Tree Management Plan

Van Buren Point Association

January 2018

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ACKNOWLEDGEMENTS

The Van Buren Point Association's vision to promote and preserve the urban forest and improve the management of public trees was a fundamental inspiration for this project. This vision will ensure canopy continuity, which will reduce stormwater runoff and improve air quality, public health, and aesthetic values.

The Van Buren Point Association also recognizes the support of its Board members and community residents.

Notice of Disclaimer. Inventory data provided by Davey Resource Group, Inc. "DRG" are based on visual recording at the time of inspection. Visual records do not include individual testing or analysis and do not include aerial or subterranean inspection. DRG is not responsible for the discovery or identification of hidden or otherwise non-observable hazards. Records may not remain accurate after inspection due to the variable deterioration of inventoried material. DRG provides no warranty with respect to the fitness of the urban forest for any use or purpose whatsoever. Clients may choose to accept or disregard DRG's recommendations or to seek additional advice. Important: know and understand that visual inspection is confined to the designated subject tree(s), and that the inspections for this project are performed in the interest of facts of the tree(s) without prejudice to or for any other service or interested party.

EXECUTIVE SUMMARY

This plan was developed for the Van Buren Point Association by DRG with a focus on addressing short- and long-term maintenance needs for inventoried public trees. DRG completed a tree inventory to gain an understanding of the needs of the existing urban forest and to project a recommended maintenance schedule for tree care. Analysis of inventory data and information about the Van Buren Point Association's existing program and vision for the urban forest was utilized to develop this management plan.

State of the Existing Urban Forest

The October 2017 inventory included trees, stumps, and planting sites along public street rights-of-way (ROW) and in specified parks and private properties. A total of 717 sites were recorded during the inventory: 683 individual trees and 34 stumps, of which 374 trees were managed by Van Buren Point. The charts included in this plan reflect the total population with the exception of the budget analysis; only those trees managed by the Association were taken into consideration. Analysis of the tree inventory data found the following:

- The overall condition of the inventoried tree population is rated good.
- Two species, *Acer* and *Fraxinus*, make up such a large percentage (30% each) that they threaten biodiversity.
- Overall, the diameter size class distribution of the inventoried tree population is not trending towards the ideal, with a greater number of Established trees than Young, Mature, or Maturing trees.

Tree Maintenance and Planting Needs

Trees provide many environmental and economic benefits that justify the time and money for planting and maintenance. Recommended maintenance needs include pruning (89%), tree removal, stump removal (10%), and tree planting (1%). Maintenance should be prioritized by addressing trees with the highest risk first. The inventory noted many Moderate and Low Risk trees (95% and 5% of trees assessed, respectively); these trees should be pruned or removed to promote public safety. Trees should be planted to mitigate removals and create canopy. The table below represents the publicly managed tree maintenance recommendations.

Tree Removal	• Low Risk = 8 trees
Priority Pruning	• Moderate Risk = 3 trees • Low Risk = 286 trees
Routine Prune Cycle	• Total trees = 289 • Trees in cycle 57
Young Tree Training Cycle	• Total trees = 39 • Trees in cycle each year = at least 13
Tree Planting	• Trees planted each year = at least 7
Stump Removal	• Total stumps = 31

Van Buren Point Association urban forest will benefit greatly from a three-year young tree training cycle and a five-year routine pruning cycle. Proactive pruning cycles improve the overall health of the tree population and may eventually reduce program costs. In most cases, pruning cycles will correct defects in trees before they worsen, which will avoid costly problems. Based on inventory data, at least 13 young trees should be structurally pruned each year during the young tree training cycle, and approximately 57 trees should be cleaned during the routine pruning cycle each year.

Planting trees is necessary to maintain canopy cover and to replace trees that have been removed or lost to natural mortality (expected to be 1%–3% per year) or other threats (for example, construction, invasive pests, or impacts from weather events such as drought, flooding, ice, snow, storms, and wind). We recommend planting at least 7 trees of a variety of species each year to offset these losses and maintain canopy and maximum benefits.

Photograph 1. The Van Buren Point Association recognizes that its urban forest is critical to ecosystem health and economic growth. Planning and action is required to promote and sustain a healthy urban forest.

Trees of varied species should be planted; however, the planting of *Acer* and *Fraxinus* (maple and ash) should be limited until the species distribution normalizes. We provide a planting list that offers smart choices for species selection and diversity to build a resilient urban forest that will not be significantly affected by any single disease or invasive pest. Due to the species distribution and impending threats from emerald ash borer (EAB, *Agrilus planipennis*), all *Fraxinus* spp. (ash) trees should be temporarily removed from the planting list or planted only when a landscape plan is in place.

Urban Forest Program Needs

Adequate funding will be needed for the Van Buren Point Association to implement an effective management program that provides short- and long-term public benefits, ensures that priority maintenance is expediently performed, and establishes proactive maintenance cycles. The estimated total cost for the first year of this five-year program is approximately $ 20,000; this total will decrease to approximately $ 12,000 per year by the second year of the program. Removals and pruning is costly. Since most of this work is scheduled during the first year of the program, the budget is higher for that year. After removal work has been completed, the urban forestry program will mostly involve proactive work, which is generally less costly. Budgets for later years are thus projected to be lower.

Over the long term, funding that supports proactive management of trees will reduce municipal tree care management costs and possibly reduce the costs to build, manage, and support some Van Buren Point infrastructure.

Van Buren Point has many opportunities to improve its urban forest. Planned tree planting and a systematic approach to tree maintenance will transform an on-demand, priority-based operation into a cost-effective, proactive program. Investing in this tree management program will improve tree care efficiency, increase the economic, environmental, and social benefits the community receives from its trees, and promote public safety.

SECTION 1. INTRODUCTION

The Van Buren Point Association is home to many summer residents who enjoy the beauty and benefits of their urban forest. The Association manages trees on public property—in parks, in public spaces, and along the street ROW.

Approach to Tree Management

The best approach to managing an urban forest is to develop an organized, proactive program using tools (such as a tree inventory and tree management plan) to set goals and measure progress. These tools can be utilized to draft cost-effective budgets based on projected needs, establish tree care priorities, generate strategic planting plans, and ultimately minimize the need for costly, reactive solutions to crises or urgent hazards.

In October 2017, Van Buren Point worked with DRG to inventory trees and develop a management plan. This plan considers the diversity, distribution, and general condition of the inventoried trees, but also provides a prioritized system for managing street ROW and park trees. The following tasks were completed:

- Inventory of trees and stumps, within the street ROW, select private homeowner properties, and in community parks.
- Analysis of tree inventory data.
- Evaluation of pest and disease threats.
- Calculation of ecological, monetary, and other benefits.
- Development of a plan that prioritizes the recommended tree maintenance.

This plan is divided into three sections:

- Section 1 *(Tree Inventory Analysis)* summarizes the tree inventory data and presents observations, results, and trends.
- Section 2 *(Benefits of the Urban Forest)* presents information about the economic, environmental, and social benefits that trees provide to the community.
- Section 3 *(Tree Management Program)* utilizes the inventory data to develop a prioritized maintenance schedule and projected budget for the implementation of the recommended tree maintenance over a five-year period.

Tree Inventory Analysis

In October 2017, DRG arborists certified by the International Society of Arboriculture assessed and inventoried trees and stumps, along the street ROW, select private properties and trees in parks. A total of 717 sites were collected during the inventory: 683 trees and 34 stumps.

