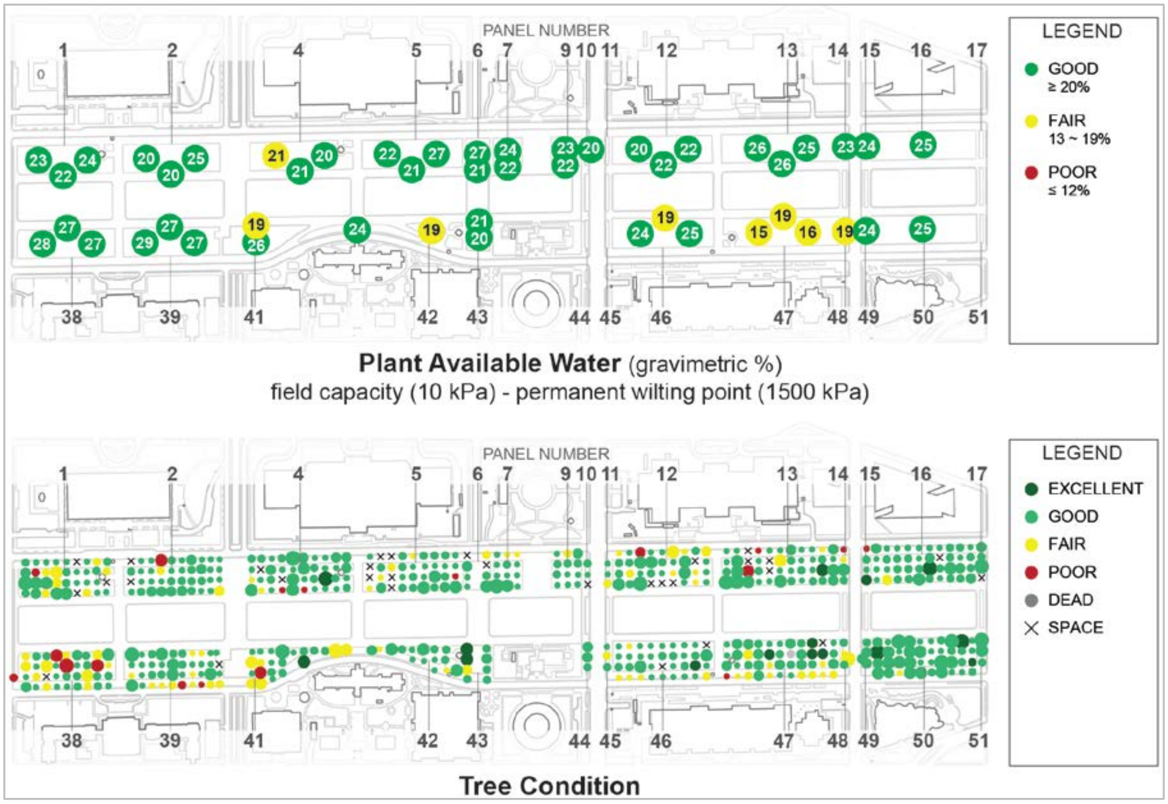

Figure 19. Plant available water and tree condition

Plant available water (PAW) is the measure of how much water is available for plant growth. It is measured in pressure chambers and calculates the amount of water from field capacity (10kPa) and the permanent wilting point (1500kPa). In the field, soil water supply (rainfall and/or irrigation) followed by the drainage by the force of gravity, is the high end of PAW. Soil can store water in its pore spaces. Of this water storage, PAW can be used by the plants' root systems, and is important source of water during dry weather periods. On the Mall, gravimetric plant available water (PAW) ranged between 15% – 29%, and the overall average of all samples was 23%. Of 49 samples, only 16% of samples (8 samples) were rated "fair" (PAW between 13% – 19%), and the rest of 84% of samples (41 samples) were rated "good" (PAW > 20%). After the water supply (rainfall and / or irrigation) followed by the drainage by the force of gravity, soil can store water in pore space. Of this water storage, PAW can be used by the plants' root systems, and is important source of water during dry weather periods. Overall PAW was rated "good" on the Mall.

Root Growth Limitation & Bulk Density

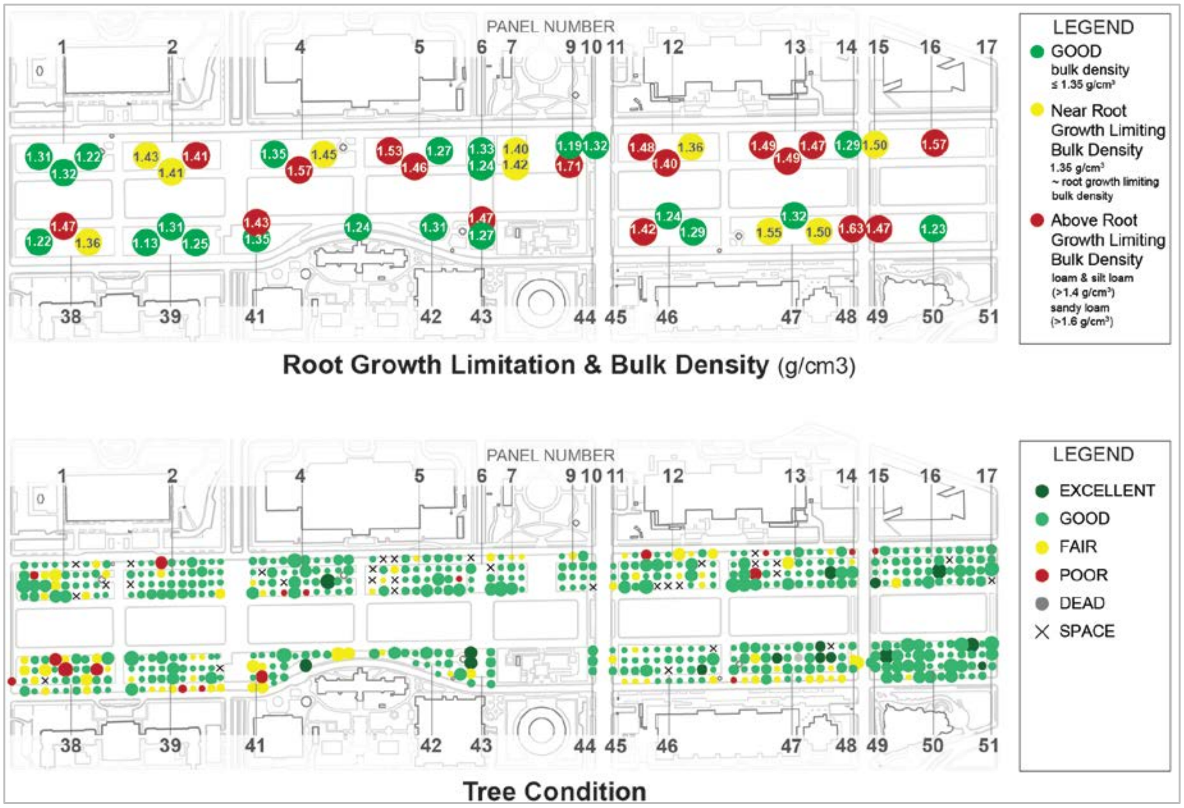

Figure 20. Root growth limitation, bulk density, and tree condition

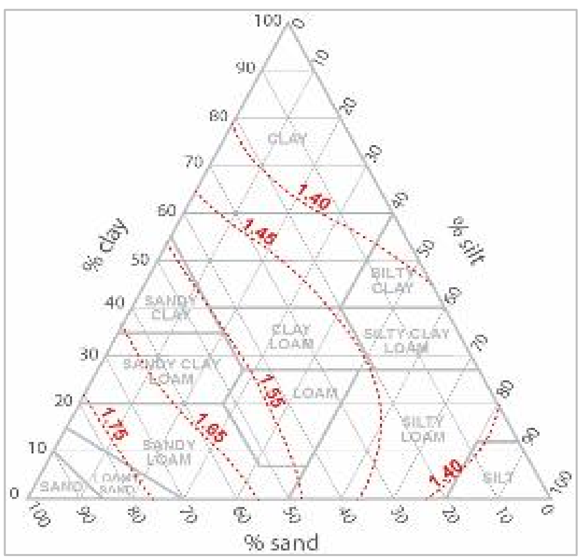

Figure 21. Soil texture classes and root limiting bulk density [9]

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9. Richard L., Gordon E. Warrington. (1983)"Growth-limiting Soil Bulk Densities As Influenced by Soil Texture" Watershed Systems Development Group USDA Forest Service

Soil bulk density, sometimes called dry density, is an important measure of the limits of root penetration in soil and indirectly water drainage and soil aeration. The smaller the pores in the soil, the slower water will drain, and the slower air will take the place of the draining water. It is also a direct measurement of the force needed for a root to grow through the soil. Based on texture, 1.4 g/cc and 1.5g/cc are root growth limiting soil densities for loam and sandy loam respectively. Bulk density is measured by removing an undisturbed cylindrical core from the soil. The cylinder has a known volume. The soil is removed from the core, dried, and weighed. By dividing soil weight by the core volume, density is calculated, usually as grams per cubic centimeter. Of the 49 locations, bulk density ranged 1.13-1.71 g/cm^3, and the overall average of all samples was 1.38 g/cm^3. The bulk density that can limit the plant's root growth depends on soil texture classes: bulk density values above 1.6 g/cm^3 for sandy loam, and above 1.4 g/cm^3 for loam or silt loam. Also, even below the root growth limiting bulk density, bulk density above 1.3 g/cm^3 can affect tree growth and health by reducing root growth in loam, sandy loam, and silt loam, which are labeled as "near root growth limiting bulk density." Of 49 locations, 35% (17 locations) exceeded the root growth limiting bulk density, and 39% (19 locations) were near root growth limiting, whereas the rest (13 locations) had bulk densities below 1.3 g/cm^3, to which "good" is given as bulk density rating. High bulk density is a significant soil characteristic that challenges the health of the elms on the Mall.

Soil Texture Classes

Figure 22. Soil texture classes and tree condition

Soil texture is measured by the percentage of sand, silt, and clay in a soil. Of 49 samples, 59% of samples (29 samples) were loam, and 37% of samples (18 samples) were sandy loam, whereas 4% of samples (2 samples) were silt loam. These soil texture classes were determined by the gravimetric particle size distribution of clay, silt, and sand, which were measured by the reciprocal shaker. Among common soil texture classes, silt loam can have the maximum plant available water, and silt loam sample in panel 39 has the maximum plant available water (29%) in the present study. Unlike the management of pH, organic matter and soil aggregate stability, soil texture classes are rarely changed by management, unless a large volume of mineral soil is imported from outside the site. All of these soil textural classes are considered acceptable for tree growth—the difference is in the way they are managed.

Usable Depth

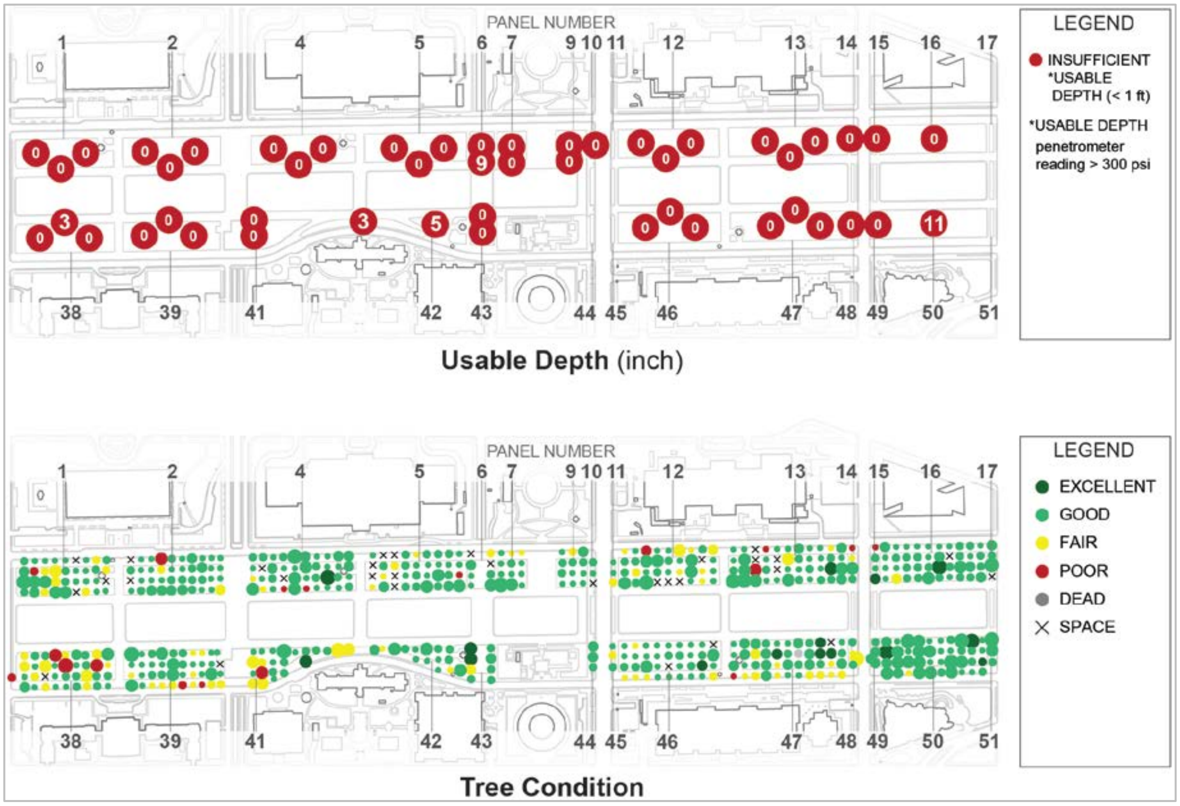


Figure 23. Usable depth and tree condition

Figure 24. A penetrometer was used to measure usable depth

Usable depth is the depth from the soil surface, to which a cone penetrometer reading is consistently below 300 psi (≒2068 kPa). These measurements were taken directly in the field on the Mall at each point where a soil sample was removed. A penetrometer can provide direct measurements of root penetration resistance, which is physical force necessary for the plant's root to penetrate a soil. Root penetration can be limited over 300 psi of penetrometer readings, and a minimum of 2ft (60cm) of usable depth is recommended for tree planting in general. Of 49 sampling locations, however, none had usable depth equal to or over 1ft, whereas 5 locations had depths which ranged up to only 11 inches (27.9cm). Root penetration can be reduced in proportion to penetration resistance, and values near 300 psi do not contribute to plants' vigor through root growth. Penetration resistance around <200 psi for the minimum of 2ft soil depth is recommended as management target. Useable depth is a significant challenge to the health of the elms on the Mall.

Soil Active Carbon

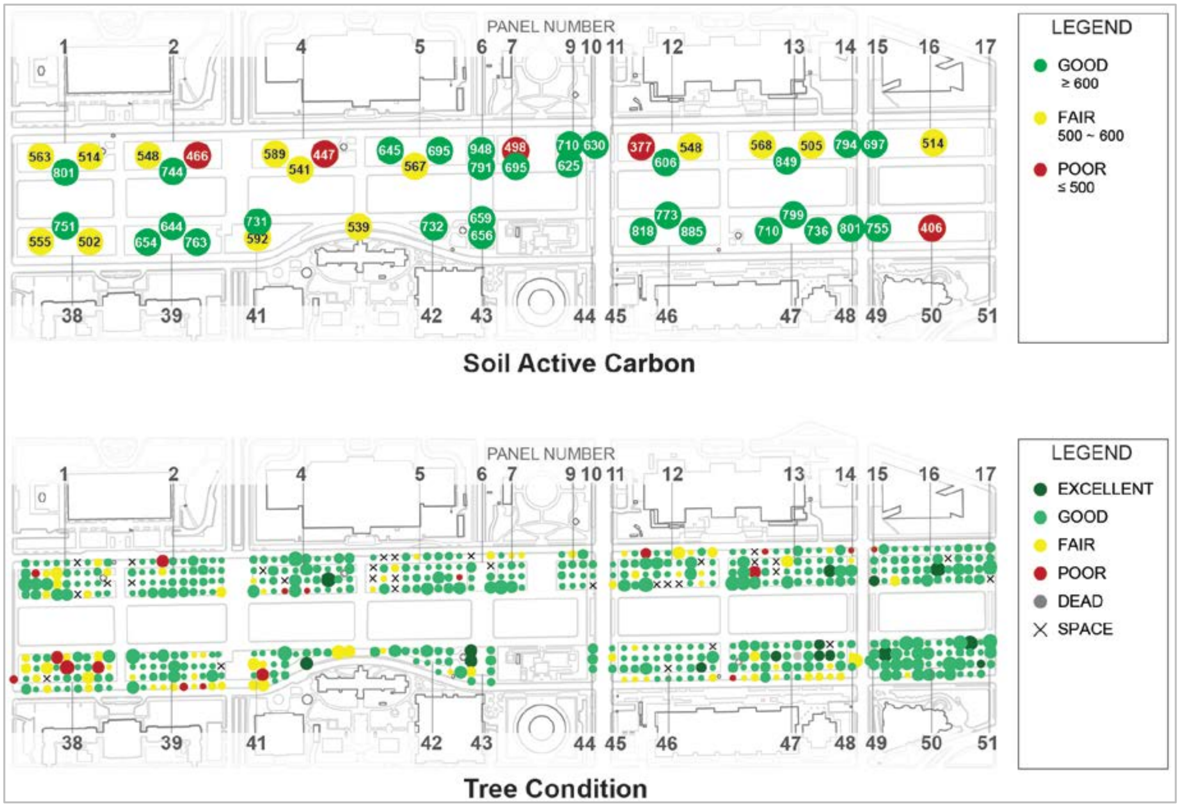


Figure 25. Soil active carbon and tree condition

Active carbon is a fraction of the total organic matter that can be readily used by microorganisms in the soil. Adequate active carbon provides fuel for microbes to digest and excrete nutrients in simple soluble forms that plants can take up. The microbes are also important in helping to 'glue' sand, silt and clay particles together to form aggregates in the soil. Active carbon is calculated by quantifying potassium permanganate oxidation with a spectrophotometer. Good levels of active carbon are >600, while fair levels are between 500 and 600 and poor levels are <500. Thirty of the soil samples had good levels of soil active carbon, while 14 had fair levels and 5 had poor levels. The two easternmost tested panels of the Mall had fair or poor active carbon as did the soil in panel 4.