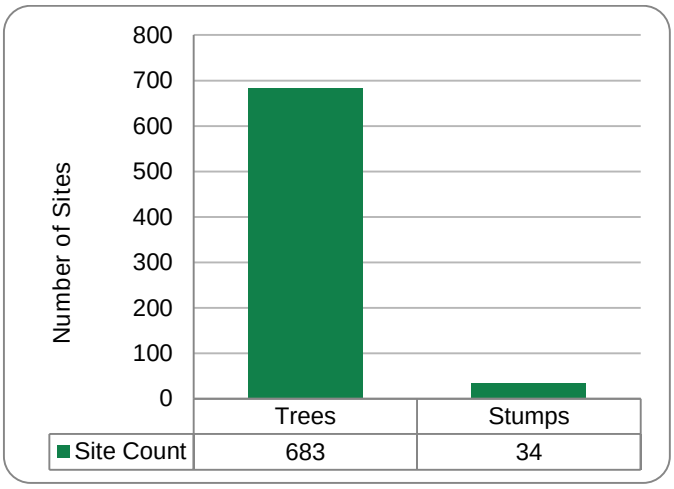


Figure 1. Detailed breakdown of the number and type of sites inventoried.

Data Collection Methods

Tree inventory data were collected using a system developed by DRG that utilizes a customized program loaded onto pen-based field computers equipped with geographic information system (GIS) and global positioning system (GPS) receivers. The knowledge and professional judgment of DRG's arborists ensure the high quality of inventory data.

Data fields are defined in the Glossary, and the site location method is provided in Appendix A. At each site, the following data fields were collected:

- aboveground utilities
- block side
- address
- defects
- condition
- further inspection
- stems
- mapping coordinate
- notes
- observations
- primary maintenance needs
- risk assessment
- risk rating
- tree size*
- species

* measured in inches in diameter at 4.5 feet above ground (or diameter at breast height [DBH])

Primary and secondary maintenance are based on ANSI A300 (Part 1) (2008). Risk assessment and risk rating are based on the *Best Management Practices: Tree Risk Assessment* (International Society of Arboriculture [ISA] 2011).

Project Area

All trees and stumps within the Van Buren Point ROW were inventoried as well as any found in community parks. Homeowners were given the option to have their trees added to the inventory; those trees are included in the inventory as well.

Assessment of Tree Inventory Data

Data analysis and professional judgment are used to make generalizations about the state of the inventoried tree population. Analysis of the data included both publicly and privately managed sites. The tree management program described in Section 3 of this document only included sites publicly managed. Recognizing trends in the data can help guide short- and long-term management planning. In this plan, the following criteria and indicators of the inventoried tree population were assessed:

Photograph 2. *DRG's* ISA Certified Arborists inventoried trees within Van Buren Point to collect information about trees that could be used to assess the state of urban forest.

- *Species Diversity*—The variety of species in a specific population; affects the population's ability to withstand threats from invasive pests and diseases; impacts tree maintenance needs and costs, tree planting goals, and canopy continuity.
- *Diameter Size Class Distribution*—Statistical distribution of a given tree population's trunk-size class; affects the valuation of tree-related benefits as well as the estimation of maintenance needs and costs, planting goals, and canopy continuity; the diameter size class distribution is used to indicate the relative age of a tree population.
- *Condition*—The general health of a tree population; indicates how well trees are performing given their site-specific conditions; general health affects both short- and long-term maintenance needs and costs as well as canopy continuity.
- *Street ROW Stocking Level*—The portion of existing street ROW trees compared to the total number of potential street ROW trees (number of inventoried trees plus the number of potential planting spaces); stocking level can help determine tree planting needs and budgets.
- *Other Observations*—Inventory data analysis that provides insight into past maintenance practices and growing conditions; discusses observations that may affect future management decisions.

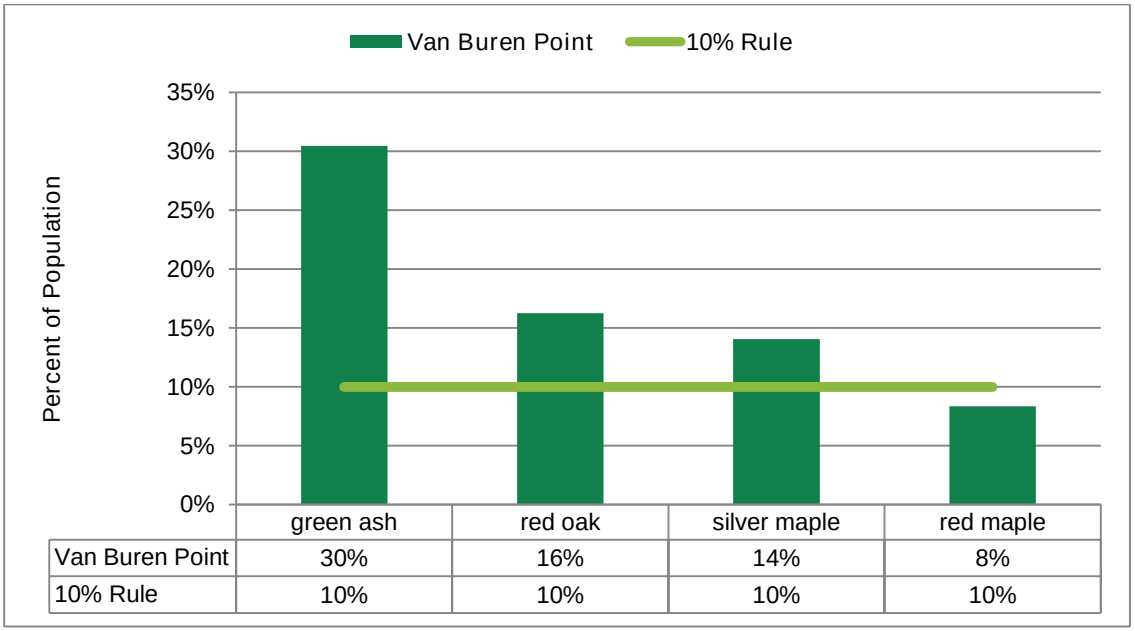
Species Diversity

Species diversity affects canopy continuity, maintenance costs, planting goals, and the forestry program's ability to respond to threats from invasive pests or diseases. Low species diversity (large number of trees of the same species) can lead to extreme losses in the event of species-specific epidemics such as the devastating results of Dutch elm disease (DED, *Ophiostoma novo-ulmi*) throughout New England and the Midwest. Because of the introduction and spread of DED in the 1930s, combined with its prevalence today, massive numbers of *Ulmus americana* (American elm), a popular street tree in Midwestern cities and towns, have perished (Karnosky 1979). Many Midwestern communities were stripped of most of their mature shade trees, creating a drastic void in canopy cover. Many communities replanted to replace the lost elm trees. Ash and maple trees were popular replacements for American elm in the wake of Dutch elm disease. Unfortunately, some of the replacement species for American elm trees are now overabundant, which is a concern for biodiversity. Emerald ash borer (EAB, *Agrilus planipennis*) and Asian longhorned beetle (ALB, *Anoplophora glabripennis*) are non-native insect pests that attack some of the most prevalent urban shade trees and some agricultural trees throughout the country.

The composition of a tree population should follow the 10-20-30 Rule for species diversity: a single species should represent no more than 10% of the urban forest, a single genus no more than 20%, and a single family no more than 30%.

Findings

Analysis of Van Buren Point's tree inventory data indicates that the population has a relatively weak diversity, with 25 genera and 43 species represented.



	green ash	red oak	silver maple	red maple
Van Buren Point	30%	16%	14%	8%
10% Rule	10%	10%	10%	10%

Figure 2. Four most abundant species of the inventoried tree population compared to the 10% Rule.