Soil Respiration

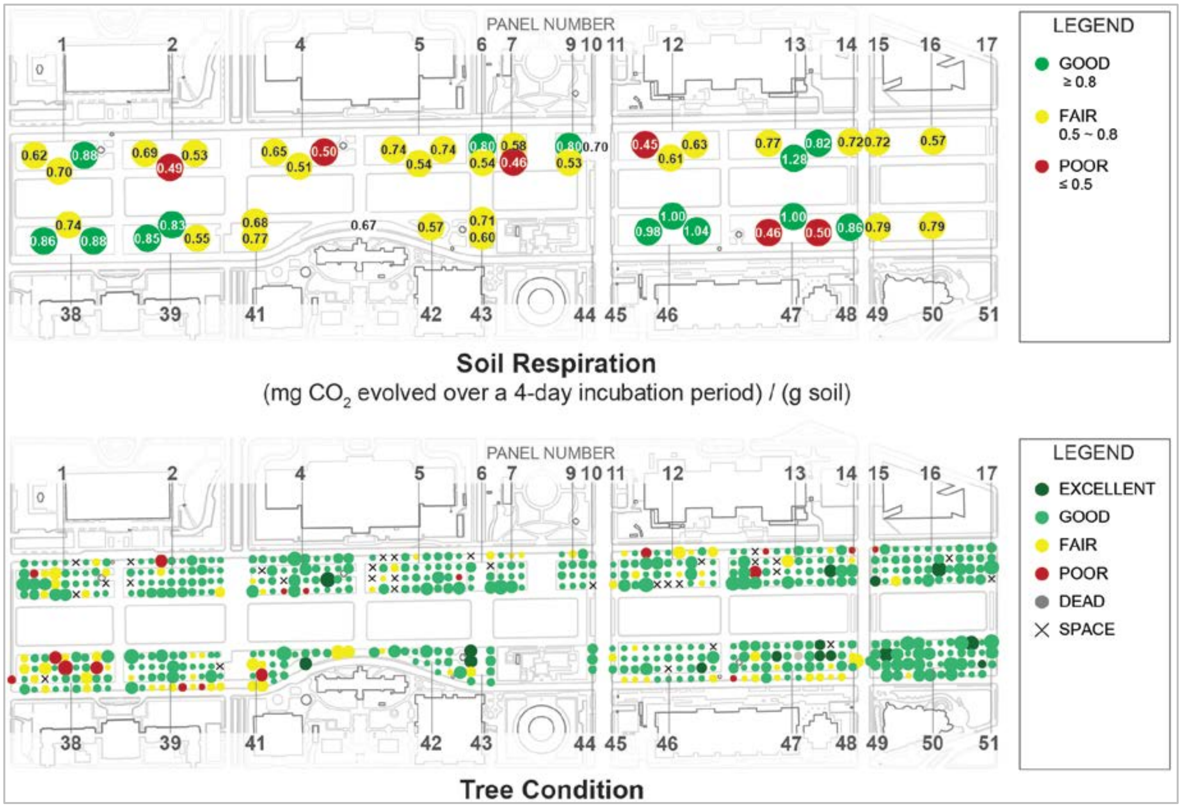


Figure 26. Soil respiration and tree condition

Soil respiration is a direct measure of microbial activity. Microbial activity is important for breaking down nutrients for plant uptake, the formation of soil aggregates, the sequestration of carbon dioxide, and often the suppression of soil borne diseases. Soil respiration is measured by wetting air-dried soil and capturing and quantifying and carbon dioxide produced.

Microbial activity is directly affected by soil density and its effect of on drainage and aeration. Maps showing soil density and soil respiration have many overlapping points showing the interdependence of one upon the other. Less than half (only 14) samples had good soil respiration on the Mall.

Soil Nutrients

Macronutrients are chemical elements needed in relatively large amounts to support plants' growth and health. Among macronutrients, phosphorus and potassium concentrations of soil were measured by using the modified Morgan extractant, a weak acid solution commonly used to extract nutrients in soil analysis. Of 49 samples, phosphorus concentrations varied between 4–659 (mg P / kg soil) and the overall average was 50 (mg P / kg soil), whereas potassium concentrations varied between 70–408 (mg K / kg soil) and the overall average was 163 (mg K / kg soil). This suggests that all 49 sample locations already have more than sufficient levels of phosphorous and potassium in soil for tree planting respectively. Further inputs of phosphorus through fertilizer application should be avoided in this site because excessive phosphorus levels of soil can increase phosphorus outflow through surface runoff and/or groundwater recharge, which can pose negative environmental impact on surface water quality, known as eutrophication.

Micronutrients are chemical elements needed in relatively small quantities yet are essential to support plants' growth and health. Among micronutrients, magnesium (86–287 mg Mg / kg soil), iron (2–72 mg Fe / soil kg), manganese (7–29 mg Mn / kg soil), and zinc (1 – 170 mg Zn / kg soil) concentrations were measured for all 49 samples respectively, of which none were deficient of any of these micronutrients for tree planting. If plants exhibit signs of deficiency for any of macro and/or micronutrients analyzed in the present study, they may not result from the lack of these nutrients in soil, yet from the availability of these nutrients in soil. Typically, soil nutrient availability can be reduced by drought and/or soil pH outside the desirable range (6.1-7.3), and low phosphorus availability can be caused by the suppressed soil microbial activities and/or excessive metal concentrations of soil.

Photographs of Soil Conditions

Figure 27. Loam soil sample under 1 – 2 inches of radial superficial compost amendment in panel 16. The sample had pH of 4.9, which was the lowest among all 49 soil samples. Bulk density was 1.57 g/cm^3, which can limit the trees' root growth in loam-textured soil. Effective methods of organic amendment application and pH control must be specified

Figure 28. Surfaced root systems in the middle planting row of panel 13. Panel 13 had loam soil with pH ranging down to 4.9, which was the lowest pH of all 49 samples collected. Bulk density of the panel 13 ranged between 1.47-1.49 g/cm^3, which can limit the trees' root growth in loam-textured soil.

Figure 29. Surfaced root systems in the middle planting row of panel 47. Panel 47 had sandy loam soil, and the bulk density of the middle planting row was 1.50 g/cm^3 and 1.55 g/cm^3, which were the 2 highest bulk densities among 18 sandy loam soil samples. For sandy loam, reference bulk density to limit root growth is above 1.60 g/cm^3, whereas bulk density near this reference value can also cause limitation to root growth as shown in the image.

Ground Penetrating Radar Sampling of Roots

In November of 2017, seventeen elm trees in twelve panels (fig. 30) were selected for a more in-depth investigation using Ground Penetrating Radar (GPR). These trees represented some of the oldest and largest trees located in the panels at the eastern end of the Mall, an area which had the greatest observed soil disturbance, as well as trees from the western end, notably panels 1 and 2, which had the best turf and showed the least observed soil disturbance.

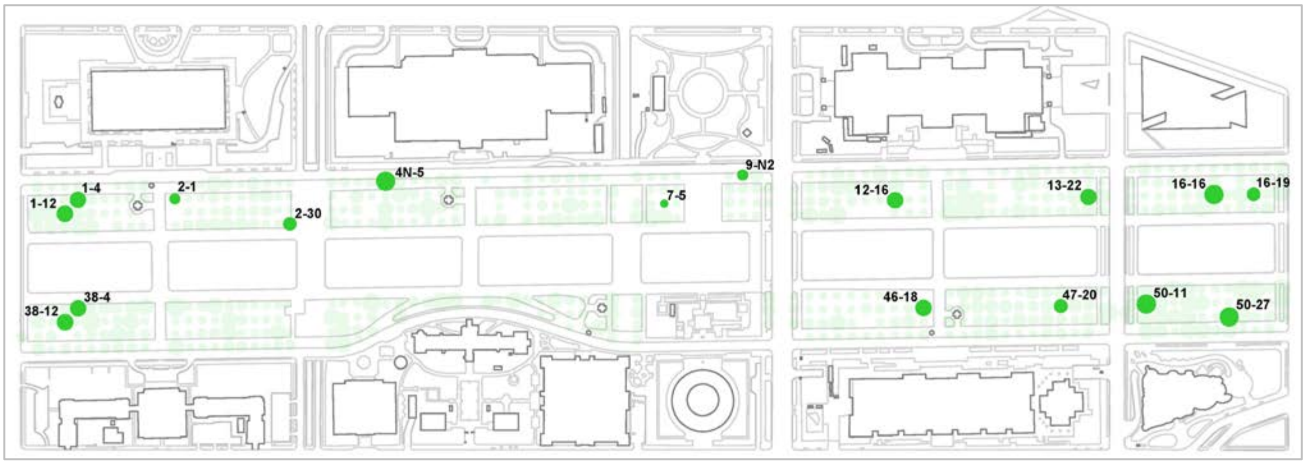


Figure 31. Trees on the Mall that received GPR sampling

GPR has been shown to successfully locate tree roots non-invasively and in three dimensions in forest soils. Although this technology has a long history of use in archaeology and engineering to locate antiquities and utilities, the practice of using it to map roots in urban soils, which can be compacted, layered and discontinuous, is comparatively new. In principle, detection of roots with GPR is possible because of the contrast in moisture content between the tree's root system and the surrounding soil. The high moisture content of the root system's functioning xylem, the "plant plumbing" responsible for the transport of water, provides an excellent contrast to the drier surrounding soil. Still, individual roots that have little or no functioning water-filled xylem may not be detected with GPR.

Although the roots involved with water transport are detectable, it may only be possible to estimate a bulk property of the roots' structure, such as the number of root detections in a specified area. For this study, the GPR instrument was used to trace three concentric circles at set distances from the trunk of each tree. While the circles varied in size (8', 16' or 24' radius), by dividing the number of roots detected at a specified depth by the distance traveled by the GPR instrument for each circle, we are able to calculate the density of roots for a given zone. This metric, "root density," which equals the number of root detections per foot at a specified depth range, allows us to easily compare the numbers of roots present at different distances from the trunk and at different specified soil depths.

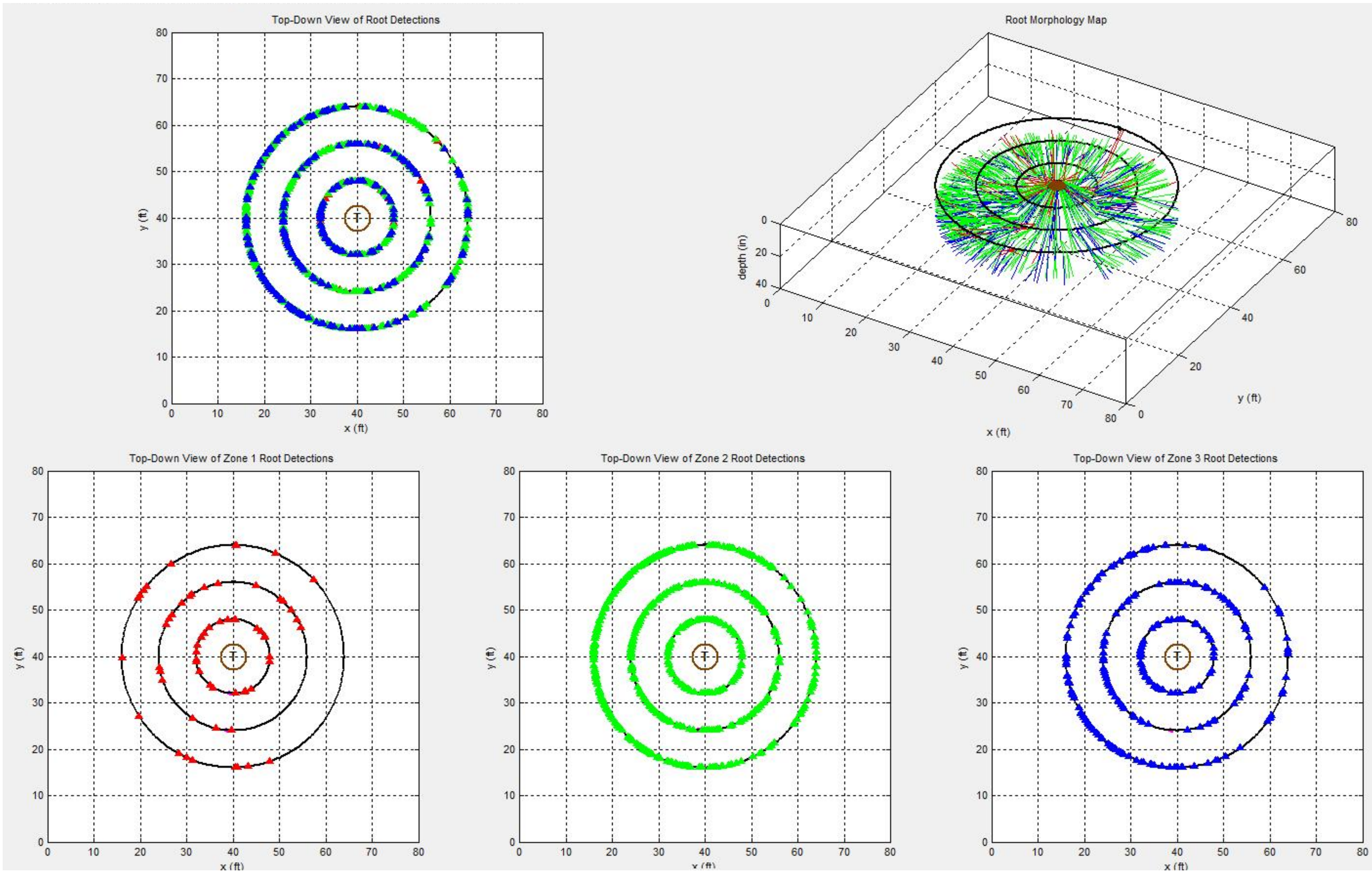


Figure 32. Example of data generated from GPR sampling of roots. This data is from tree 46-18

Roots were detected between the soil surface and the depth of the GPR instrument's detection limit (36"), but the greatest root density occurred between 8-16" from the surface (fig. 33). Given that the soil was consistently compacted, we can only conclude that these roots grew at this depth soon after the trees were transplanted when the soil bulk density was temporarily reduced. It is important to recognize that GPR only detects roots that are greater than 1cm in diameter. Roots detected under the elms represent the older structural roots, not fine feeder roots. Concentric scans of roots were measured within a radius of 24' from the trunk. In most cases, the greatest root density occurred in the first 8' from the trunk (fig. 34). Roots were significantly curtailed when they encountered a paved sidewalk, although the gravel paths lining the outer paths of the Mall did not seem to hinder root growth. Interestingly, surface roots were not detected when scanned with the GPR. These woody surface roots were often visibly damaged (see figures 35 & 36), and most likely contained little functioning, water-filled xylem, leaving them undetectable to the GPR. However, their visual prominence will figure into the management plan that is to follow this report.

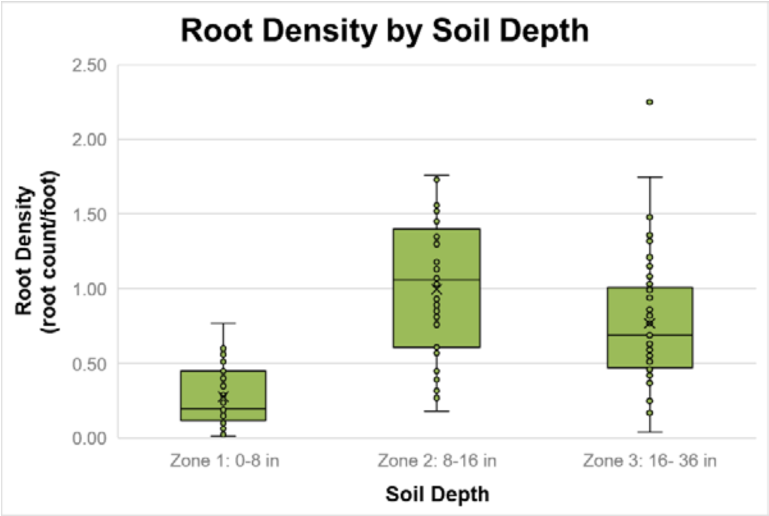


Figure 37. Root Density by Soil Depth

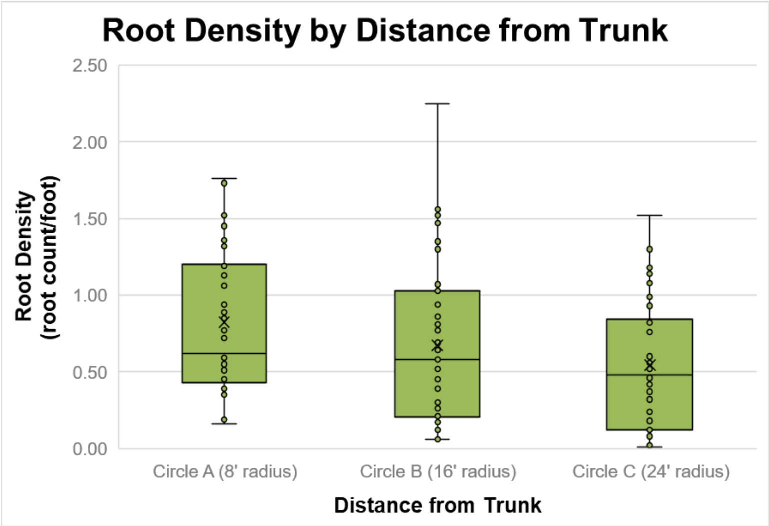


Figure 38. Root Density by Distance from Trunk

There was no apparent relationship between the trunk DBH, condition of the tree, and the number of detected roots (fig. 39). It was notable that several large trees in good condition between 20” and 40” in DBH had the greatest root density, however this relationship was not consistent.

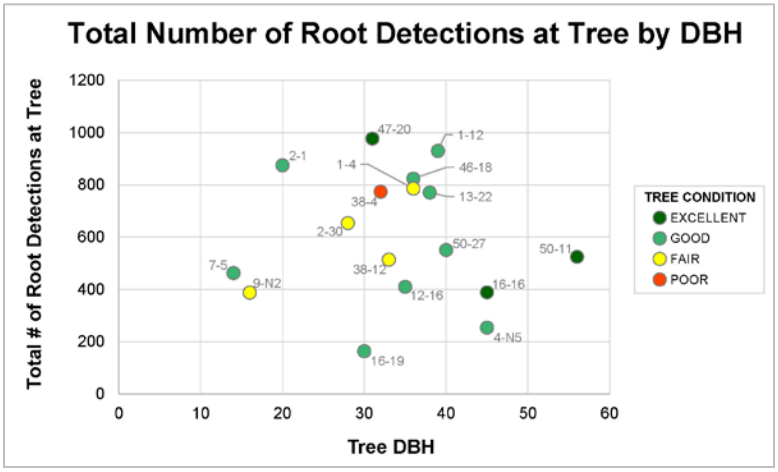
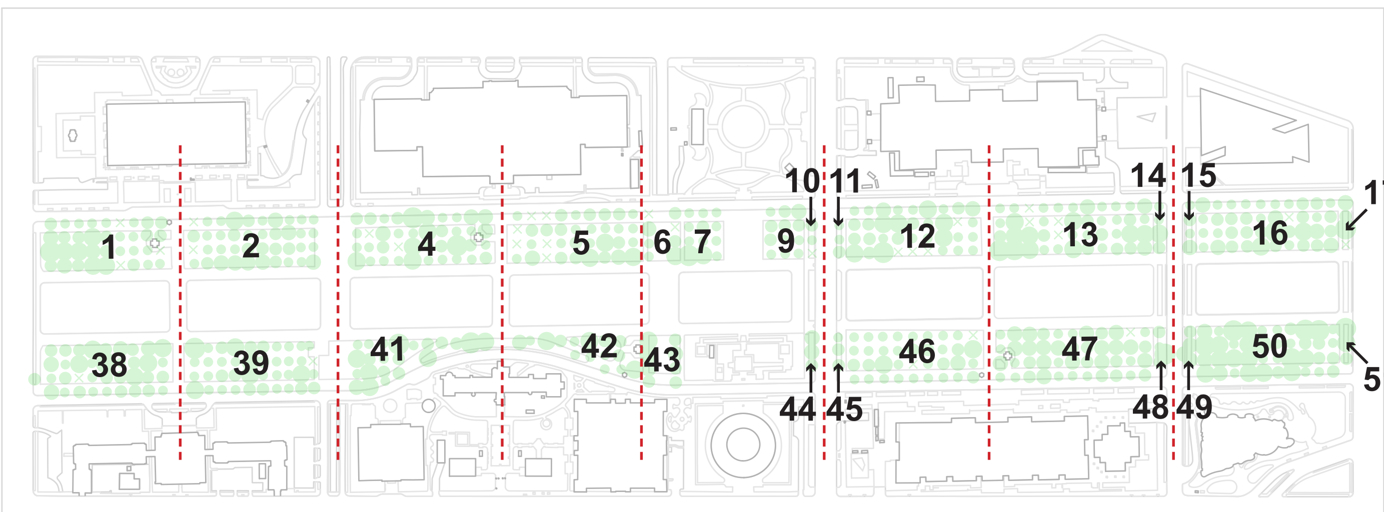


Figure 40. Total Number of Root Detections at Tree by DBH. Data labels specify the ID # of each tree, and the colors indicate each tree’s condition.