Figure 2 compares the percentages of the most common species identified during the inventory to the 10% Rule. *Fraxinus pennsylvanica* (green ash), *Quercus rubra* (red oak), and *Acer saccharinum* (silver maple) far exceed the recommended 10% maximum for a single species in a population, comprising 30% and 16% of the inventoried tree population, respectively. *Acer rubrum* (red maple) is approaching the 10% threshold.

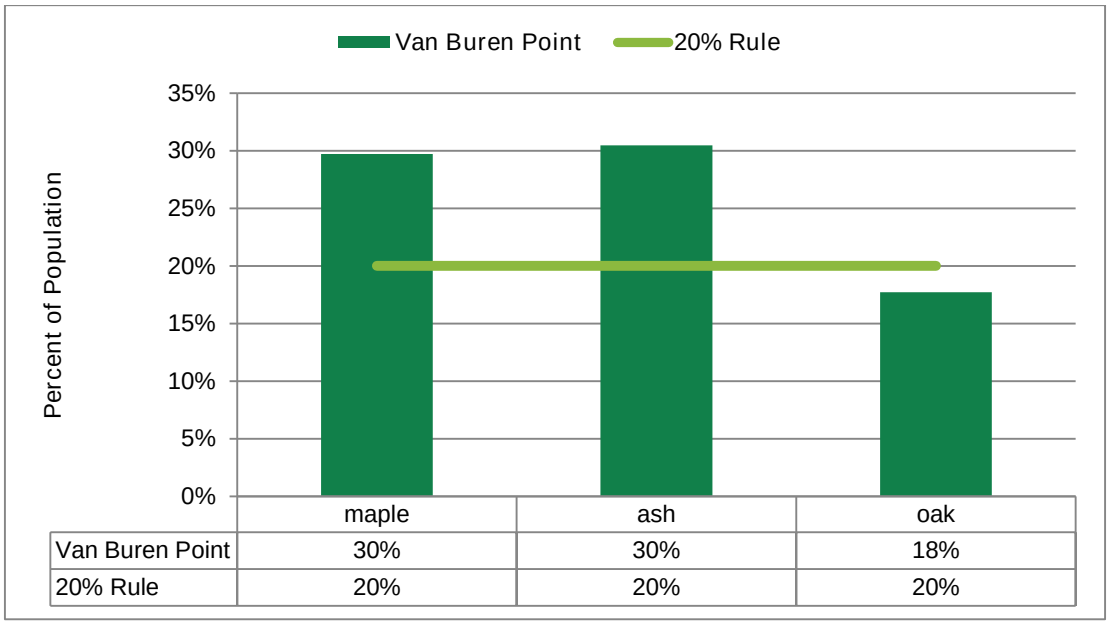


Figure 3. Three most abundant genus of the inventoried tree population compared to the 20% Rule.

Figure 3 compares the percentages of the most common genus to the 20% Rule. *Fraxinus* (ash) and *Acer* (maple) far exceed the recommended 20% maximum for a single genus in a population, comprising 30% and 30% of the inventoried tree population, respectively. *Quercus* (oak) is approaching the 20% threshold.

Discussion/Recommendations

Fraxinus spp.(ash) and *Acer* spp. (maple) dominate the inventory. This is a biodiversity concern because of their abundance in the landscape makes it a limiting species. Also, ash is a target of EAB, and maple is a target of ALB. Having a diverse population of trees will ensure that Van Buren Point's urban forest is sustainable and resilient to future invasive pest infestations.

Considering the large quantity of ash and maple already present in the population, combined with their susceptibility to EAB and ALB, the planting of ash and maple should be limited to minimize the potential for loss should either insect threaten Van Buren Point's urban tree population. See Appendix B for a recommended tree species list for planting.

Diameter Size Class Distribution

Analyzing the diameter size class distribution provides an estimate of the relative age of a tree population and insight into maintenance practices and needs.

The inventoried trees were categorized into the following diameter size classes: Young (0–8 inches DBH), Established (9–17 inches DBH), Maturing (18–24 inches DBH), and Mature trees (>24 inches DBH). These categories were chosen so that the population could be analyzed following Richards' ideal distribution (1983). Richards proposed an ideal diameter size class distribution for street trees based on observations of well-adapted trees in Syracuse, New York. Richards' ideal distribution suggests that the largest fraction of trees (approximately 40% of the population) should be Young (<8 inches DBH), while a smaller fraction of trees (approximately 10%) should be in the Mature size class (>24 inches DBH). A tree population with an ideal distribution would have an abundance of newly planted and Young trees, and lower numbers of Established, Maturing, and Mature trees.

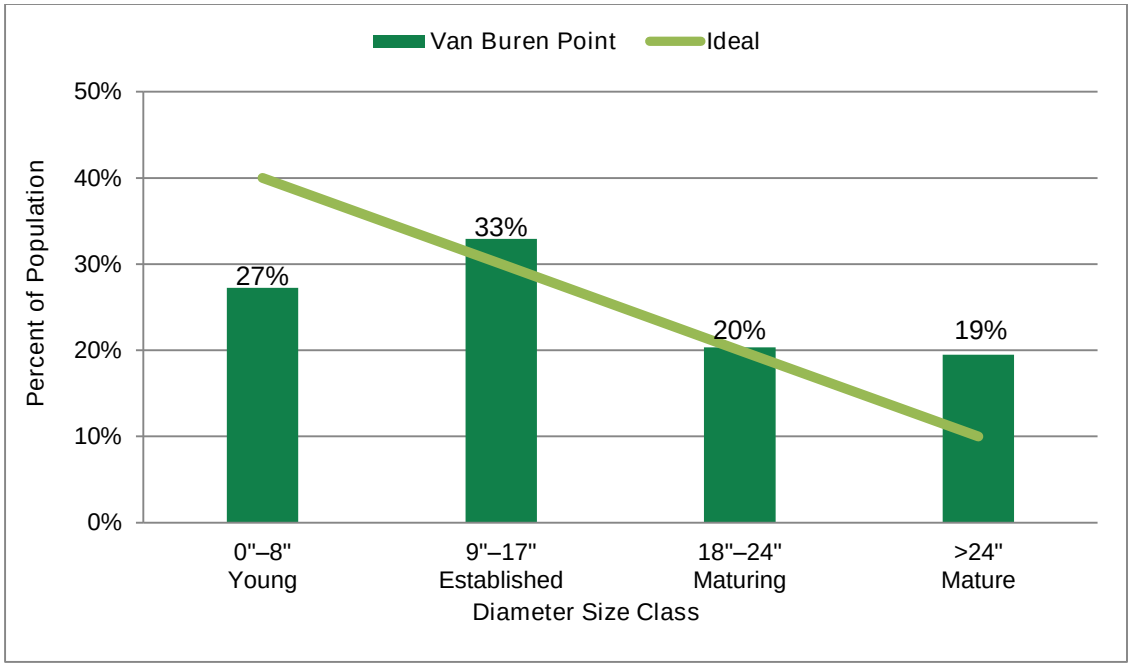


Figure 4. Comparison of diameter size class distribution for inventoried trees to the ideal distribution.

Findings

Figure 4 compares Van Buren Points diameter size class distribution of the inventoried street and park tree population to the ideal proposed by Richards (1983). Van Buren Points distribution does not trend towards the ideal; Young trees are under the ideal distribution by over 13%, while larger diameter size classes are exceeding.

Discussion/Recommendations

Van Buren Point has a deficiency of Young trees and has an overabundance of Mature trees. One of Van Buren Points objectives is to have an uneven-aged distribution of trees at the street, as well as throughout the association. DRG recommends that Van Buren Point support a strong planting and maintenance program to ensure that young, healthy trees are in place to fill in gaps in the tree canopy and provide for gradual succession of older trees. The Van Buren Point must promote tree preservation and proactive tree care to ensure the long-term survival of older trees. Tree planting and tree care will allow the distribution to normalize over time.