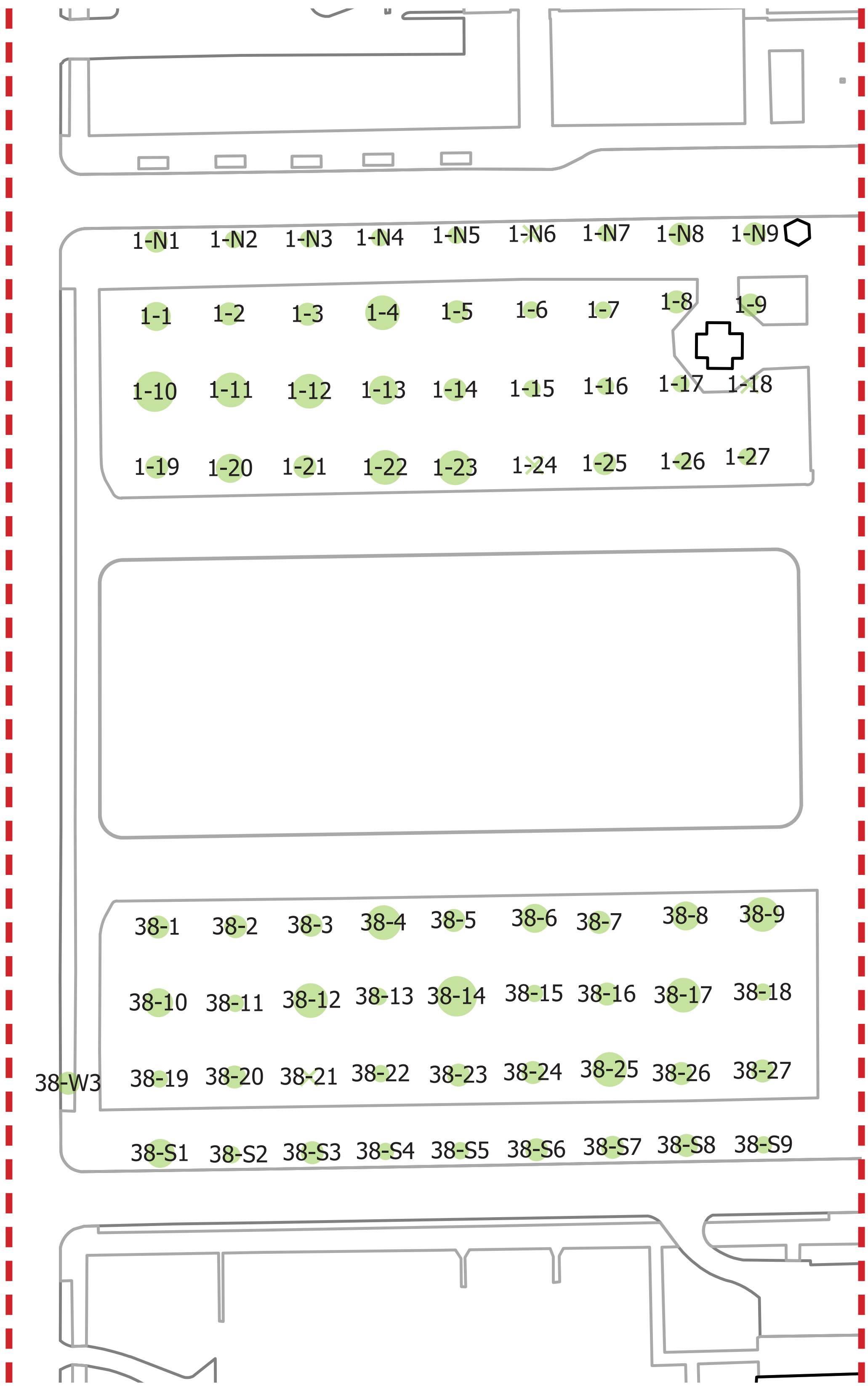
Appendix

- Panel ID Numbers
- Tree ID Numbers
- Elm Data
- Select Results from iTree Eco Analysis
- Maps
  - Elm Trees and Spaces
  - Identified Elm Species and Cultivars
  - Tree Condition
  - Signs of Dutch Elm Disease
  - Tree Maintenance Priority
  - Visual Tree Risk Assessment (VTRA)
  - Trees with Observed Cabling