Planting trees is necessary to increase canopy cover and to replace trees lost to natural mortality (expected to be 1%–3% per year) and other threats (for example, invasive pests or impacts from weather events such as storms, wind, ice, snow, flooding, and drought). Planning for the replacement of existing trees and finding the best places to create new canopy is critical.

General Health

Davey Resource Group assessed the condition of individual trees based on methods defined by the International Society of Arboriculture (ISA). Several factors were considered for each tree, including root characteristics, branch structure, trunk, canopy, foliage condition, and the presence of pests. The condition of each inventoried tree was rated Good, Fair, Poor, or Dead.

In this plan, the general health of the inventoried tree population was characterized by the most commonly assigned condition during the inventory.

Comparing the condition of the inventoried tree population with relative tree age can provide insight into the stability of the population. In this plan, relative age was based on DBH. Since tree species have different lifespans and mature at different diameters, heights, and crown spreads, actual tree age cannot be determined from diameter size class alone. However, general classifications of size can be extrapolated into relative age classes. The following categories are used to describe the relative age of a tree: Young (0–8 inches DBH), Established (9–17 inches DBH), Maturing (18–24 inches DBH), and Mature (>24 inches DBH).

Findings

Most of the inventoried trees were found to be in good or fair condition, 78% and 18%, respectively (Figure 5). Based on these data, the general health of the overall inventoried tree population is rated good. Figure 6 illustrates that most of the Young, Established, Maturing, and Mature trees were rated to be in good condition.

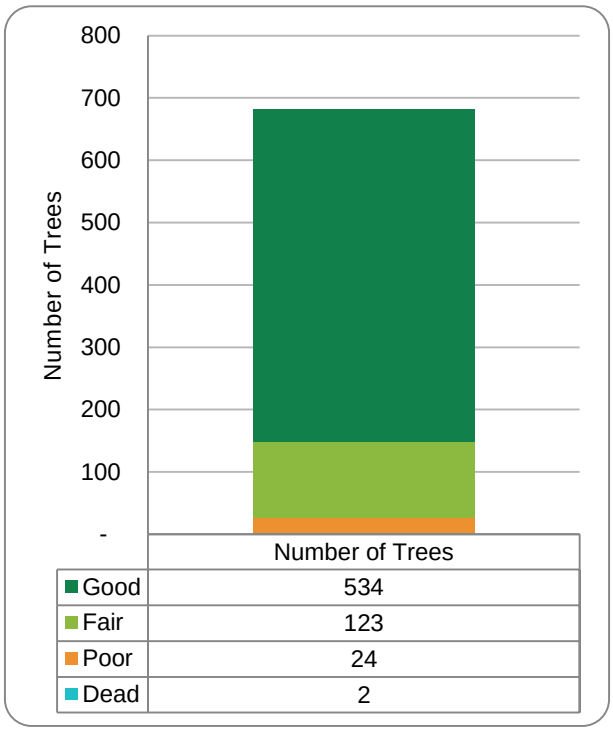


Figure 5. Condition of inventoried trees during the 2017 inventory.

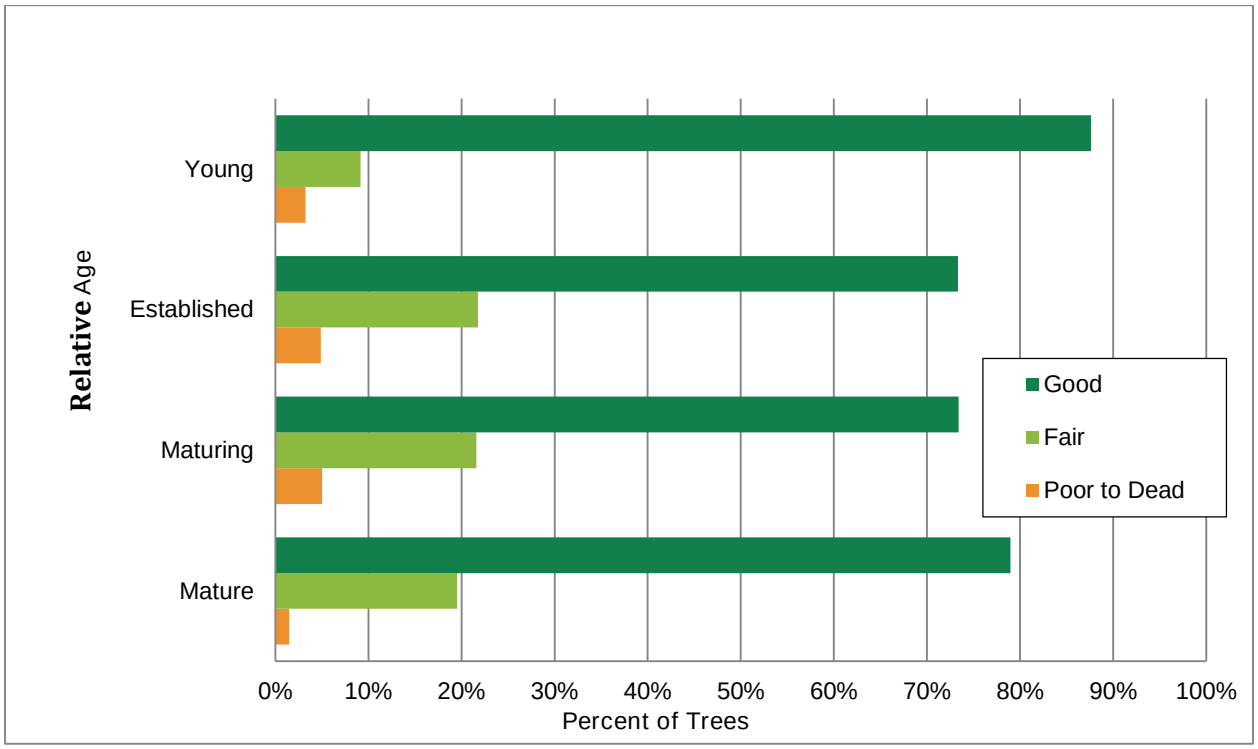


Figure 6. Tree condition by relative age during the 2017 inventory.

Discussion/Recommendations

Even though the condition of Van Buren Points inventoried tree population is typical, data analysis has provided the following insight into historical maintenance practices and future maintenance needs:

- The similar trend in tree condition across street ROW and private trees reveals that growing conditions and/or past management of trees were consistent.
- Remove Dead trees and trees in Critical condition. Because of their failed health, these trees most likely will not recover, even with increased care.
- Younger trees rated in Fair or Poor condition can benefit from improvements in structure, which over time may improve the health of these trees. Pruning should follow ANSI A300 (Part 1) (ANSI 2008).
- Poor condition ratings assigned to Mature trees were generally due to visible signs of decline and stress, including decay, dead limbs, sparse branching, or poor structure. These trees will require corrective pruning, regular inspections, and possible intensive plant health care to improve their vigor.
- Proper tree care practices are needed for the long-term general health of the urban forest. Many of the newly planted trees were improperly mulched or had staking hardware attached to them long after it should have been removed. Follow guidelines developed by the ISA and those recommended by ANSI A300 (Part 1) (ANSI 2011) to ensure that tree maintenance practices improve the general health of the urban forest.

Other Observations

Observations were recorded during the inventory to further describe a tree's health, location, or structure when more detail was needed.