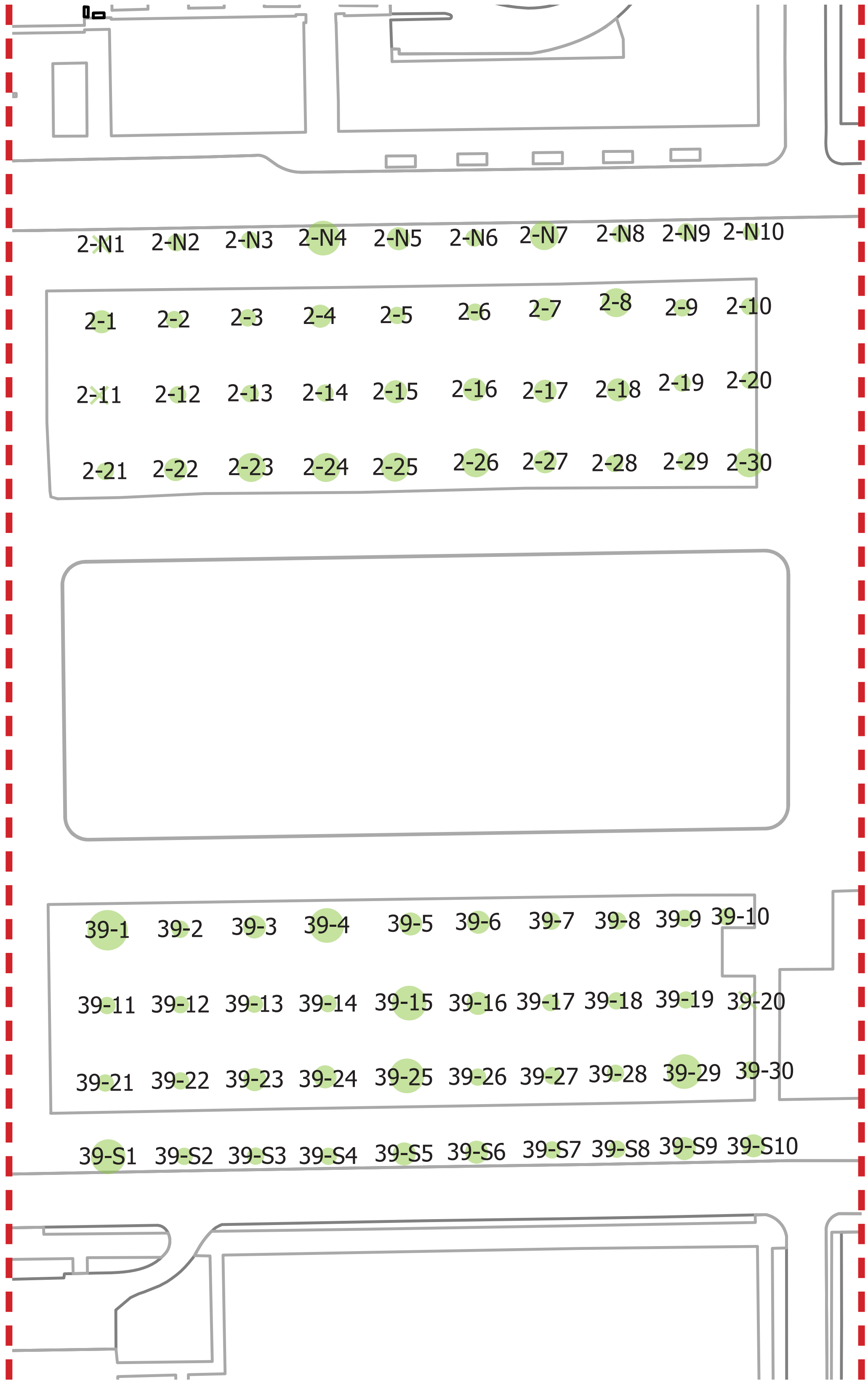
Panel ID Numbers - Key Map



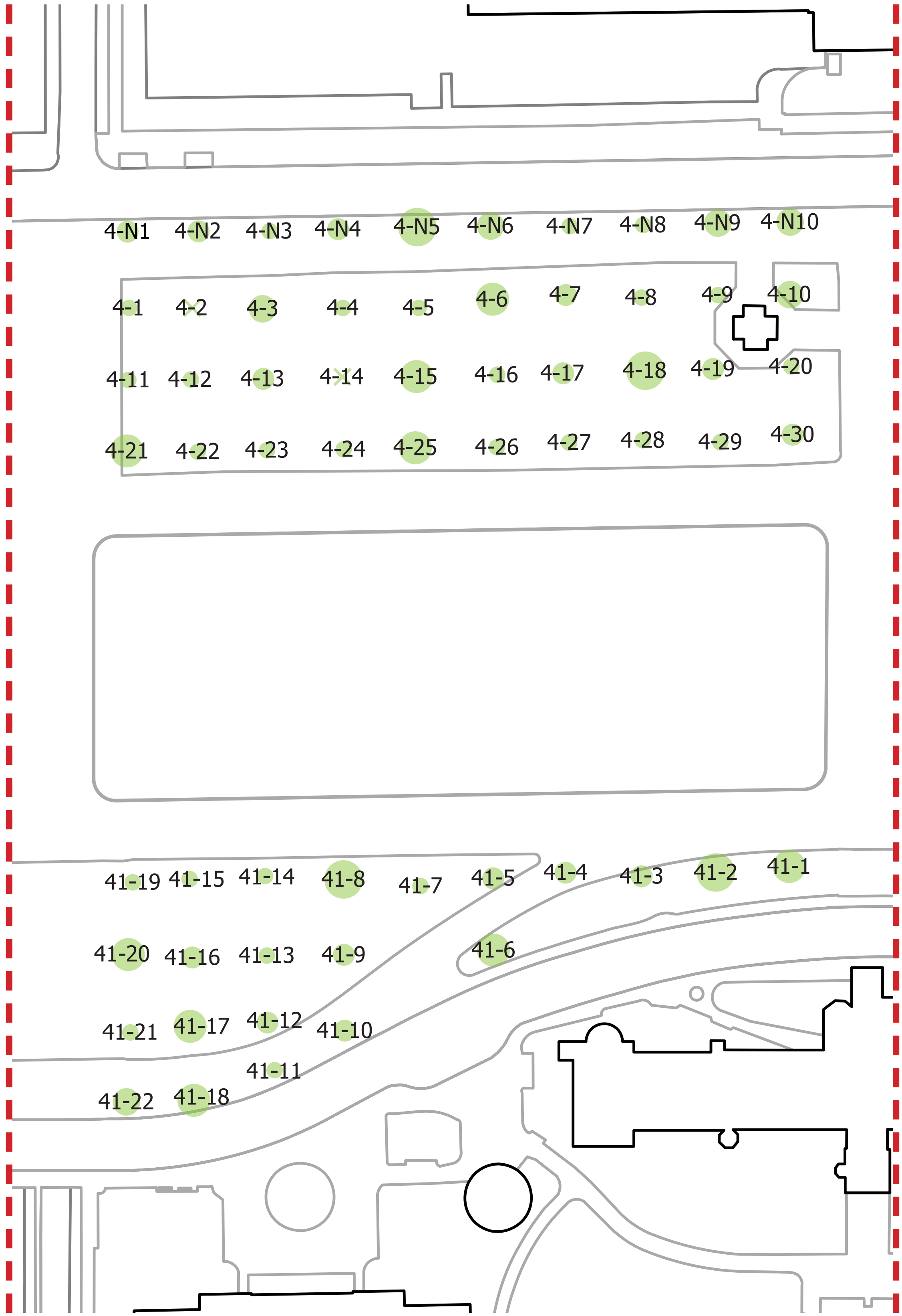
Tree ID Numbers - Panels 1 & 38



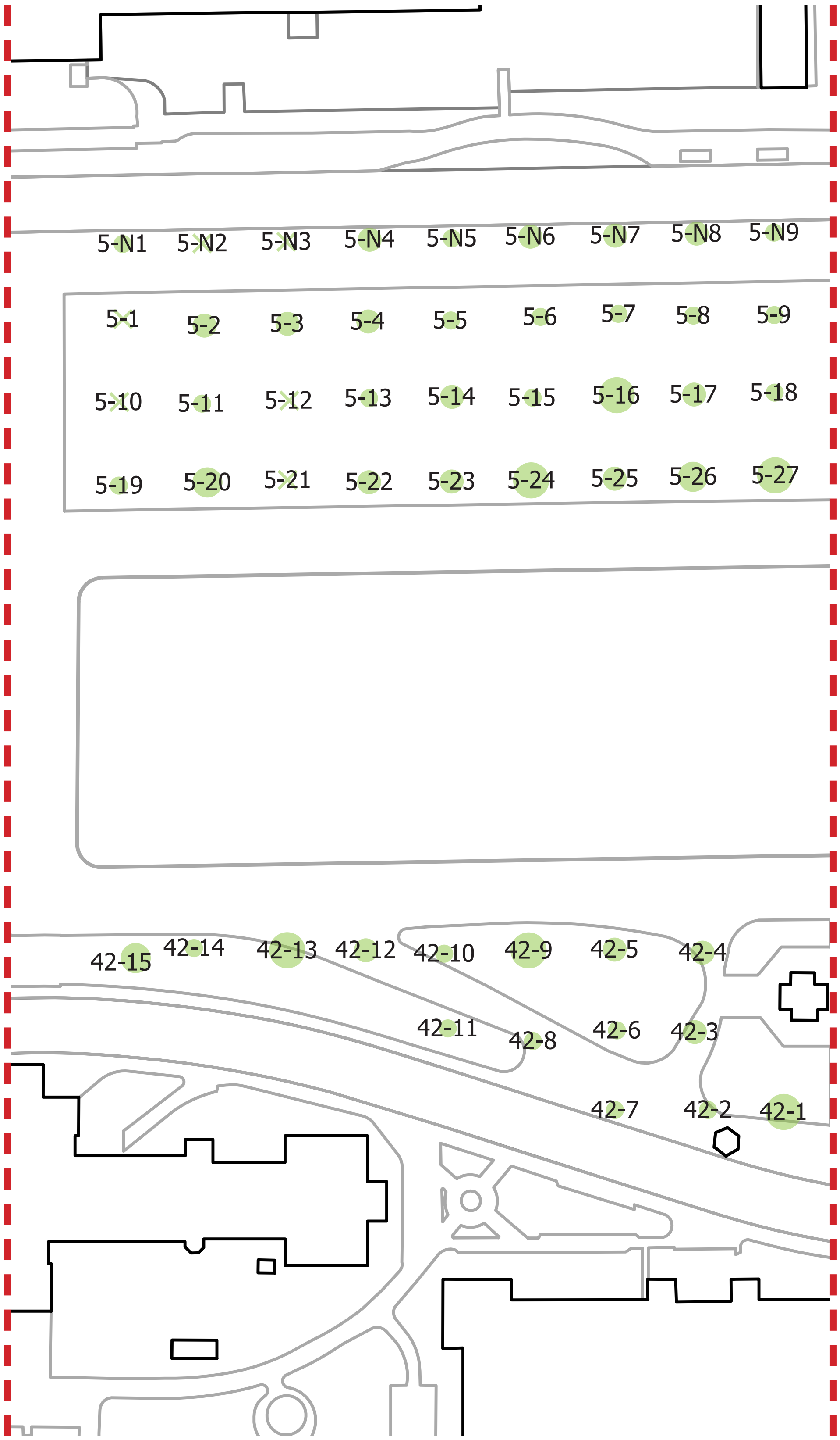
Tree ID Numbers - Panels 2 & 39



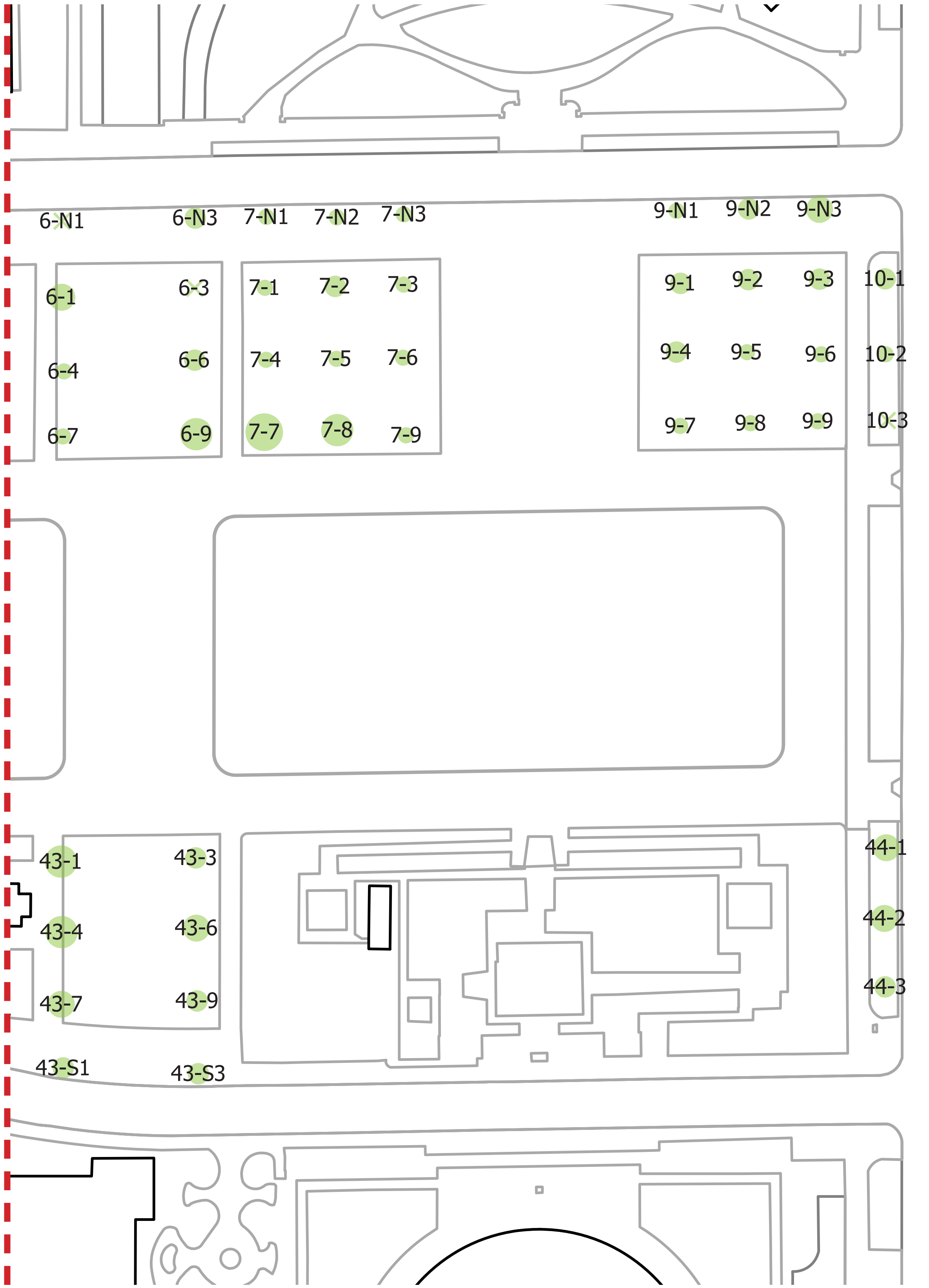
Tree ID Numbers - Panels 4 & 41



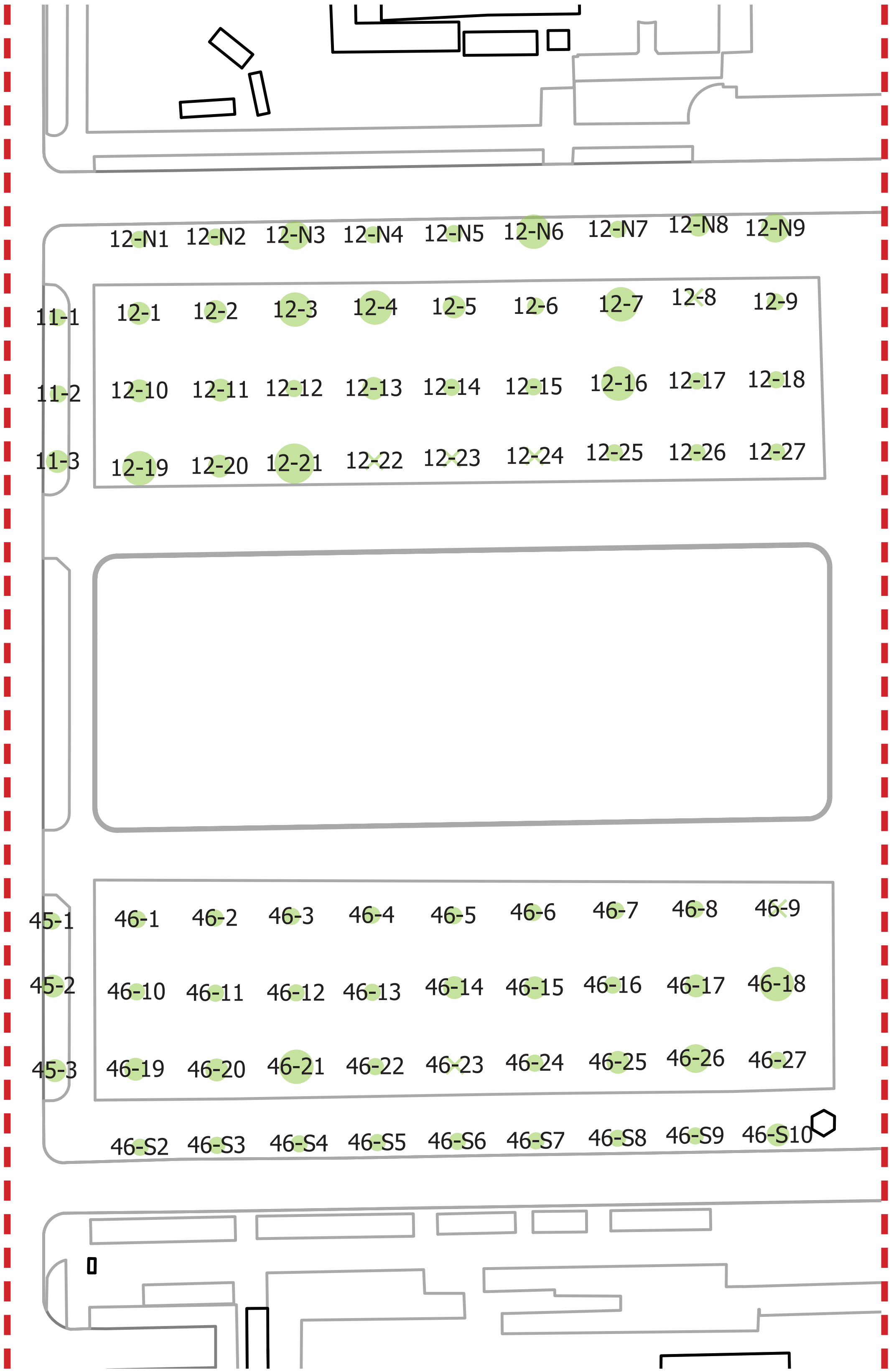
Tree ID Numbers - Panels 5 & 42



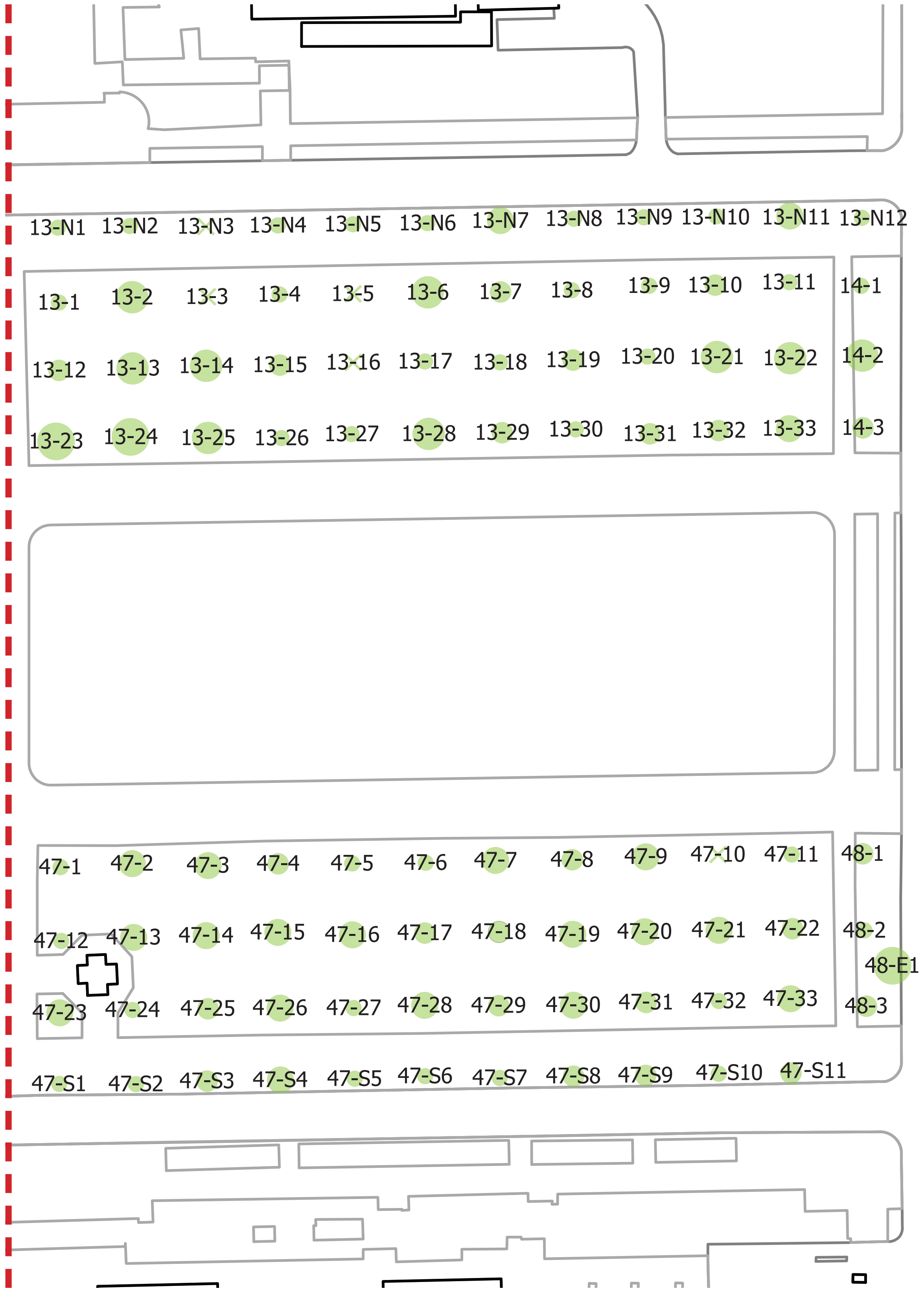
Tree ID Numbers - Panels 6, 7, 9, 10, 43 & 44



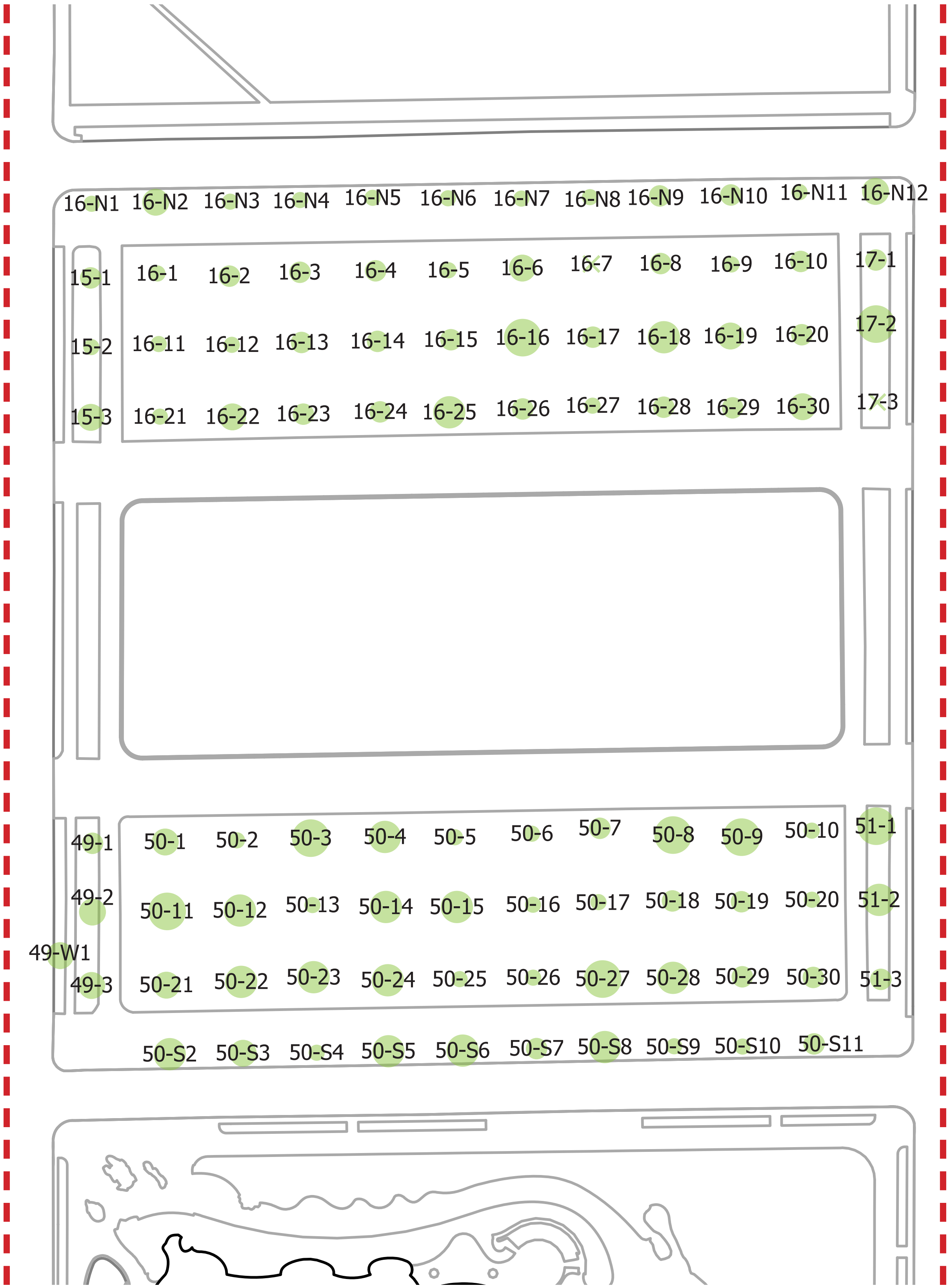
Tree ID Numbers - Panels 11, 12, 45 & 46



Tree ID Numbers - Panels 13, 14, 47 & 48



Tree ID Numbers - Panels 15, 16, 17, 49, 50 & 51



Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
1-1	Ulmus americana	26	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-2	Ulmus americana	20	POOR	NONE	LOW	NONE	NO	NONE	LOW	NO
1-3	Ulmus americana	18	FAIR	POOR STRUCTURE	LOW	NONE	NO	NONE	LOW	NO
1-4	Ulmus americana	36	FAIR	FURTHER INSPECTION NEEDED: CHECK BROKEN CABLING. POSSIBLE GANODERMA	MODERATE	NONE	NO	NONE	HIGH	YES
1-5	Ulmus americana	21	GOOD	SLACK CABLE	LOW	NONE	NO	NONE	LOW	YES
1-6	Ulmus americana	8	GOOD	SOIL ADDITION NEEDED	LOW	NONE	NO	NONE	LOW	NO
1-7	Ulmus – possible hybrid	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-8	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-9	Ulmus americana	18	FAIR	FURTHER INSPECTION NEEDED: FAILING BRANCHES	EXTREME	BRANCH FAILURE IS PROBABLE	NO	CABLE BRANCHES OR REMOVE TREE	HIGH	NO
1-10	Ulmus americana	40	GOOD	SLACK CABLE. FURTHER INSPECTION NEEDED: POSSIBLE ARMILLARIA	LOW	NONE	NO	BROKEN HANGER	LOW	YES
1-11	Ulmus americana	38	GOOD	FURTHER INSPECTION NEEDED: CHECK CABLING	LOW	NONE	NO	NONE	LOW	YES
1-12	Ulmus americana	39	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-13	Ulmus americana	27	FAIR	FURTHER INSPECTION NEEDED: CHECK WEAK CROTCH	HIGH	NONE	NO	NONE	HIGH	NO
1-14	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-15	Ulmus americana	2	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-16	Ulmus americana	5	GOOD	LARGE WOUND: CONSIDER REPLACING	LOW	NONE	NO	NONE	LOW	NO
1-17	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-18	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
1-19	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-20	Ulmus americana	29	GOOD	GOOD CABLE	LOW	NONE	NO	NONE	LOW	YES
1-21	Ulmus americana	16	FAIR	PAST DIEBACK	LOW	NONE	NO	NONE	LOW	NO
1-22	Ulmus americana	38	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-23	Ulmus americana	36	GOOD	A FEW OF THE CABLED BRANCHES ARE DEAD	LOW	NONE	NO	NONE	LOW	YES
1-24	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
1-25	Ulmus americana	19	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
1-26	Ulmus americana	2	GOOD	NONE	LOW	NONE	NO	TRAIN. REMOVE STAKES	MEDIUM	NO
1-27	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N1	Ulmus americana	21	GOOD	"AH" TAG	LOW	NONE	NO	NONE	LOW	NO
1-N2	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N3	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N4	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N5	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N6	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
1-N7	Ulmus americana	10	GOOD	NONE	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	NONE	LOW	NO
1-N8	Ulmus americana	19	FAIR	NONE	HIGH	FAILING BRANCH	NO	REPLACE TREE	HIGH	NO
1-N9	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-1	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-2	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-3	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-4	Ulmus americana	21	FAIR	NONE	LOW	NONE	NO	PRUNE	LOW	NO
2-5	Ulmus americana 'Augustine Ascending'	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-6	Ulmus – (U. americana?)	3	GOOD	NONE	LOW	NONE	NO	TRAIN. REMOVE STAKES	MEDIUM	NO
2-7	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-8	Ulmus americana	25	GOOD	FURTHER INSPECTION NEEDED: VERY LARGE TRUNK WOUND	HIGH	NONE	NO	INSPECTION NEEDED	HIGH	NO
2-9	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-10	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-11	SPACE	0	N/A	SPACE IS NEAR WATER MAIN, CONSIDER NOT REPLANTING	LOW	NONE	NO	NONE	LOW	NO
2-12	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-13	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO

*VTRA = Visual Tree Risk Assessment following ISA Level 2 Protocol
VTRA Ratings: Low, Moderate, High, Extreme Risk
Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
2-14	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-15	Ulmus americana 'Augustine Ascending'	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-16	Ulmus americana 'Augustine Ascending'	23	GOOD	CODOMINANT LEADERS, INCLUDED BARK	LOW	NONE	NO	CONSIDER CABLING	MEDIUM	NO
2-17	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-18	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-19	Ulmus americana	2	GOOD	NONE	LOW	NONE	NO	TRAIN. REMOVE STAKES	MEDIUM	NO
2-20	Ulmus – possible hybrid	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-21	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-22	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-23	Ulmus americana	28	GOOD	FURTHER INSPECTION NEEDED: LARGE WOUND IN TRUNK	HIGH	NONE	NO	INSPECTION NEEDED	HIGH	NO
2-24	Ulmus americana	26	GOOD	LARGE BRANCH WOUNDS. CABLED	HIGH	NONE	NO	INSPECTION NEEDED	HIGH	YES
2-25	Ulmus americana 'Augustine Ascending'	24	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-26	Ulmus americana 'Augustine Ascending'	27	GOOD	LEANING	LOW	NONE	NO	INSPECTION NEEDED	MEDIUM	NO
2-27	Ulmus americana	23	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-28	Ulmus americana 'Augustine Ascending'	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-29	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-30	Ulmus americana	28	FAIR	FURTHER INSPECTION NEEDED: LARGE CAVITIES PRESENT	HIGH	NONE	NO	INSPECTION NEEDED	HIGH	NO
2-N1	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
2-N10	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-N2	Ulmus americana	14	GOOD	NONE	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	NONE	LOW	NO
2-N3	Ulmus americana	13	GOOD	"NACC DED 32-0" TAG	LOW	NONE	NO	NONE	LOW	NO
2-N4	Ulmus americana	34	POOR	CABLED	MODERATE	NONE	MAYBE	INSPECTION NEEDED	HIGH	YES
2-N5	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-N6	Ulmus – distinctive striped cultivar (U. americana?)	4	GOOD	NONE	LOW	NONE	NO	TRAIN	MEDIUM	NO
2-N7	Ulmus americana	30	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
2-N8	Ulmus americana	9	GOOD	INCLUDED BARK	LOW	NONE	NO	NONE	LOW	NO
2-N9	Ulmus – distinctive striped cultivar (U. americana?)	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-1	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-2	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
4-3	Ulmus americana	26	GOOD	NONE	LOW	NONE	NO	RECOMMEND REPLACING	MEDIUM	NO
4-4	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-5	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-6	Ulmus americana	37	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
4-7	Ulmus americana	22	GOOD	SPROUTS ON BRANCHES	LOW	NONE	NO	NONE	LOW	NO
4-8	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
4-9	Ulmus americana	9	GOOD	GIRDLING ROOT	LOW	NONE	NO	REMOVE GIRDLING ROOT	LOW	NO
4-10	Ulmus americana 'Augustine Ascending'	29	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
4-11	Ulmus americana	6	FAIR	TERRIBLE FORM.	LOW	NONE	NO	TREE REPLACEMENT RECOMMENDED	MEDIUM	NO
4-12	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-13	Ulmus americana	18	GOOD	NARROW CROTCHES	MODERATE	POORLY ATTACHED BRANCH	NO	RECOMMEND CABLING	HIGH	NO
4-14	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
4-15	Ulmus americana	36	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-16	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-17	Ulmus americana	18	GOOD	BROKEN BRANCH	LOW	NONE	NO	REMOVE DEAD BRANCH	MEDIUM	NO
4-18	Ulmus americana	43	EXCELLENT	GREAT CONDITION	LOW	NONE	NO	NONE	LOW	NO
4-19	Ulmus americana	16	GOOD	GIRDLING ROOTS	LOW	NONE	NO	NONE	LOW	NO
4-20	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-21	Ulmus americana	39	GOOD	OAK-LIKE FORM. SOME DROPPED YELLOW LEAVES	LOW	NONE	NO	NONE	LOW	NO
4-22	Ulmus americana	3	FAIR	MANY RAT HOLES IN ROOT ZONE	LOW	NONE	NO	NONE	LOW	NO
4-23	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO

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Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
4-24	Ulmus americana	3	POOR	FALLING OVER	LOW	NONE	NO	NONE	LOW	NO
4-25	Ulmus americana	35	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-26	Ulmus americana	15	POOR	"BH 139" TAG. DEAD LIMBS	MODERATE	NONE	NO	PRUNE OUT DEAD LIMBS	HIGH	NO
4-27	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-28	Ulmus americana	7	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
4-29	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-30	Ulmus americana	19	GOOD	A FEW WOUNDS	LOW	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	NO
4-N1	Ulmus americana	19	GOOD	NONE	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	NONE	LOW	NO
4-N10	Ulmus americana	25	GOOD	NONE	HIGH	LARGE DEAD BRANCHES OVER BUSY AREA	MAYBE	REMOVE ANY HAZARDOUS BRANCHES	HIGH	NO
4-N2	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-N3	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-N4	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-N5	Ulmus americana	45	GOOD	NONE	HIGH	LARGE DEAD BRANCH OVER STREET	NO	REMOVE ANY HAZARDOUS BRANCHES	HIGH	NO
4-N6	Ulmus americana	30	GOOD	"J-546" TAG. FURTHER INSPECTION NEEDED: LARGE TRUNK WOUND	LOW	NONE	NO	INSPECTION NEEDED	HIGH	NO
4-N7	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
4-N8	Ulmus americana	13	GOOD	"BH-90" TAG	LOW	NONE	NO	NONE	LOW	NO
4-N9	Ulmus americana	31	GOOD	NONE	LOW	NONE	NO	CONSIDER PRUNING EPICORMIC SHOOTS	LOW	NO
5-1	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
5-2	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-3	Ulmus americana	17	FAIR	CAVITY AT BASE (RATS?)	LOW	NONE	NO	NONE	LOW	NO
5-4	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-5	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	REMOVE STAKE	MEDIUM	NO
5-6	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-7	Ulmus americana	4	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-8	Ulmus americana	4	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-9	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-10	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
5-11	Ulmus americana	4	FAIR	LARGE WOUND RUNNING UP TRUNK	LOW	NONE	NO	RECOMMEND REPLACING	LOW	NO
5-12	SPACE	0	N/A	UTILITY CONFLICT; CONSIDER NOT REPLANTING	LOW	NONE	NO	NONE	LOW	NO
5-13	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-14	Ulmus americana	20	GOOD	WOUND AT BASE. OAK-LIKE FORM.	LOW	NONE	NO	NONE	LOW	NO
5-15	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-16	Ulmus americana	33	GOOD	CABLED. POSSIBLE HOLLOW BRANCH	MODERATE	NONE	NO	CHECK CABLING AND HOLLOW BRANCH	MEDIUM	YES
5-17	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-18	Ulmus americana	14	POOR	NONE	LOW	NONE	NO	PRUNE	LOW	NO
5-19	Ulmus americana	3	FAIR	NONE	LOW	NONE	NO	CHECK STAKE	LOW	NO
5-20	Ulmus americana	24	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
5-21	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
5-22	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-23	Ulmus americana	23	GOOD	NONE	LOW	NONE	NO	INSPECT BRANCH WITH WOUND	LOW	NO
5-24	Ulmus americana	33	GOOD	CABLED	HIGH	BRANCH FAILURE IS PROBABLE. VERY BAD SITUATION	NO	ADDRESS FAILING BRANCH ISSUE	HIGH	YES
5-25	Ulmus americana	23	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-26	Ulmus americana 'Augustine Ascending'	31	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
5-27	Ulmus americana 'Augustine Ascending'	37	GOOD	CABLED. LARGE CAVITY, MUSHROOMS AT BASE	HIGH	NONE	NO	INSPECTION NEEDED	HIGH	YES
5-N1	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	NONE	LOW	NONE	NO	STRUCTURAL PRUNING	MEDIUM	NO
5-N2	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
5-N3	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
5-N4	Ulmus americana 'Augustine Ascending'	23	GOOD	"BH 62" TAG	LOW	NONE	NO	NONE	LOW	NO
5-N5	Ulmus americana 'Augustine Ascending'	14	FAIR	NONE	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	NONE	LOW	NO
5-N6	Ulmus americana 'Augustine Ascending'	21	GOOD	"BH 52" TAG	LOW	NONE	NO	NONE	LOW	NO

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Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
5-N7	Ulmus americana 'Augustine Ascending'	22	GOOD	"BH 47" TAG	LOW	NONE	NO	NONE	LOW	NO
5-N8	Ulmus americana 'Augustine Ascending'	23	GOOD	"BH 42" TAG	LOW	NONE	NO	NONE	LOW	NO
5-N9	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	REMOVE STAKE	MEDIUM	NO
6-1	Ulmus americana 'Augustine Ascending'	29	GOOD	"BJ 117" TAG	LOW	NONE	NO	CONSIDER CABLING	LOW	NO
6-3	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
6-4	Ulmus americana	15	GOOD	CAVITY IN CROTCH	LOW	NONE	NO	INSPECTION OF CAVITY RECOMMENDED	MEDIUM	NO
6-6	Ulmus americana	18	GOOD	"BJ 113" TAG	LOW	NONE	NO	NONE	LOW	NO
6-7	Ulmus americana	13	GOOD	BAD FORM	LOW	NONE	NO	NONE	LOW	NO
6-9	Ulmus americana	36	GOOD	"BJ 114" TAG. CABLED	LOW	NONE	NO	NONE	LOW	YES
6-N1	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
6-N3	Ulmus americana	16	FAIR	NONE	LOW	NONE	NO	PRUNE DEAD BRANCHES	MEDIUM	NO
7-1	Ulmus – hybrid with small leaves	3	GOOD	NONE	LOW	NONE	NO	REMOVE STAKES	MEDIUM	NO
7-2	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-3	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-4	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-5	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-6	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-7	Ulmus americana	43	GOOD	CABLED	LOW	NONE	NO	INSPECTION NEEDED	MEDIUM	YES
7-8	Ulmus americana	36	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-9	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
7-N1	Ulmus americana	2	GOOD	NONE	LOW	NONE	NO	REMOVE STAKES	MEDIUM	NO
7-N2	Ulmus americana	12	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
7-N3	Ulmus americana	15	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
9-1	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-2	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-3	Ulmus americana	20	GOOD	"NAMA 19 10" TAG	LOW	NONE	NO	NONE	LOW	NO
9-4	Ulmus americana	17	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
9-5	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-6	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	REMOVE STAKES	MEDIUM	NO
9-7	Ulmus americana	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-8	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-9	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-N1	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
9-N2	Ulmus americana	16	FAIR	SOME DEAD BRANCHES	LOW	NONE	NO	NONE	LOW	NO
9-N3	Ulmus americana	27	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
10-1	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
10-2	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
10-3	SPACE	0	N/A	POSSIBLE UTILITY CONFLICTS	LOW	NONE	NO	NONE	LOW	NO
11-1	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	PRUNE/TRAIN	LOW	NO
11-2	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
11-3	Ulmus americana	16	FAIR	"BJ 82" TAG.	LOW	NONE	NO	NONE	LOW	NO
12-1	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-2	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-3	Ulmus americana	32	GOOD	CABLED. INCLUDED BARK AT CROTCH WOUND	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
12-4	Ulmus americana	36	GOOD	CABLED. LARGE BRANCH WOUND	HIGH	NONE	NO	INSPECTION RECOMMENDED. CUT GIRDLING ROOT	HIGH	YES
12-5	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-6	Ulmus americana	12	GOOD	GIRDLING ROOTS	LOW	NONE	NO	CUT GIRDLING ROOTS	LOW	NO
12-7	Ulmus americana	34	GOOD	CABLED. GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	YES
12-8	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
12-9	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	PRUNE/TRAIN	LOW	NO
12-10	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-11	Ulmus americana	18	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
12-12	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-13	Ulmus americana	16	GOOD	WOUNDED BRANCH	LOW	NONE	NO	PRUNE WOUNDED BRANCH	LOW	NO
12-14	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	SPLIT BRANCH	LOW	NONE	NO	PRUNE OUT SPLIT BRANCH	MEDIUM	NO

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Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
12-15	Ulmus americana	13	FAIR	BAD FORM. GIRDLING ROOT. SPARSE CANOPY	LOW	NONE	NO	NONE	LOW	NO
12-16	Ulmus americana	35	GOOD	CABLED. BRANCH WITH CAVITIES	LOW	NONE	NO	INSPECT BRANCH WITH CAVITIES	LOW	YES
12-17	Ulmus americana	14	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
12-18	Ulmus americana	6	GOOD	WOUNDS AT BASE	LOW	NONE	NO	REPLACEMENT RECOMMENDED	LOW	NO
12-19	Ulmus americana	35	GOOD	WOUNDS IN CROTCHES	LOW	NONE	NO	INSPECTION RECOMMENDED (WOUNDS)	LOW	NO
12-20	Ulmus americana	16	GOOD	GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
12-21	Ulmus americana	40	GOOD	GIRDLING ROOT. BROKEN CABLE	HIGH	NONE	NO	INSPECTION RECOMMENDED. LIKELY NEEDS CABLING. CUT GIRDLING ROOT	HIGH	NO
12-22	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
12-23	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
12-24	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
12-25	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-26	Ulmus americana	6	FAIR	WOUND AT BASE.	LOW	NONE	NO	REPLACEMENT RECOMMENDED	LOW	NO
12-27	Ulmus – distinctive striped cultivar (U. americana?)	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-N1	Ulmus americana	14	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
12-N2	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
12-N3	Ulmus americana	25	POOR	NONE	HIGH	NONE	NO	INSPECTION RECOMMENDED. LIKELY REMOVAL	HIGH	NO
12-N4	Ulmus americana	10	GOOD	BAD FORM	LOW	NONE	NO	NONE	LOW	NO
12-N5	Ulmus americana	12	GOOD	ZELKOVA-LIKE FORM. INCLUDED BARK	LOW	NONE	NO	NONE	LOW	NO
12-N6	Ulmus americana	32	FAIR	BOLTED. DEEP TRUNK CAVITY	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	YES
12-N7	Ulmus americana	10	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
12-N8	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
12-N9	Ulmus americana	26	FAIR	"3-127" TAG.	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	NO
13-1	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-2	Ulmus americana	34	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
13-3	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
13-4	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-5	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
13-6	Ulmus americana	36	FAIR	CABLED. DEEP CAVITY	HIGH	LEANING OVER SIDEWALK	NO	INSPECTION RECOMMENDED	HIGH	YES
13-7	Ulmus americana	18	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
13-8	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-9	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-10	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	CABLING RECOMMENDED	LOW	NO
13-11	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-12	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-13	Ulmus americana	32	GOOD	LOOSE CABLE. BRANCH WITH LONG WOUND	LOW	NONE	NO	CHECK CABLING	LOW	YES
13-14	Ulmus americana	33	POOR	NONE	HIGH	NONE	NO	INSPECTION RECOMMENDED. LIKELY REMOVAL	HIGH	NO
13-15	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-16	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
13-17	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	REMOVE STAKES	MEDIUM	NO
13-18	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-19	Ulmus americana	17	GOOD	MANY BRANCHES COMING FROM ONE POINT	LOW	NONE	NO	NONE	LOW	NO
13-20	Ulmus americana	13	GOOD	NARROW CROTCHES	LOW	NONE	NO	NONE	LOW	NO
13-21	Ulmus americana	32	EXCELLENT	ATTRACTIVE SEMI-WEEPING FORM	LOW	NONE	NO	NONE	LOW	NO
13-22	Ulmus americana	38	GOOD	CABLE (BROKEN). CAVITY	LOW	NONE	NO	INSPECT CAVITY	LOW	YES
13-23	Ulmus americana	42	GOOD	CABLED (SOME SLACK)	LOW	NONE	NO	CHECK CABLING	LOW	YES
13-24	Ulmus americana	42	GOOD	MANY CABLES. BOLTED	LOW	NONE	NO	NONE	LOW	YES
13-25	Ulmus americana	39	GOOD	"BM 113" TAG.	LOW	NONE	NO	NONE	LOW	NO
13-26	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
13-27	Ulmus americana	3	GOOD	NONE	LOW	NONE	NO	REMOVE STAKES	LOW	NO
13-28	Ulmus americana	36	GOOD	CABLED	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
13-29	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-30	Ulmus americana	15	GOOD	GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
13-31	Ulmus americana	20	GOOD	NORWAY MAPLE-LIKE FORM	LOW	NONE	NO	NONE	LOW	NO

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Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
13-32	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-33	Ulmus americana	24	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-N1	Ulmus americana	14	GOOD	ZELKOVA-LIKE FORM.	LOW	NONE	NO	NONE	LOW	NO
13-N10	Ulmus americana	11	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
13-N11	Ulmus americana	28	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
13-N12	Ulmus americana	11	POOR	LARGE WOUNDS AT BASE	LOW	NONE	NO	REPLACEMENT RECOMMENDED	LOW	NO
13-N2	Ulmus americana	13	GOOD	"BM 117" TAG.	LOW	NONE	NO	NONE	LOW	NO
13-N3	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
13-N4	Ulmus americana	4	POOR	DEAD LEADER. LARGE WOUND AT BASE	LOW	NONE	NO	REMOVE AND REPLACE	LOW	NO
13-N5	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-N6	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
13-N7	Ulmus americana	31	GOOD	CABLED. LARGE DEAD LIMB	MODERATE	LARGE DEAD LIMB OVER STREET	NO	REMOVE DEAD BRANCH	MEDIUM	YES
13-N8	Ulmus americana	9	GOOD	INCLUDED BARK	LOW	NONE	NO	NONE	LOW	NO
13-N9	Ulmus americana	15	GOOD	"BM 142" TAG. INCLUDED BARK	LOW	NONE	NO	NONE	LOW	NO
14-1	Ulmus americana	6	FAIR	LARGE WOUNDS AT BASE. CABLED	LOW	NONE	NO	REPLACEMENT RECOMMENDED	LOW	YES
14-2	Ulmus americana	32	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
14-3	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
15-1	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
15-2	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
15-3	Ulmus americana	25	EXCELLENT	NONE	LOW	NONE	NO	NONE	LOW	NO
16-1	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-2	Ulmus americana	21	GOOD	CABLED	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
16-3	Ulmus americana	17	GOOD	HUGE WOUND	HIGH	NONE	NO	REMOVE AND REPLACE	HIGH	NO
16-4	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-5	Ulmus americana	15	GOOD	NONE	MODERATE	NONE	NO	CABLING OR BRACING RECOMMENDED	MEDIUM	NO
16-6	Ulmus americana	29	GOOD	CABLED. GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT. CHECK CABLE	LOW	YES
16-7	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
16-8	Ulmus americana	20	GOOD	GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
16-9	Ulmus americana	15	GOOD	AREA WITH WEAK BRANCHES	MODERATE	NONE	NO	INSPECTION RECOMMENDED (ESPECIALLY FOR SPLIT OUT AREA)	MEDIUM	NO
16-10	Ulmus americana	23	GOOD	"BP 33" TAG.	LOW	NONE	NO	NONE	LOW	NO
16-11	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-12	Ulmus americana	7	GOOD	POOR CROTCH	LOW	NONE	NO	NONE	LOW	NO
16-13	Ulmus americana	18	GOOD	SNAPPED CABLE	LOW	NONE	NO	CABLING RECOMMENDED	HIGH	YES
16-14	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-15	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-16	Ulmus americana	45	EXCELLENT	BROKEN CABLE. GREAT TREE	LOW	NONE	NO	NONE	LOW	YES
16-17	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-18	Ulmus americana	34	GOOD	CABLED (BROKEN BUT OK). NICE TREE	LOW	NONE	NO	NONE	LOW	YES
16-19	Ulmus americana	30	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-20	Ulmus americana	17	GOOD	NONE	MODERATE	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	NO
16-21	Ulmus americana	2	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-22	Ulmus americana	31	FAIR	CABLED. MANY EPICORMIC SHOOTS	LOW	NONE	NO	NONE	LOW	YES
16-23	Ulmus americana	23	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-24	Ulmus americana	17	GOOD	GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
16-25	Ulmus americana 'Augustine Ascending'	35	GOOD	MANY CABLES. INCLUDED BARK ON MAIN FORK	LOW	NONE	NO	NONE	LOW	YES
16-26	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-27	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	INCLUDED BARK	LOW	NONE	NO	NONE	LOW	NO
16-28	Ulmus americana	21	GOOD	CAVITY	MODERATE	NONE	NO	INSPECTION RECOMMENDED (ESPECIALLY CAVITY)	HIGH	NO
16-29	Ulmus americana	17	GOOD	INCLUDED BARK	HIGH	NONE	NO	CABLING RECOMMENDED	MEDIUM	NO
16-30	Ulmus americana	24	GOOD	LOW, UNNESECARY CABLE	LOW	NONE	NO	NONE	LOW	YES
16-N1	Ulmus americana	14	POOR	NONE	LOW	NONE	NO	REMOVE AND REPLACE	LOW	NO
16-N10	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N11	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N12	Ulmus americana	27	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
16-N2	Ulmus americana	24	GOOD	NONE	HIGH	STREET TREE. HIGH RISK OF FAILURE	NO	REMOVE AND REPLACE	HIGH	NO
16-N3	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO

*VTRA = Visual Tree Risk Assessment following ISA Level 2 Protocol
VTRA Ratings: Low, Moderate, High, Extreme Risk
Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
16-N4	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N5	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N6	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N7	Ulmus americana	12	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
16-N8	Ulmus americana	13	GOOD	ZELKOVA-LIKE FORM.	LOW	NONE	NO	NONE	LOW	NO
16-N9	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
17-1	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
17-2	Ulmus americana	44	GOOD	MANY CABLES	HIGH	HIGH RISK. MANY TARGETS	NO	INSPECTION RECOMMENDED	HIGH	YES
17-3	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
38-1	Ulmus americana	18	FAIR	RATS	LOW	NONE	NO	NONE	LOW	NO
38-2	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-3	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-4	Ulmus americana	32	POOR	CABLED. BROKEN CABLE	LOW	NONE	NO	NONE	LOW	YES
38-5	Ulmus americana	18	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
38-6	Ulmus americana	27	GOOD	CABLED (VERY THIN, LIKE WIRES)	HIGH	FAILING BRANCHES, SPLIT	NO	INSPECTION RECOMMENDED. LIKELY NEEDS CABLING OR REMOVAL	HIGH	YES
38-7	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-8	Ulmus americana	31	FAIR	POSSIBLE LIGHTING STRIKE	MODERATE	LARGE DEAD LIMB	NO	INSPECTION RECOMMENDED	MEDIUM	NO
38-9	Ulmus americana	35	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-10	Ulmus americana	30	FAIR	CABLED. INCLUDED BARK	LOW	NONE	NO	REPLACE CABLES	MEDIUM	YES
38-11	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
38-12	Ulmus americana	33	FAIR	CABLED	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
38-13	Ulmus americana	12	GOOD	BAD FORM	LOW	NONE	NO	NONE	LOW	NO
38-14	Ulmus americana	46	POOR	MANY WOUNDS, DEAD BRANCHES	HIGH	NONE	YES	REMOVE	HIGH	NO
38-15	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-16	Ulmus americana	19	GOOD	CRACK IN UPPER FORK	MODERATE	NONE	NO	CUT GIRDLING ROOTS. INSPECTION RECOMMENDED. LIKELY NEEDS CABLING.	MEDIUM	NO
38-17	Ulmus americana	34	POOR	DEAD BRANCHES, DED	MODERATE	NONE	YES	REMOVE	HIGH	NO
38-18	Ulmus americana	12	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
38-19	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-20	Ulmus americana	20	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
38-21	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
38-22	Ulmus americana	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-23	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-24	Ulmus americana	21	GOOD	POSSIBLE SPLITTING BRANCH	LOW	NONE	NO	CABLING RECOMMENDED	LOW	NO
38-25	Ulmus americana	32	FAIR	HUGE CAVITY	HIGH	POSSIBLE FAILURE OF WHOLE TREE	MAYBE	INSPECTION NEEDED	HIGH	NO
38-26	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-27	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-S1	Ulmus americana	25	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
38-S2	Ulmus – distinctive striped cultivar (U. americana?)	6	GOOD	BAD FORM	LOW	NONE	NO	NONE	LOW	NO
38-S3	Ulmus americana	17	FAIR	RATS	LOW	NONE	NO	NONE	LOW	NO
38-S4	Ulmus americana	14	GOOD	NONE	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	NONE	LOW	NO
38-S5	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
38-S6	Ulmus americana	22	GOOD	GIRDLING ROOTS	LOW	EXPOSED ROOTS ARE A TRIP HAZARD	NO	CUT GIRDLING ROOT	LOW	NO
38-S7	Ulmus americana	20	FAIR	SOME DEAD WOOD	LOW	NONE	NO	NONE	LOW	NO
38-S8	Ulmus americana	21	GOOD	WEAK POINT AT CROTCH	LOW	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	NO
38-S9	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	LARGE WOUND	LOW	NONE	NO	NONE	LOW	NO
38-W3	Ulmus americana	18	POOR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-1	Ulmus americana	42	GOOD	VERY LARGE CAVITIES. CABLED	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	YES
39-2	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
39-3	Ulmus americana	23	GOOD	"BE 37" TAG	LOW	NONE	NO	NONE	LOW	NO
39-4	Ulmus americana 'Augustine Ascending'	33	GOOD	DEAD LIMB ~4" IN DIAMETER	LOW	NONE	NO	PRUNE	LOW	NO
39-5	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-6	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-7	Ulmus americana	12	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO

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Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
39-8	Ulmus americana	14	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-9	Ulmus – hybrid with small leaves	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-10	Ulmus – hybrid with small leaves	6	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
39-11	Ulmus – distinctive striped cultivar (U. americana?)	4	GOOD	WOUNDS ALL AROUNG BASE	LOW	NONE	NO	REPLACE TREE	LOW	NO
39-12	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-13	Ulmus – distinctive striped cultivar (U. americana?)	5	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-14	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-15	Ulmus americana 'Augustine Ascending'	33	GOOD	"BE 46" TAG. LARGE CRACK AT CROTCH	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	NO
39-16	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-17	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-18	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-19	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-20	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
39-21	Ulmus americana	15	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-22	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-23	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-24	Ulmus americana	17	GOOD	LARGE GIRDLING ROOTS. "BE 42" TAG	LOW	NONE	NO	NONE	LOW	NO
39-25	Ulmus americana 'Augustine Ascending'	32	GOOD	NONE	LOW	NONE	NO	CABLING RECOMMENDED	LOW	NO
39-26	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-27	Ulmus americana	14	FAIR	GIRDLING ROOTS	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
39-28	Ulmus americana	14	GOOD	GIRDLING ROOTS, WEAK LIMB (LOWEST)	LOW	NONE	NO	REMOVE LOWEST LIMB	LOW	NO
39-29	Ulmus americana	38	GOOD	"BE 63" TAG	LOW	NONE	NO	NONE	LOW	NO
39-30	Ulmus – hybrid with small leaves	7	GOOD	BAD GIRDLING ROOTS	LOW	NONE	NO	PRUNE	LOW	NO
39-S1	Ulmus americana	35	GOOD	NONE	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
39-S10	Ulmus americana	19	FAIR	"NACC DED 44-?" TAG. A FEW WOUNDS	LOW	NONE	NO	INSPECTION NEEEDED	LOW	NO
39-S2	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
39-S3	Ulmus americana	8	FAIR	CROTCH SPLITTING?	LOW	NONE	NO	BOLTING RECOMMENDED	LOW	NO
39-S4	Ulmus americana	12	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-S5	Ulmus americana	18	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-S6	Ulmus americana	17	POOR	LARGE DEAD LIMB. RATS	LOW	NONE	NO	REMOVE	LOW	NO
39-S7	Ulmus americana	11	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
39-S8	Ulmus americana	11	POOR	"BE 57" TAG	LOW	NONE	NO	NONE	LOW	NO
39-S9	Ulmus americana	23	FAIR	CAVITY	LOW	NONE	NO	INSPECTION NEEDED	LOW	NO
41-1	Ulmus americana	33	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
41-2	Ulmus americana	43	FAIR	CABLED. "N-22" TAG. EPICORMIC SPROUTS	HIGH	NONE	NO	REMOVE SPROUTS, THEN INSPECT	HIGH	YES
41-3	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	RECOMMEND CABLING	MEDIUM	NO
41-4	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-5	Ulmus americana	17	GOOD	LARGE WOUND,	LOW	NONE	NO	INSPECTION NEEDED. ESPECIALLY AT LARGE WOUND	LOW	NO
41-6	Ulmus americana	33	EXCELLENT	CABLED. ONE CABLE IS BROKEN	LOW	NONE	NO	INSPECT CABLING	LOW	YES
41-7	Ulmus americana	15	GOOD	"BH 144" TAG	LOW	NONE	NO	NONE	LOW	NO
41-8	Ulmus americana	41	GOOD	CABLED. WOUNDED BRANCH OVER WALKWAY	MODERATE	NONE	NO	INSPECTION NEEDED	HIGH	YES
41-9	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-10	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-11	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
41-12	Ulmus americana	19	GOOD	"BH 9" TAG	LOW	NONE	NO	NONE	LOW	NO
41-13	Ulmus americana	7	GOOD	NONE	LOW	NONE	NO	PRUNE/TRAIN	MEDIUM	NO
41-14	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-15	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-16	Ulmus americana	17	FAIR	BRANCH RIP OUT. HAS BEEN DECREASING IN SIZE	LOW	NONE	NO	NONE	LOW	NO
41-17	Ulmus americana	38	POOR	DEAD BRANCHES AND FOLIAGE	HIGH	DEAD BRANCHES NEAR WALKWAY	YES	REMOVE	HIGH	NO
41-18	Ulmus americana	32	FAIR	"N-34" TAG	LOW	NONE	NO	NONE	LOW	NO
41-19	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-20	Ulmus americana	32	FAIR	LARGE CAVITY, DROOPING LEAVES	LOW	NONE	NO	INSPECTION NEEDED	LOW	NO

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Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
41-21	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
41-22	Ulmus americana	24	FAIR	A FEW SMALL HOLES	LOW	NONE	NO	NONE	LOW	NO
42-1	Ulmus americana	33	GOOD	CABLED	HIGH	BIG BRANCHES, LOTS OF TARGETS	NO	INSPECTION NEEDED	HIGH	YES
42-2	Ulmus americana	12	FAIR	"BH 31" TAG	HIGH	BRANCH AT RISK	NO	INSPECTION NEEDED	HIGH	NO
42-3	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-4	Ulmus americana	23	GOOD	LARGE WOUND	MODERATE	NONE	NO	INSPECTION NEEDED	HIGH	NO
42-5	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-6	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-7	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-8	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-9	Ulmus americana	36	GOOD	LARGE WOUNDS AT BASE. CABLED	HIGH	HIGH RISK UNTIL INSPECTION PROVES OTHERWISE	NO	INSPECTION NEEDED	HIGH	NO
42-10	Ulmus americana	15	GOOD	GIRDLING ROOT	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
42-11	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
42-12	Ulmus americana	22	GOOD	MANY WOUNDS	HIGH	MIDDLE OF WALKWAY	NO	INSPECTION NEEDED	HIGH	NO
42-13	Ulmus americana	35	GOOD	BOLTED, CABLED. "N-18" TAG	LOW	NONE	NO	NONE	LOW	YES
42-14	Ulmus americana	14	FAIR	HUGE SPLIT OUT WOUND	LOW	NONE	NO	REMOVE AND REPLACE	LOW	NO
42-15	Ulmus americana	30	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
43-1	Ulmus americana	37	EXCELLENT	"BJ 4" TAG. CABLED	LOW	NONE	NO	NONE	LOW	YES
43-3	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
43-4	Ulmus americana	39	EXCELLENT	BOLTED, CABLED	LOW	NONE	NO	NONE	LOW	YES
43-6	Ulmus americana	25	GOOD	"BJ 6" TAG	LOW	NONE	NO	PRUNE EPICORMIC SHOOTS	LOW	NO
43-7	Ulmus americana	27	FAIR	BOLTED, CABLED	MODERATE	LOTS OF TARGETS	NO	INSPECTION NEEDED	HIGH	YES
43-9	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	CUT GIRDLING ROOT	MEDIUM	NO
43-S1	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
43-S3	Ulmus americana	20	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
44-1	Ulmus americana	29	GOOD	CABLED. BROKEN CABLE	LOW	NONE	NO	CHECK CABLING	LOW	YES
44-2	Ulmus americana	25	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
44-3	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
45-1	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
45-2	Ulmus americana	20	FAIR	"BJ 38" TAG.	LOW	NONE	NO	NONE	LOW	NO
45-3	Ulmus americana	18	GOOD	HUGE WOUND	MODERATE	NONE	NO	CABLING RECOMMENDED	HIGH	NO
46-1	Ulmus americana	7	GOOD	MISSING CENTRAL LEADER AND MAJOR BRANCH	LOW	NONE	NO	REPLACEMENT RECOMMENDED	LOW	NO
46-2	Ulmus americana	11	FAIR	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-3	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-4	Ulmus americana	13	GOOD	BAD STRUCTURE	LOW	NONE	NO	NONE	LOW	NO
46-5	Ulmus americana	15	GOOD	BAD STRUCTURE	LOW	NONE	NO	NONE	LOW	NO
46-6	Ulmus americana	11	GOOD	BAD STRUCTURE AT FORK	LOW	NONE	NO	NONE	LOW	NO
46-7	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-8	Ulmus – distinctive striped cultivar (U. americana?)	7	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-9	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
46-10	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-11	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-12	Ulmus americana	12	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-13	Ulmus americana	13	GOOD	BAD STRUCTURE	LOW	NONE	NO	NONE	LOW	NO
46-14	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-15	Ulmus americana	20	GOOD	INCLUDED BARK AT FORK	LOW	NONE	NO	CABLING OR BRACING RECOMMENDED	LOW	NO
46-16	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-17	Ulmus americana	17	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-18	Ulmus americana	36	GOOD	CABLED. GIRDLING ROOTS. RAT COLONY	LOW	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	YES
46-19	Ulmus americana	18	GOOD	CAVITY	LOW	NONE	NO	INSPECT CAVITY	LOW	NO
46-20	Ulmus americana	17	GOOD	CAVITY AT FORK	LOW	NONE	NO	CONSIDER CABLING	LOW	NO
46-21	Ulmus americana	37	GOOD	CABLED. MAJOR CAVITY AND CRACK	HIGH	NONE	NO	REMOVAL RECOMMENDED	HIGH	NO
46-22	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-23	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
46-24	Ulmus americana	9	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-25	Ulmus americana	16	GOOD	GIRDLING ROOTS	LOW	NONE	NO	CUT GIRDLING ROOTS	LOW	NO
46-26	Ulmus americana	29	EXCELLENT	NONE	LOW	NONE	NO	CUT GIRDLING ROOTS	LOW	NO
46-27	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO

*VTRA = Visual Tree Risk Assessment following ISA Level 2 Protocol
VTRA Ratings: Low, Moderate, High, Extreme Risk
Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
46-S10	Ulmus americana	17	FAIR	LARGE RIPOUT	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
46-S2	Ulmus americana	14	FAIR	MANY RAT HOLES IN ROOT ZONE	LOW	NONE	NO	NONE	LOW	NO
46-S3	Ulmus americana	14	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
46-S4	Ulmus americana	8	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
46-S5	Ulmus americana	12	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
46-S6	Ulmus americana	12	GOOD	GIRDLING ROOT	LOW	NONE	NO	PRUNE. CUT GIRDLING ROOT	LOW	NO
46-S7	Ulmus americana	12	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-S8	Ulmus americana	7	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
46-S9	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-1	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-2	Ulmus americana	25	GOOD	SOME SMALL CAVITIES. DEAD BRANCH	LOW	NONE	NO	PRUNE DEAD BRANCHES. INSPECTION RECOMMENDED	LOW	NO
47-3	Ulmus americana	24	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-4	Ulmus americana	18	GOOD	NONE	HIGH	NONE	NO	INSPECTION NEEDED. REMOVAL RECOMMENDED	HIGH	NO
47-5	Ulmus – distinctive striped cultivar (U. americana?)	4	GOOD	NONE	LOW	NONE	NO	PRUNE/TRAIN	LOW	NO
47-6	Ulmus americana	5	GOOD	TRUNK WOUND	LOW	NONE	NO	NONE	LOW	NO
47-7	Ulmus americana	29	GOOD	MULTIPLE BRANCH CAVITIES	MODERATE	OVER BENCHES	NO	INSPECTION RECOMMENDED	MEDIUM	NO
47-8	Ulmus americana	21	GOOD	GIRDLING ROOTS. INCLUDED BARK	LOW	NONE	NO	RECOMMEND CABLING	LOW	NO
47-9	Ulmus americana	24	EXCELLENT	NONE	LOW	NONE	NO	NONE	LOW	NO
47-10	SPACE	0	N/A	NONE	LOW	NONE	NO	NONE	LOW	NO
47-11	Ulmus americana	11	GOOD	VERY BAD FORM	LOW	NONE	NO	NONE	LOW	NO
47-12	Ulmus americana	6	GOOD	NONE	LOW	NONE	NO	PRUNE	LOW	NO
47-13	Ulmus americana	28	GOOD	CAVITY AT FORK. CABLED	MODERATE	OVER SEATING AREA	NO	INSPECTION RECOMMENDED	MEDIUM	YES
47-14	Ulmus americana	30	FAIR	LARGE CAVITY. EPICORMIC SHOOTS. LARGE DEAD BRANCH	HIGH	LARGE DEAD BRANCH	NO	REMOVE DEAD BRANCH	HIGH	NO
47-15	Ulmus americana	24	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-16	Ulmus americana	24	EXCELLENT	CABLES (THIN WIRES)	LOW	NONE	NO	NONE	LOW	YES
47-17	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	CUT GIRDLING ROOT	LOW	NO
47-18	Ulmus americana	17	DEAD	DEAD FROM DED	LOW	NONE	YES	REMOVE	HIGH	NO
47-19	Ulmus americana	24	GOOD	A FEW CAVITIES	LOW	NONE	NO	NONE	LOW	NO
47-20	Ulmus americana	31	EXCELLENT	"BM 51" TAG. WOUNDED BRANCH	LOW	NONE	NO	INSPECTION RECOMMENDED. LIKELY NEEDS CABLING	LOW	NO
47-21	Ulmus americana	24	EXCELLENT	GOOD FORM	LOW	NONE	NO	NONE	LOW	NO
47-22	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-23	Ulmus americana	26	GOOD	DEAD WOOD	MODERATE	OVER POPULAR EATING AREA	NO	PRUNE DEAD WOOD	MEDIUM	NO
47-24	Ulmus americana	15	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-25	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-26	Ulmus americana	28	GOOD	SLACK CABLE. CAVITY AT CROTCHES	LOW	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	YES
47-27	Ulmus – distinctive striped cultivar (U. americana?)	6	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-28	Ulmus americana	25	GOOD	MANY BRANCHES FROM CROTCH	LOW	NONE	NO	CUT SMALL GIRDLING ROOTS	LOW	NO
47-29	Ulmus americana	20	GOOD	"BM 42" TAG	LOW	NONE	NO	NONE	LOW	NO
47-30	Ulmus americana	28	GOOD	LARGE WOUND, CAVITIES	LOW	NONE	NO	INSPECTION RECOMMENDED	MEDIUM	NO
47-31	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	CUT SMALL GIRDLING ROOTS	LOW	NO
47-32	Ulmus americana	15	FAIR	"BM 55" TAG	LOW	NONE	NO	NONE	LOW	NO
47-33	Ulmus americana	24	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S1	Ulmus americana	15	POOR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S10	Ulmus americana	11	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S11	Ulmus americana	19	FAIR	CABLED	LOW	NONE	NO	NONE	LOW	YES
47-S2	Ulmus americana	15	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S3	Ulmus americana	20	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S4	Ulmus americana	27	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S5	Ulmus americana	10	FAIR	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S6	Ulmus americana	11	GOOD	ZELKOVA-LIKE FORM.	LOW	NONE	NO	NONE	LOW	NO
47-S7	Ulmus americana	13	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
47-S8	Ulmus americana	18	FAIR	POSSIBLE DED	LOW	NONE	MAYBE	WATCH FOR DED	LOW	NO
47-S9	Ulmus americana	17	FAIR	DEAD BRANCH	MODERATE	DEAD BRANCH OVER STREET	NO	REMOVE DEAD BRANCH	MEDIUM	NO
48-1	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
48-2	Ulmus americana	9	FAIR	SMALL CAVITY	LOW	NONE	NO	NONE	LOW	NO