Findings

Dead and dying parts was observed and recorded most often (86% of inventoried trees). Of these 256 trees, 21 were recommended for removal. A secondary observation was recorded concerning broken or hanging branches.

Photograph 3. The maple located within a park has dead or dying parts. With proper pruning, the Association can mitigate risk and prolong the many ecological benefits of the tree.

Table 1. Observations Recorded During the Street Tree Inventory

Observation	Number of Trees	Percent
Dead and dying parts	256	86%
Broken or hanging branches	31	10%
Missing or decayed wood	5	2%
Cracks	4	1%
Root problems	3	1%
Total	299	100%

Discussion/Recommendations

Trees noted as having cavity or decay (5 trees) should be regularly inspected. Corrective actions should be taken when warranted. If their condition worsens, removal may be required.

Staking should only be installed when necessary to keep trees from leaning (windy sites) or to prevent damage from pedestrians and/or vandals. Stakes should only be attached to trees with a loose, flexible material. Installed hardware that has been attached to any tree for more than one year and hardware that may no longer be needed for its intended purposes should be inspected and removed as appropriate.

Costs for treating defective trees must be considered to determine whether removing and replacing the tree is the most viable option.

Infrastructure Conflicts

In an urban setting, space is limited both above and below ground. Trees in this environment may conflict with infrastructure such as buildings, sidewalks, and utility wires and pipes, which may create risks to public health and safety. Existing or possible conflicts between trees and infrastructure recorded during the inventory include:

- *Overhead Utilities*—The presence of overhead utility lines above a tree or vacant planting site was noted; it is important to consider these data when planning pruning activities and selecting tree species for planting.

Findings

There were 107 trees with utilities directly above, or passing through, the tree canopy that are currently in conflict with the utilities. Of those trees, 84% were large- or medium-sized trees.

Discussion/Recommendations

Tree canopy should not block signs, signals, or lights, nor should trees interfere with vehicular or pedestrian traffic, or rest on buildings. Pruning to avoid clearance issues and to raise tree crowns should be completed in accordance with *ANSI A300* (*Part 9*) (ANSI 2011). DRG's clearance distance guidelines are: 14 feet over streets; 8 feet over sidewalks; and 5 feet from buildings, lights, signals, or signs.

Planting only small-growing trees within 20 feet of overhead utilities, medium-sized trees within 20–40 feet, and large-growing trees outside 40 feet will help improve future tree conditions, minimize future conflicts, and reduce the costs of maintaining trees under utility lines.

When planting around hardscape, it is important to give the tree enough growing room aboveground. Guidelines for planting trees among hardscape features are: give small-growing trees 4 to 5 feet, medium-growing trees 6 to 7 feet, and large-growing trees 8 feet or more between hardscape features. In most cases, this will allow for the spread of a tree's trunk taper, root collar, and immediate larger-diameter structural roots.

Growing Space

To prolong the useful life of street trees, small-growing tree species should be planted in tree lawns that are 4 to 5 feet wide, medium-sized tree species in tree lawns that are 6 to 7 feet wide, and large-growing tree species in tree lawns that are at least 8 feet wide. The functional life of a public tree is ended when the cost of maintenance is greater than the value contributed by the tree. This scenario can be a result of either increased maintenance required by a tree in decline, or the costs of repairing damage caused by a tree in a restricted site.

Further Inspection

This data field indicates whether a particular tree requires further inspection—such as a Level III risk inspection in accordance with ANSI A300 (Part 9)—or periodic inspection due to particular conditions that may cause the tree to be a safety risk and, therefore, hazardous. If a tree is noted for further inspection, Van Buren Point staff should investigate as soon as possible to determine corrective actions. It should be noted only three trees require further follow-up in the inventory due to structure concerns. Due to the detection of EAB on the grounds, it is recommended any untreated ash be inspected yearly to determine if they are becoming a hazard to the community.

Findings

DRG recommended three trees for further inspection.

Discussion/Recommendations

An ISA Certified Arborist should perform additional inspections of the three trees. If it is determined that these trees exceed the threshold for acceptable risk, the defective part(s) of the trees should be corrected or removed or the entire tree may need to be removed.

The 208 ash trees observed as having possible symptoms of EAB should be monitored; if the trees are not treated and continue to deteriorate then the tree should be removed and the site inspected for potential replacement.

Potential Threats from Pests

Insects and diseases pose serious threats to tree health. Awareness and early diagnosis are crucial to ensuring the health and continuity of street trees. Appendix C provides information about some of the current potential threats to Van Buren Point's trees and includes websites where more detailed information can be found.

Many pests target a single species or an entire genus. The inventory data were analyzed to provide a general estimate of the percentage of trees susceptible to some of the known pests in New York (Figure 7). It is important to note that the figure presents data exclusively from the inventory. Many more trees throughout Van Buren Point, including those on public and private property, may be susceptible to these invasive pests.

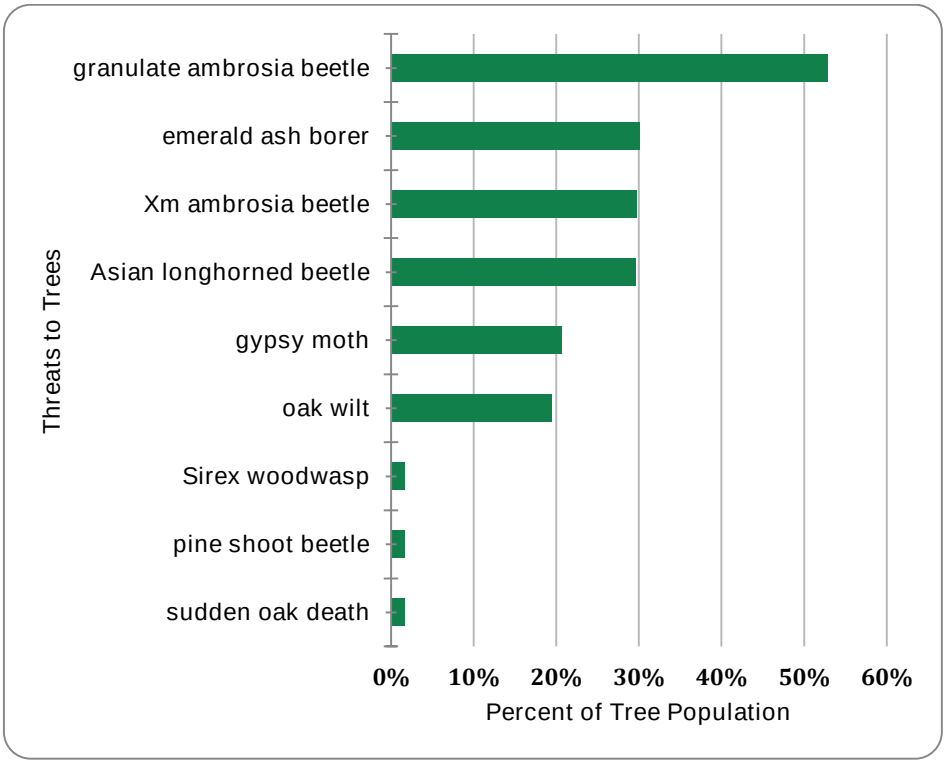


Figure 7. Potential impact of insect and disease threats noted during the 2017 inventory.

Findings

ALB and EAB are a known threat to a large percentage of the inventoried street trees (30% and 30%, respectively). EAB was detected in Van Buren Point; due to its detection Van Buren Point could see Extreme losses in its tree population.

EAB is present in Van Buren Point: NYSDEC staff found beetles infesting an ash within the Association. There were 207 ash trees inventoried, and several showed potential symptoms.

Discussion/Recommendations

Van Buren Point has become aware of the signs and symptoms of infestations and should be prepared to act in the coming spring. An integrated pest management plan should be established. The plan should focus on identifying and monitoring threats, understanding the economic threshold, selecting the correct treatment, properly timing management strategies, recordkeeping, and evaluating results.

SECTION 2. THE BENEFITS OF VAN BUREN POINT'S URBAN FOREST

i-Tree Streets Inputs

In addition to tree inventory data, i-Tree Streets requires cost-specific information to manage a community's tree management program—including administrative costs and costs for tree pruning, removal, and planting. Regional data, including energy prices, property values, and stormwater costs, are required inputs to generate the environmental and economic benefits trees provide. If community program costs or local economic data are not available, i-Tree Streets uses default economic inputs from a reference city selected by USDA FS for the climate zone in which your community is located. Any default value can be adjusted for local conditions

Van Buren Point's Inputs

Since specific local economic data for Van Buren Point's urban forestry program were not available at the time of this plan, economic data from Queens, New York, NY were used to help calculate the benefits provided by Van Buren Point's community.

Because unadjusted program economic defaults were used, the reporting function of the i-Tree Streets model is based on estimates of tree benefits. Net Annual Benefits, Cost for Public Trees, and Benefit-Cost Ratio (BCR) will not be calculated.

Annual Benefits

The i-Tree Streets model estimated that the inventoried trees provide a total annual benefit of $84,530. Essentially, approximately $85,000 was saved to cool buildings, manage stormwater, and clean the air. In addition, community aesthetics were improved and property values increased because of the presence of trees. On average, one of Van Buren Point's trees provides an annual benefit of $123.76.

The assessment found that aesthetics and other tangible and intangible benefits trees provide were the greatest value to the community. Approximately half of the total annual benefits were due to increases in property value. In addition to increasing property values, trees also play a major role in stormwater management. The HOA's trees alone intercepted over 492,571 gallons of rainfall, which equates to a savings of $3,941 in stormwater management costs. Stormwater management comprises 5% of the annual benefits trees provide. Energy conservation and reductions in CO_2 are important but typically account for lesser amounts of work performed by community trees. Energy reductions accounted for 52% of the annual benefits, while CO_2 reductions accounted for >1% of the annual benefits. The effect of the urban forest on air quality was $1,150. Figure 8 summarizes the annual benefits and results for the street tree population.

Aesthetic/Other Benefits

The total annual benefit associated with property value increases and other tangible and intangible benefits of street trees was $35,184. The average benefit per tree equaled $51.51 per year.

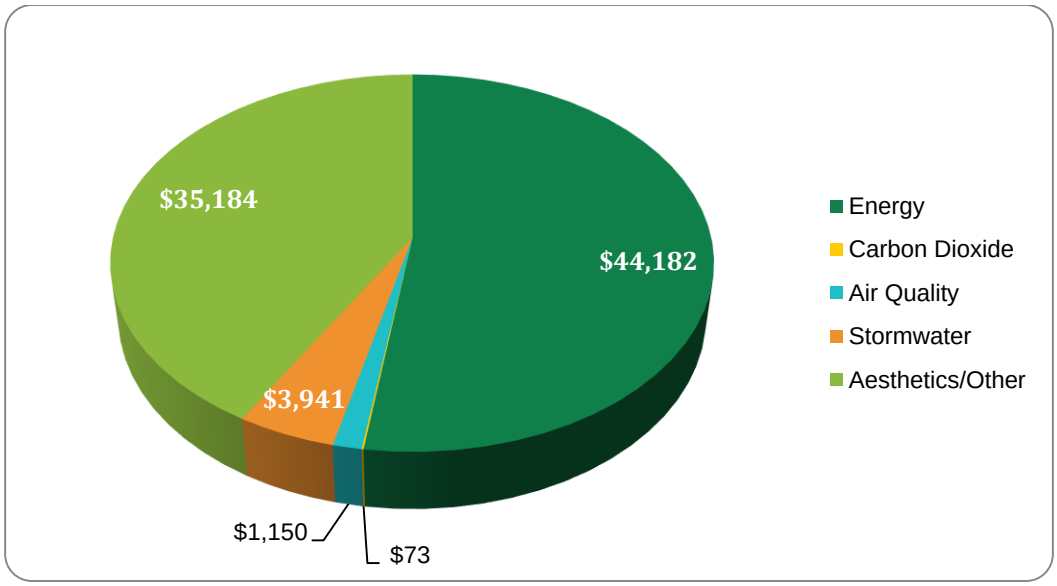


Figure 8. Breakdown of total annual benefits provided to Van Buren Point.

Stormwater Benefits

Trees intercept rainfall, which helps lower costs to manage stormwater runoff. The inventoried trees at Van Buren Point intercept 492,571 gallons of rainfall annually. On average, the estimated annual savings for the HOA in stormwater runoff management is $3,941.

Air Quality Improvements

The inventoried tree population annually removes 163.63 pounds of air pollutants (including ozone, nitrogen dioxide, sulfur dioxide, and particulate matter) through deposition.

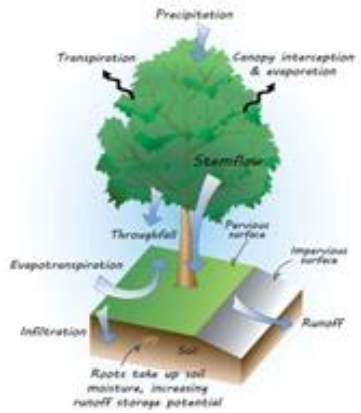
The i-Tree Streets calculation takes into account the biogenic volatile organic compounds (BVOC's) that are released from trees. The net total value of these benefits is estimated to be $1,150. The inventoried trees removed or avoided more pollutants than they emitted, resulting in a positive economic value.

Carbon Storage and Carbon Sequestration

Trees store some of the carbon dioxide (CO_2) they absorb. This prevents CO_2 from reaching the upper atmosphere, where it can react with other compounds and form harmful gases like ozone, which adversely affects air quality. These trees also sequester some of the CO_2 during growth (Nowak et al. 2013).

The i-Tree Streets calculation takes into account the carbon emissions that are not released from power stations due to the heating and cooling effect of trees (i.e., conserved energy in buildings and homes). It also calculates emissions released during tree care and maintenance, such as driving to the site and operating equipment. The net carbon benefit is approximately $72.95 per year.

Van Buren Point's trees store 4.84 tons of carbon (measured in CO_2 equivalents). This amount reflects the amount of carbon they have amassed during their lifetimes. Through sequestration and avoidance, 12.29 tons of CO_2 are removed each year.



- *Trees reduce stormwater runoff by capturing and storing rainfall in their canopy and releasing water into the atmosphere.*
- *Tree roots and leaf litter create soil conditions that promote the infiltration of rainwater into the soil.*
- *Trees help slow down and temporarily store runoff and reduce pollutants by absorbing nutrients and other pollutants from soils and water through their roots.*
- *Trees transform pollutants into less harmful substances.*

Energy Benefits

Landscaped trees conserve energy by shading structures and surfaces, which reduces electricity use for air conditioning in the summer. Trees divert wind in the winter to reduce natural gas use. Based on the inventoried trees, the annual electric and natural gas savings are equivalent to 67,973 kWh of electricity and 24,616 therms of natural gas, which accounts for an annual savings of $44,182 in energy consumption.