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VTRA Ratings: Low, Moderate, High, Extreme Risk
Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Elm Tree Data

TREE ID	SPECIES/CULTIVAR	DBH (INCHES)	CONDITION	CONDITION NOTES	VTRA*	VTRA NOTES	DUTCH ELM DISEASE OBSERVED?	MAINTENANCE	MAINTENANCE PRIORITY	CABLING OBSERVED?
48-3	Ulmus americana	23	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
48-E1	Ulmus americana	41	FAIR	DEAD BRANCH	HIGH	BIG DEAD BRANCH OVER STREET	NO	REMOVE DEAD BRANCH. INSPECTION RECOMMENDED	HIGH	NO
49-1	Ulmus americana	23	GOOD	LARGE TRUNK WOUND	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
49-2	Ulmus americana	26	GOOD	NONE	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
49-3	Ulmus americana	25	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
49-W1	Ulmus americana	26	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-1	Ulmus americana	25	GOOD	NONE	LOW	NONE	NO	CABLING RECOMMENDED	LOW	NO
50-2	Ulmus americana	8	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-3	Ulmus americana	50	GOOD	CABLES. MANY LARGE TRUNK WOUNDS	HIGH	OVER BENCHES	NO	INSPECTION RECOMMENDED (SOON)	HIGH	YES
50-4	Ulmus americana	33	GOOD	CABLED.	LOW	NONE	NO	NONE	LOW	YES
50-5	Ulmus americana	12	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-6	Ulmus americana	11	GOOD	BAD FORM	LOW	NONE	NO	NONE	LOW	NO
50-7	Ulmus americana	18	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-8	Ulmus americana	40	GOOD	"NACC DED 44-04" TAG. BROKEN CABLE	MODERATE	NONE	NO	CABLING RECOMMENDED	MEDIUM	YES
50-9	Ulmus americana	41	EXCELLENT	CABLED	LOW	NONE	NO	NONE	LOW	YES
50-10	Ulmus americana	10	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-11	Ulmus americana	56	EXCELLENT	CABLED. LARGE WOUND. CAVITY	LOW	NONE	NO	INSPECTION RECOMMENDED (BECAUSE OF SIZE AND AGE)	MEDIUM	YES
50-12	Ulmus americana	35	GOOD	LARGE WOUNDS ON MAIN BRANCH	HIGH	HUGE, RISKY BRANCH	NO	INSPECTION RECOMMENDED (SOON)	HIGH	NO
50-13	Ulmus americana	15	GOOD	TRUNK WOUND	LOW	NONE	NO	NONE	LOW	NO
50-14	Ulmus americana	32	GOOD	SMALL CAVITIES	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
50-15	Ulmus americana	36	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-16	Ulmus americana	14	GOOD	INCLUDED BARK	LOW	NONE	NO	CABLING RECOMMENDED	LOW	NO
50-17	Ulmus americana	12	GOOD	LARGE WOUND ON LEADER	LOW	NONE	NO	NONE	LOW	NO
50-18	Ulmus americana	23	GOOD	LARGE BRANCH WOUND. LARGE CAVITY	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	NO
50-19	Ulmus americana	22	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-20	Ulmus americana	13	GOOD	"BP 38" TAG.	LOW	NONE	NO	NONE	LOW	NO
50-21	Ulmus americana	28	GOOD	CABLED. CAVITY	LOW	NONE	NO	NONE	LOW	YES
50-22	Ulmus americana	35	GOOD	CABLES (MANY SLACK)	LOW	NONE	NO	NONE	LOW	YES
50-23	Ulmus americana	35	GOOD	CABLED. CAVITY AT CROTCH	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
50-24	Ulmus americana	32	GOOD	"BP 15" TAG. CABLES. ONE SNAPPED CABLE	LOW	NONE	NO	NONE	LOW	NO
50-25	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-26	Ulmus americana	11	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-27	Ulmus americana	40	GOOD	CABLED AND BOLTED. INCLUDED BARK	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	YES
50-28	Ulmus americana	36	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
50-29	Ulmus americana	19	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-30	Ulmus americana	18	EXCELLENT	NONE	LOW	NONE	NO	NONE	LOW	NO
50-S10	Ulmus americana	14	GOOD	ZELKOVA-LIKE FORM. MANY BRANCHES FROM ONE POINT	LOW	NONE	NO	NONE	LOW	NO
50-S11	Ulmus americana	21	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
50-S2	Ulmus americana	33	GOOD	"BP 1" TAG. POSSIBLE LIGHTNING STRIKE	LOW	NONE	NO	INSPECTION RECOMMENDED	LOW	NO
50-S3	Ulmus americana	30	GOOD	CABLED."3-390" TAG. "B-31" TAG. POSSIBLY HOLLOW	HIGH	AT RISK OF WHOLE TREE FAILURE	NO	INSPECTION RECOMMENDED. REMOVAL LIKELY	HIGH	YES
50-S4	Ulmus americana	12	FAIR	SOME DIEBACK	LOW	NONE	NO	NONE	LOW	NO
50-S5	Ulmus americana	33	GOOD	"BP 16" TAG. CABLED. LARGE CAVITY	MODERATE	NONE	NO	INSPECTION RECOMMENDED	HIGH	YES
50-S6	Ulmus americana	32	GOOD	CABLED	LOW	NONE	NO	NONE	LOW	YES
50-S7	Ulmus americana 'Augustine Ascending'	23	GOOD	"BP 24" TAG.	LOW	NONE	NO	NONE	LOW	NO
50-S8	Ulmus americana	33	GOOD	"BP 25" TAG. "B-16" TAG.	HIGH	HUGE FAILING BRANCH OVER ROAD	NO	INSPECTION RECOMMENDED	HIGH	NO
50-S9	Ulmus americana	14	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO
51-1	Ulmus americana	42	GOOD	"B-1" TAG. "NACC DED 57 06" TAG. MIGHT HAVE BEEN HIT BY LIGHTNING	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	NO
51-2	Ulmus americana	39	GOOD	CABLED. HUGE CAVITY	HIGH	NONE	NO	INSPECTION RECOMMENDED	HIGH	YES
51-3	Ulmus americana	16	GOOD	NONE	LOW	NONE	NO	NONE	LOW	NO

*VTRA = Visual Tree Risk Assessment following ISA Level 2 Protocol
VTRA Ratings: Low, Moderate, High, Extreme Risk
Condition Ratings: Excellent, Good, Fair, Poor, Dead
Maintenance Priority: High, Medium, Low

Select Results from iTree Eco Analysis

Summary

Understanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the National Mall Elms urban forest was conducted during 2017. Data from 550 trees located throughout National Mall Elms were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station.

- Number of trees: 550
- Tree cover: 14.4 acres
- Most common species of trees: American elm
- Percentage of trees less than 6" (15.2 cm) diameter: 11.5%
- Pollution removal: 698.4 pounds/year ($9.87 thousand/year)
- Carbon storage: 435 tons ($56.4 thousand)
- Carbon sequestration: 8.731 tons/year ($1.13 thousand/year)
- Oxygen production: 23.28 tons/year
- Avoided runoff: 24290 cubic feet/year ($1.62 thousand/year)
- Building energy savings: n/a – data not collected
- Avoided carbon emissions: n/a – data not collected
- Structural values: $2.98 million

Ton: short ton (U.S.) (2,000 lbs)
Monetary values $ are reported in US Dollars throughout the report except where noted
Ecosystem service estimates are reported for trees.

For an overview of i-Tree Eco methodology, see Appendix I. Data collection quality is determined by the local data collectors, over which i-Tree has no control.

Air Pollution Removal by Urban Trees

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power sources. Trees also emit volatile organic compounds that can contribute to ozone formation. However, integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (Nowak and Dwyer 2000).

Pollution removal[1] by trees in National Mall Elms was estimated using field data and recent available pollution and weather data available. Pollution removal was greatest for ozone (Figure 7). It is estimated that trees remove 698.4 pounds of air pollution (ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 2.5 microns (PM2.5)[2], and sulfur dioxide (SO2)) per year with an associated value of $9.87 thousand (see Appendix I for more details).

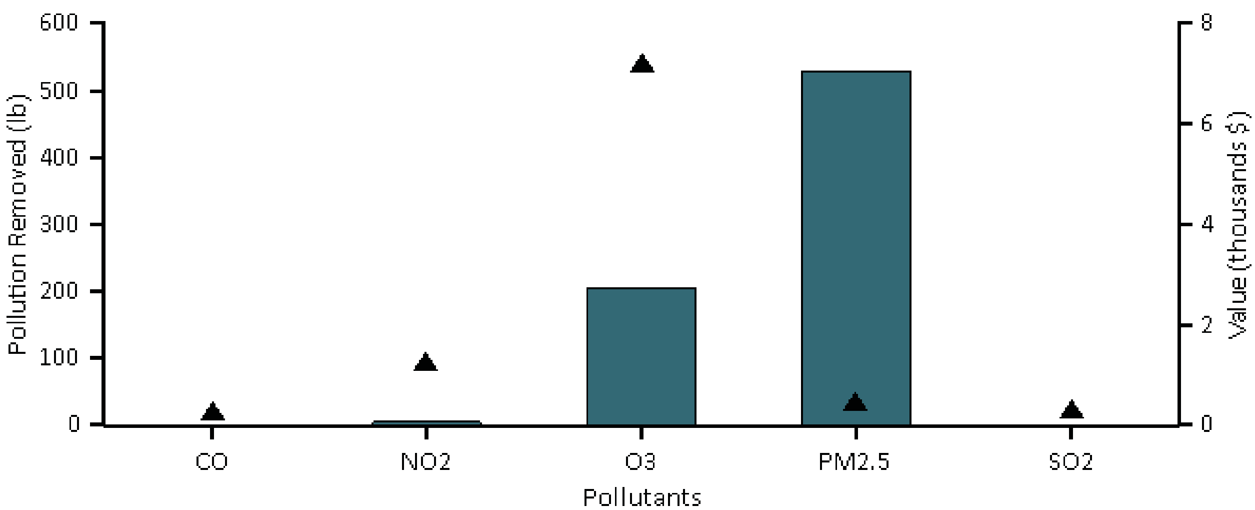

Figure 7. Annual pollution removal (points) and value (bars) by urban trees, National Mall Elms

[1] Particulate matter less than 10 microns is a significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

[2] Trees remove PM2.5 when particulate matter is deposited on leaf surfaces. This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors (see Appendix I for more details).

In 2017, trees in National Mall Elms emitted an estimated 17.05 pounds of volatile organic compounds (VOCs) (2.672 pounds of isoprene and 14.38 pounds of monoterpenes). Emissions vary among species based on species characteristics (e.g. some genera such as oaks are high isoprene emitters) and amount of leaf biomass. One hundred percent of the urban forest's VOC emissions were from American elm. These VOCs are precursor chemicals to ozone formation.[3]

General recommendations for improving air quality with trees are given in Appendix VIII.

[3] Some economic studies have estimated VOC emission costs. These costs are not included here as there is a tendency to add positive dollar estimates of ozone removal effects with negative dollar values of VOC emission effects to determine whether tree effects are positive or negative in relation to ozone. This combining of dollar values to determine tree effects should not be done, rather estimates of VOC effects on ozone formation (e.g., via photochemical models) should be conducted and directly contrasted with ozone removal by trees (i.e., ozone effects should be directly compared, not dollar estimates). In addition, air temperature reductions by trees have been shown to significantly reduce ozone concentrations (Cardelino and Chameides 1990; Nowak et al 2000), but are not considered in this analysis. Photochemical modeling that integrates tree effects on air temperature, pollution removal, VOC emissions, and emissions from power plants can be used to determine the overall effect of trees on ozone concentrations.

Carbon Storage and Sequestration

Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Abdollahi et al 2000).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of National Mall Elms trees is about 8.731 tons of carbon per year with an associated value of $1.13 thousand. See Appendix I for more details on methods.

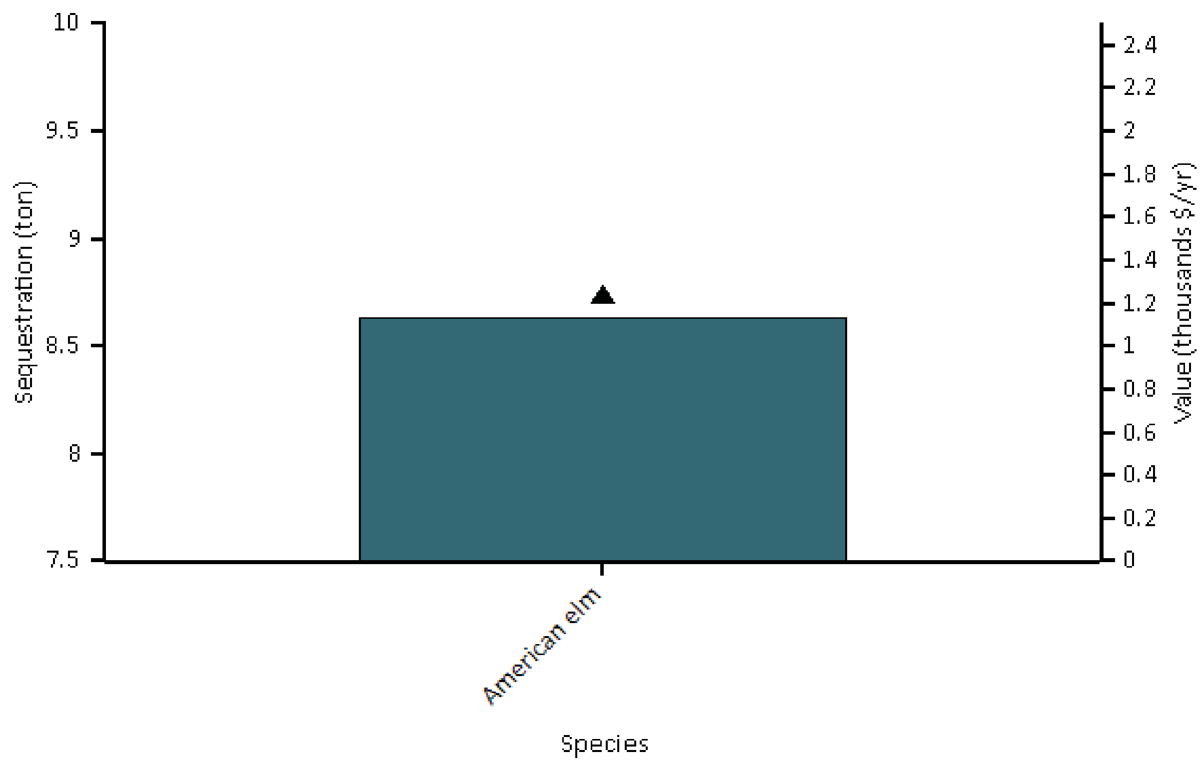

Figure 8. Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration, National Mall Elms

Carbon storage is another way trees can influence global climate change. As a tree grows, it stores more carbon by holding it in its accumulated tissue. As a tree dies and decays, it releases much of the stored carbon back into the atmosphere. Thus, carbon storage is an indication of the amount of carbon that can be released if trees are allowed to die and decompose. Maintaining healthy trees will keep the carbon stored in trees, but tree maintenance can contribute to carbon emissions (Nowak et al 2002c). When a tree dies, using the wood in long-term wood products, to heat buildings, or to produce energy will help reduce carbon emissions from wood decomposition or from fossil-fuel or wood-based power plants.

Trees in National Mall Elms are estimated to store 435 tons of carbon ($56.4 thousand). Of the species sampled, American elm stores and sequesters the most carbon (approximately 100% of the total carbon stored and 100% of all sequestered carbon.)

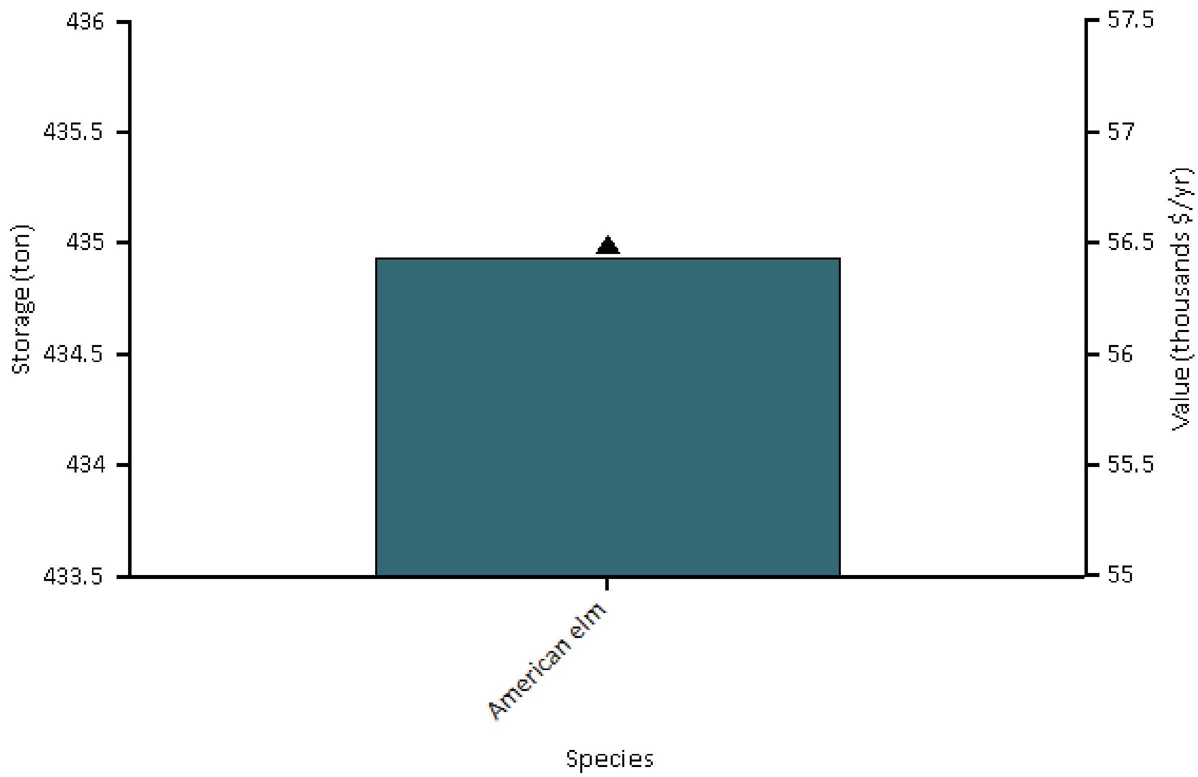

Figure 9. Estimated carbon storage (points) and values (bars) for urban tree species with the greatest storage, National Mall Elms

Oxygen Production

Oxygen production is one of the most commonly cited benefits of urban trees. The annual oxygen production of a tree is directly related to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass.

Trees in National Mall Elms are estimated to produce 23.28 tons of oxygen per year.[4] However, this tree benefit is relatively insignificant because of the large and relatively stable amount of oxygen in the atmosphere and extensive production by aquatic systems. Our atmosphere has an enormous reserve of oxygen. If all fossil fuel reserves, all trees, and all organic matter in soils were burned, atmospheric oxygen would only drop a few percent (Broecker 1970).

Table 2. The top 20 oxygen production species.