Discussion/Recommendations

The i-Tree Streets analysis found that trees provide environmental and economic benefits to the HOA by virtue of their mere presence. Currently, the aesthetic/other benefits provided by trees were rated as having the greatest value to the HOA. The property value increase provided by trees is important to stimulate economic growth. In addition to increasing aesthetics and property values, trees manage stormwater through rainfall interception, provide shade and windbreaks to reduce energy usage, and store and sequester CO_2. Even though these environmental benefits were not found to be as great as the aesthetic/other benefits, they are noteworthy. Trees work to intercept rainfall and reduce runoff—in Van Buren Point, as little as 683 trees absorb over 492,571 gallons of rainfall.

To increase benefits the urban forest provides, Van Buren Point HOA should plant young, large-statured tree species that are low emitters of BVOCs wherever possible. Leafy, large-stature trees consistently created the most environmental and economic benefits.

SECTION 3. TREE MANAGEMENT PLAN

This tree management program was developed to uphold Van Buren Point's comprehensive vision for preserving its urban forest. This five -year program is based on the publicly managed trees. This encompassed 387 total sites. This included 336 trees and 31 stumps. The program was designed to reduce risk through prioritized tree removal and pruning, and to improve tree health and structure through proactive pruning cycles. Tree planting to mitigate removals and increase canopy cover and public outreach are important parts of the program as well.

Photograph 4. Trees improve quality of life and help enhance the character of a community. Trees filter air, water, and sunlight; moderate climate; slow wind and stormwater; shade homes; and provide shelter to animals and recreational areas for people.

Implementing a tree care program is an ongoing process; however, tree work must always be prioritized to reduce public safety risks. DRG recommends completing the work identified during the inventory based on the assigned risk rating; however, it is also essential to routinely monitor the tree population to identify other Extreme or High Risk trees so that they may be systematically addressed. Regular pruning cycles and tree planting is important; however, priority work (especially for trees rated as Extreme or High Risk) must sometimes take precedence to ensure that risk is expediently managed.

Trees with elevated (Extreme or High) risk levels are usually recommended for removal or pruning. In some situations, risk may be reduced by adding support (cabling or bracing) or by moving the target away from the tree. DRG recommends only removal or pruning for the purpose of minimizing risk. However, in special situations, such as a significant or memorial tree or a tree in a historic area, Van Buren Point may decide that cabling, bracing, or moving the target may be the best option to reduce risk.

Determination of acceptable risk ultimately lies with Treesdale Community Association managers. Given that trees often have associated risks, location is an important factor in the determination and acceptability of risk for any tree. The level of risk associated with a tree increases as the frequency of human occupation increases in the vicinity of the tree. For example, a tree located next to a heavily traveled street will have a higher level of risk than a similar tree in an open field.

Priority and Proactive Maintenance

In this plan, the recommended tree maintenance work was divided into either priority or proactive maintenance. Priority maintenance includes tree removals and pruning of trees with an assessed risk rating of High and Extreme Risk. Proactive tree maintenance includes pruning of trees with an assessed risk of Moderate or Low Risk and trees that are Young. Tree planting, inspections, and community outreach are also considered proactive maintenance.

Extreme Risk	• Perform tree maintenance immediately to reduce hazards • Includes tree removal and pruning • Mostly high-use areas
High Risk	• Perform tree maintenance immediately to reduce hazards and improve tree health • Includes tree removal and pruning • Generally high-use areas
Moderate Risk	• Perform tree maintenance as soon as possible to improve tree health • Includes tree removal and pruning • May be high- or low-use areas
Low Risk	• Perform tree maintenance when convenient to improve aesthetics and eliminate nuisance trees and shrubs • Includes tree removals and pruning • Mostly low-use areas but may be high-use areas as well
Routine Pruning	• Perform tree maintenance when convenient to improve aesthetics and eliminate nuisance trees and stumps • Includes tree removals and pruning
Young Tree Training Prune	• Perform corrective pruning to young trees to increase structural integrity and develop a strong architecture of branches before serious problems develop.

Priority Maintenance

Identifying and ranking the maintenance needs of a tree population enables tree work to be assigned priority based on observed risk. Once prioritized, tree work can be systematically addressed to eliminate the greatest risk and liability first (Stamen 2011).

Risk is a graduated scale that measures potential tree-related hazardous conditions. A tree is considered hazardous when its potential risks exceed an acceptable level. Managing trees for risk reduction provides many benefits, including:

- Fewer tree removals over time.
- Healthier, long-lived trees.
- Less expenditure for claims and legal expenses.
- Lower frequency and severity of accidents, damage, and injury.
- Lower tree maintenance costs over time.

Regularly inspecting trees and establishing tree maintenance cycles generally reduce the risk of failure, as problems can be found and addressed before they escalate.

In this plan there were no trees that met the criteria for priority maintenance, and discussed for reference purposes only.

Priority Tree Removal

Although tree removal is usually considered a last resort and may sometimes create a reaction from the community, there are circumstances when removal is necessary. Trees fail from natural causes, such as diseases, insects, and weather conditions, and from physical injury due to vandalism, vehicles, and root disturbances.DRG recommends that trees be removed when corrective pruning will not adequately eliminate the hazard or when correcting problems would be cost-prohibitive. Trees that cause obstructions or interfere with power lines or other infrastructure should be removed when their defects cannot be corrected through pruning or other maintenance practices. Diseased and nuisance trees also merit removal.

Even though large short-term expenditures may be required, securing the funding required to expediently complete priority tree removals are important to reduce risk and promote public safety.

Moderate Risk

Tree removals in this category still pose some risk but have a smaller size of defect and/or less potential for target impact. The inventory identified 1 Moderate Risk tree recommended for removal. Most Moderate Risk trees were smaller than 24 inches DBH; 9 trees are in Dead, Critical, or Poor condition, but do not merit a higher risk rating due to their location. These trees should be removed as soon as possible.

Low Risk

Low Risk removals pose little threat; these trees are generally small, dead, invasive, or poorly formed trees that need to be removed. Eliminating these trees will reduce breeding site locations for diseases and insects and will enhance the aesthetic value of the area. Healthy trees growing in poor locations or undesirable species are also included in this category.

The inventory identified 8 Low Risk trees recommended for removal. Almost all of these trees were smaller than 18 inches DBH. All Low Risk trees should be removed when convenient and after all Moderate Risk removals and pruning have been completed.

Ash Removals

The inventory identified 7 Ash trees recommended for removal. Almost all of these trees were larger than 12 inches DBH.

Stump Removal

The inventory identified 31 stumps recommended for removal. Almost all of these stumps were larger than 12 inches DBH.

Discussion/Recommendations

Trees noted as having cavity or decay (5 trees) should be inspected on a regular basis. Corrective action should be taken when warranted. If their condition worsens, tree removal may be required. Proactive tree maintenance that actively mitigates elevated-risk situations will promote public safety.