Species	*Oxygen (ton)*	*Gross Carbon Sequestration (ton/yr)*	*Number of Trees*	*Leaf Area (acre)*
American elm	23.28	8.73	550	73.04

Avoided Runoff

Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, lakes, and oceans. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012). In urban areas, the large extent of impervious surfaces increases the amount of surface runoff.

Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. The trees and shrubs of National Mall Elms help to reduce runoff by an estimated 24.3 thousand cubic feet a year with an associated value of $1.6 thousand (see Appendix I for more details). Avoided runoff is estimated based on local weather from the user-designated weather station. In National Mall Elms, the total annual precipitation in 2013 was 46.7 inches.

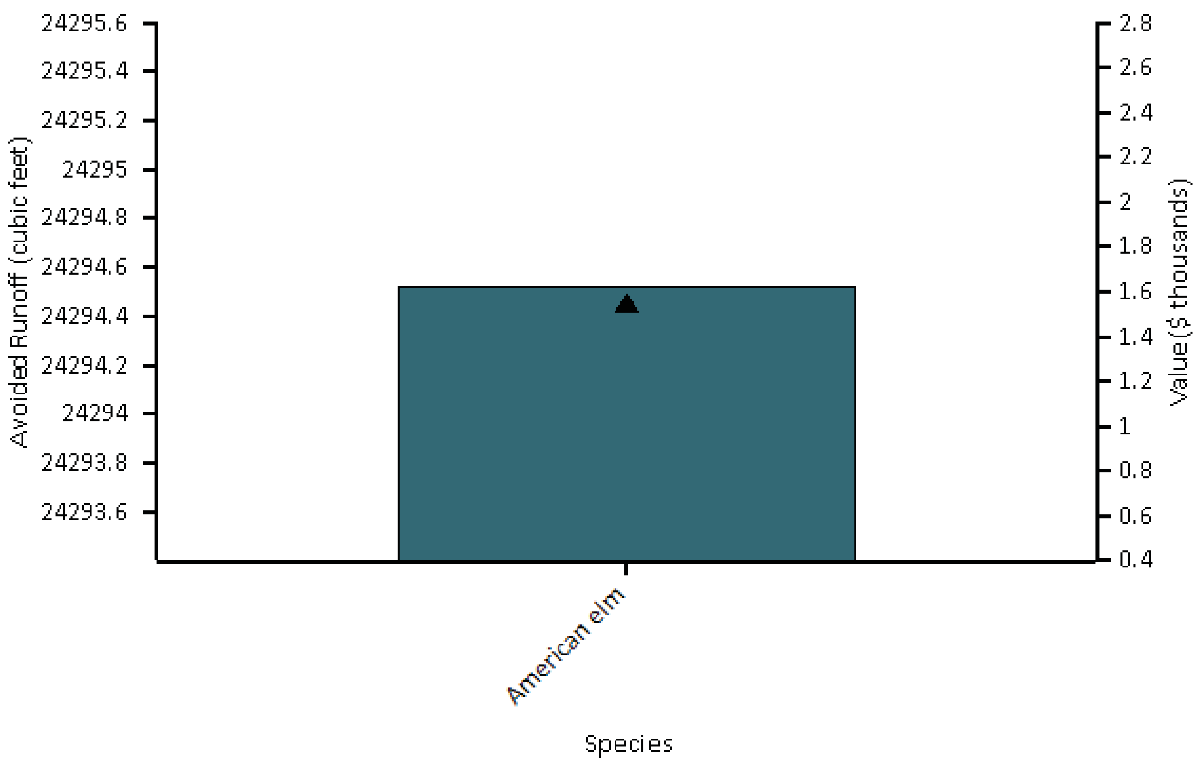

Figure 10. Avoided runoff (points) and value (bars) for species with greatest overall impact on runoff, National Mall Elms

Structural and Functional Values

Urban forests have a structural value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree); they also have functional values (either positive or negative) based on the functions the trees perform.

The structural value of an urban forest tends to increase with a rise in the number and size of healthy trees (Nowak et al 2002a). Annual functional values also tend to increase with increased number and size of healthy trees. Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines.

Urban trees in National Mall Elms have the following structural values:

- Structural value: $2.98 million
- Carbon storage: $56.4 thousand

Urban trees in National Mall Elms have the following annual functional values:

- Carbon sequestration: $1.13 thousand
- Avoided runoff: $1.62 thousand
- Pollution removal: $9.87 thousand
- Energy costs and carbon emission values: $0.00

(Note: negative value indicates increased energy cost and carbon emission value)

Figure 11. Tree species with the greatest structural value, National Mall Elms

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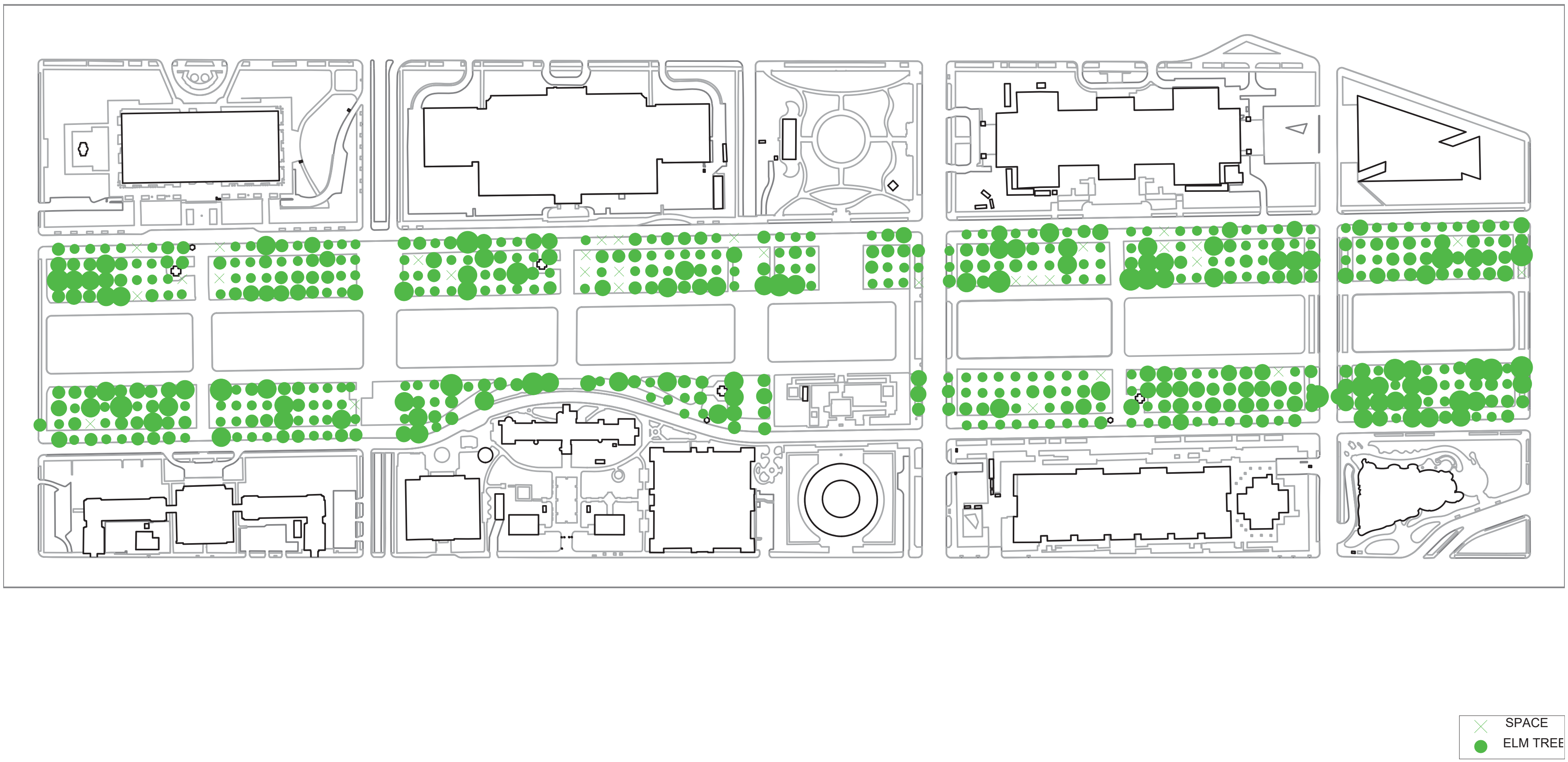
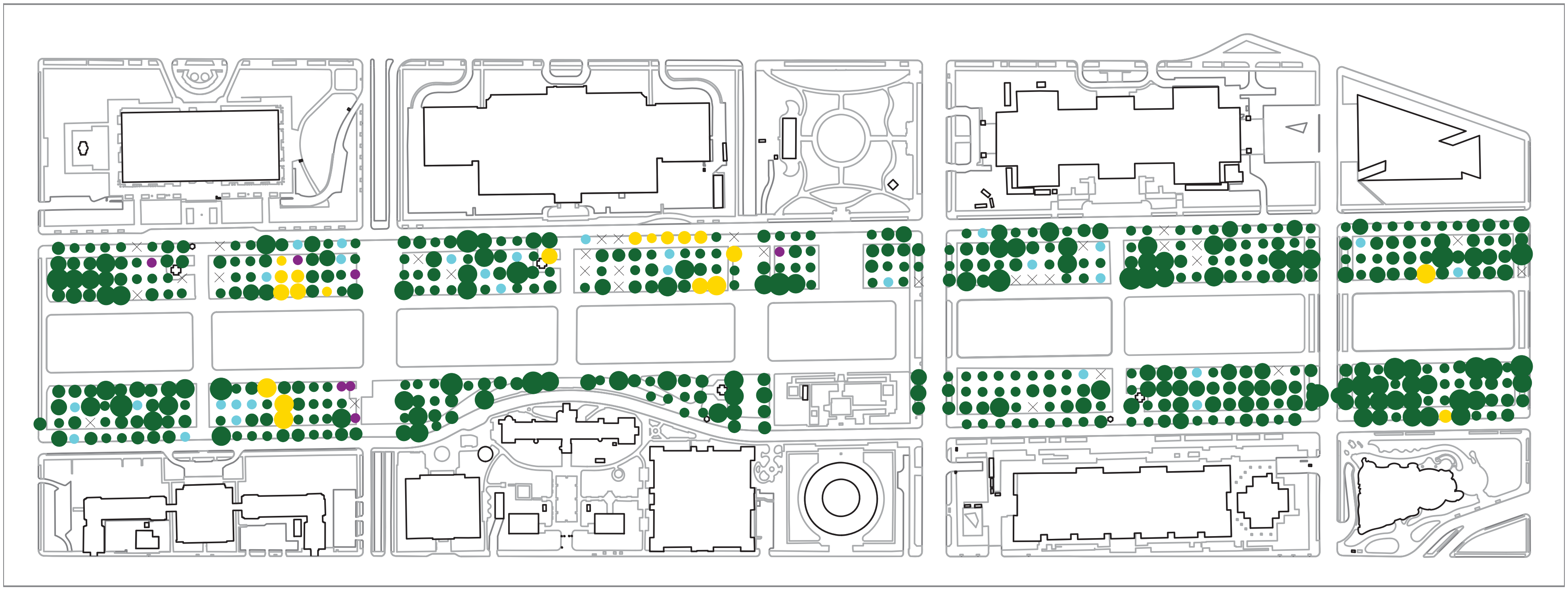
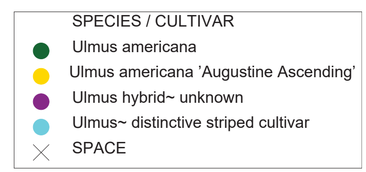
Elm Trees and Spaces



Identified Elm Species and Cultivars

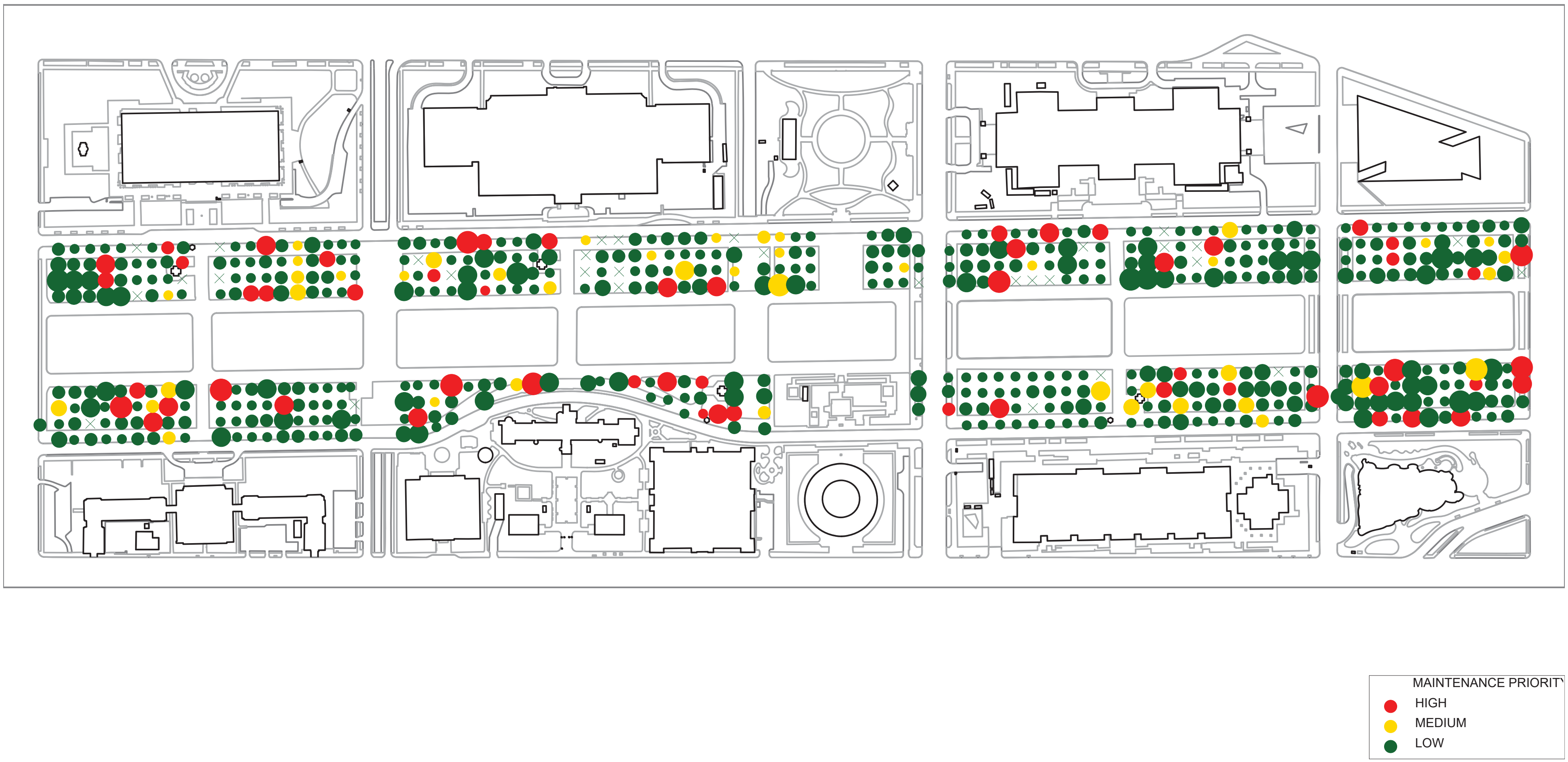




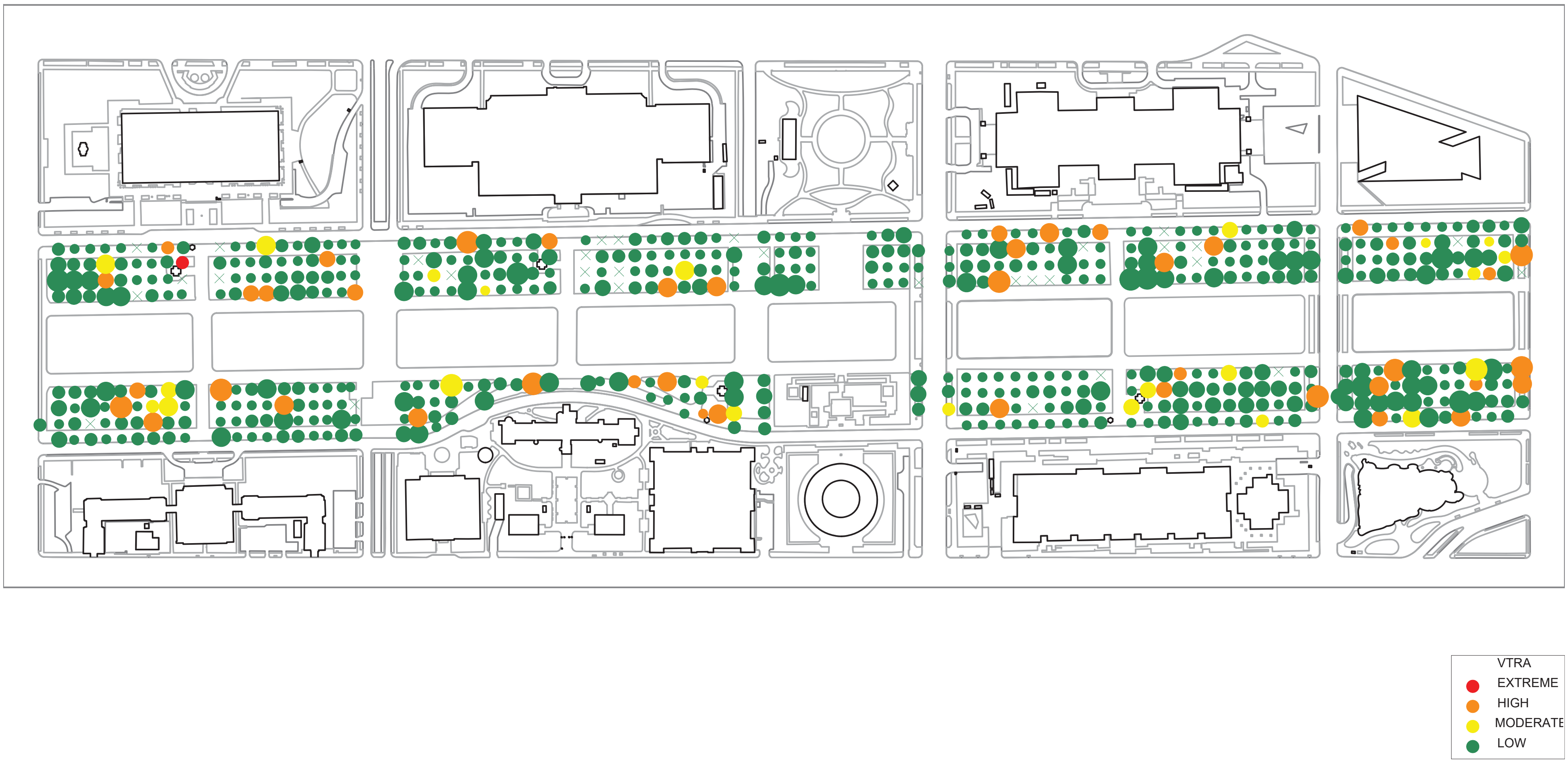
Tree Condition

Signs of Dutch Elm Disease

Tree Maintenance Priority



Visual Tree Risk Assessment (VTRA)



Trees with Observed Cabling