Priority Pruning

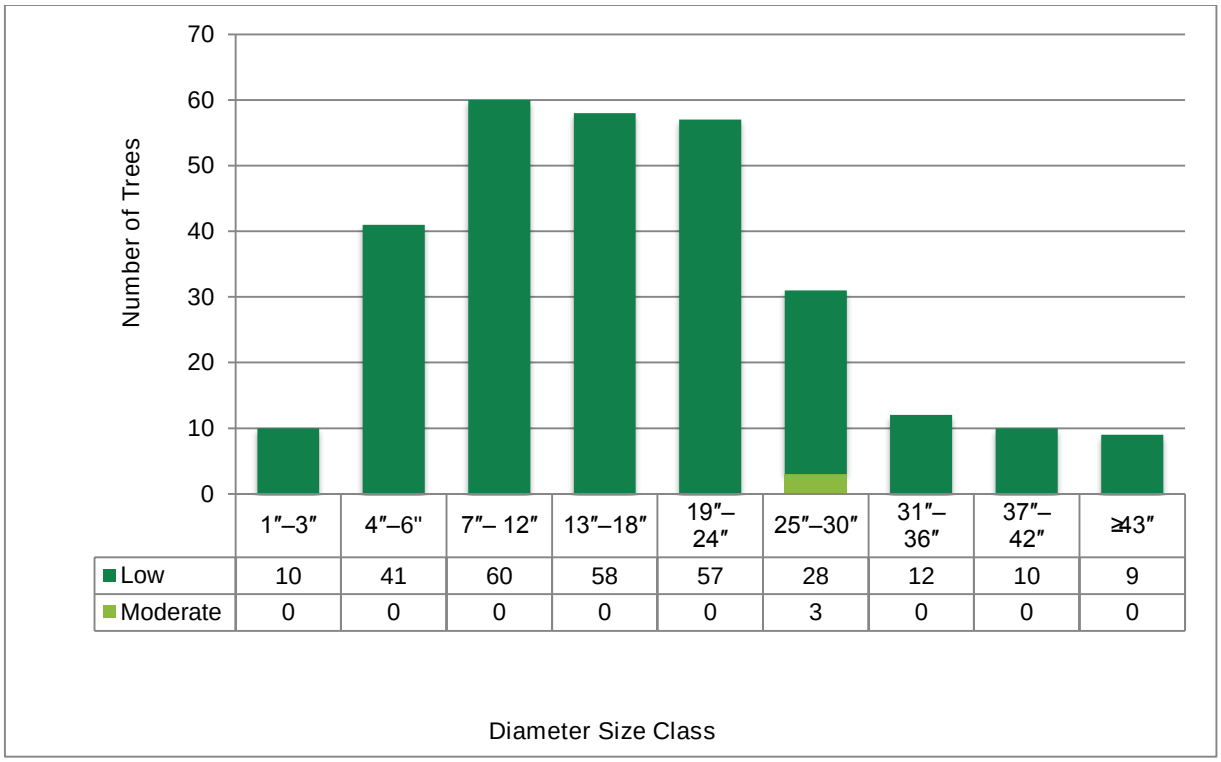
Priority pruning generally requires cleaning the canopy of both small and large trees to remove hazardous defects such as dead and/or broken branches that may be present even when the rest of the tree is sound. In these cases, pruning the branch or branches can correct the problem and reduce risk associated with the tree. Priority pruning includes trees with Extreme and High Risk, of which none were found within this analysis.

Moderate Risk

The inventory identified 3 Moderate Risk trees recommended for pruning. The size of the defect, probability of failure, or location of the trees in relation to their surroundings were the reasons for their elevated risk ratings. Moderate Risk pruning should be performed immediately when the need has been identified. Moderate Risk pruning should be performed at the same time as removals.

Low Risk

Low Risk trees recommended for pruning have observable and sizeable defects with probabilities of failure. The location of these trees in relation to their surroundings also increases their risk. The inventory identified 285 Low Risk trees recommended for pruning. The diameter sizes for these trees ranged between 7 to 60 inches DBH. Pruning should be performed according to assigned risk and may be done at the same time as other removals and pruning.



	1″–3″	4″–6″	7″– 12″	13″–18″	19″–24″	25″–30″	31″–36″	37″–42″	≥43″
Low	10	41	60	58	57	28	12	10	9
Moderate	0	0	0	0	0	3	0	0	0

Figure 9. Prune by Risk: Tree pruning by risk rating and diameter size class.

Discussion/Recommendations

The 289 recommended Priority Prunes should occur in Year 1 to mitigate potential hazards.

Proactive Maintenance

Proactive tree maintenance requires that trees are managed and maintained under the responsibility of an individual, department, or agency. Tree work is typically performed during a cycle. Individual tree health and form are routinely addressed during the cycle. When trees are planted, they are planted selectively and with purpose. Ultimately, proactive tree maintenance should reduce crisis situations in the urban forest, as every tree in the managed population is regularly visited, assessed, and maintained. Davey Resource Group recommends proactive tree maintenance that includes pruning cycles, inspections, and planned tree planting.

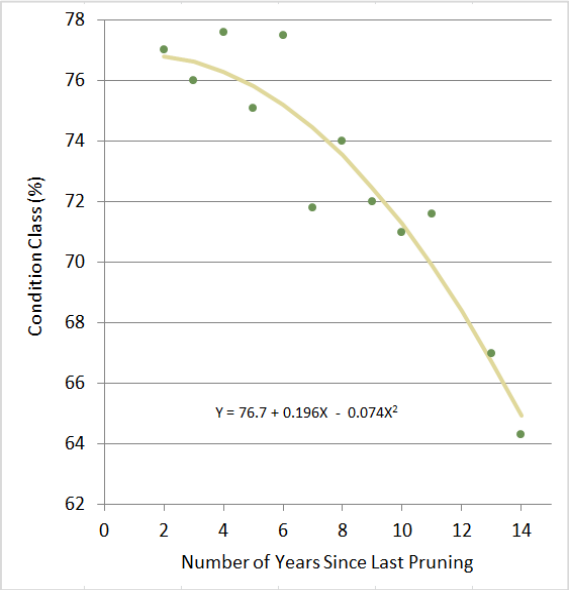


Figure 10. Relationship between average tree condition class and the number of years since the most recent pruning (adapted from Miller and Sylvester 1981).

Pruning Cycles

The goals of pruning cycles are to visit, assess, and prune trees on a regular schedule to improve health and reduce risk. Typically, DRG recommends that pruning cycles begin after all Extreme and High Risk trees are corrected through priority removal or pruning. However, due to the long-term benefits of pruning cycles, DRG recommends that the cycles be implemented in Year 2, after all priority work is completed. To ensure that all trees receive the type of pruning they need to mature with better structure and fewer hazards, two pruning cycles are recommended: the young tree training cycle (YTT Cycle) and the routine pruning cycle (RP Cycle). The cycles differ in the type of pruning, the general age of the target tree, and length.

The recommended number of trees in the pruning cycles will need to be modified to reflect changes in the tree population as trees are planted, age, and die. Newly planted trees will enter the YTT Cycle once they become Established. As Young trees reach maturity, they will be shifted from the YTT Cycle into the RP Cycle. When a tree reaches the end of its useful life, it should be removed and eliminated from the RP Cycle.

For many communities, a proactive tree management program is considered infeasible. An on-demand response to urgent situations is the norm. Research has shown that a proactive program that includes a routine pruning cycle will improve the overall health of a tree population (Miller and Sylvester 1981). Proactive tree maintenance has many advantages over on-demand maintenance, the most significant of which is reduced risk. In a proactive program, trees are regularly assessed and pruned, which generally means that most defects will be found and eliminated before they escalate to a hazardous situation with an unacceptable level of risk. Other advantages of a proactive program include: increased environmental and economic benefits from trees, more predictable budgets and projectable workloads, and reduced long-term tree maintenance costs.

Why Prune Trees on a Cycle?

Miller and Sylvester (1981) examined the frequency of pruning for 40,000 street and boulevard trees in Milwaukee, Wisconsin. They documented a decline in tree health as the length of the pruning cycle increased. When pruning was not completed for more than 10 years, the average tree condition was rated 10% lower than when trees had been pruned within the last several years. Miller and Sylvester suggested that a pruning cycle of five years is optimal for urban trees.

Young Tree Training Cycle

Trees included in the YTT Cycle are generally less than 8 inches DBH. These younger trees sometimes have branch structures that can lead to potential problems as the tree ages. Potential structural problems include codominant leaders, multiple limbs attaching at the same point on the trunk, or crossing/interfering limbs. If these problems are not corrected, they may worsen as the tree grows, which increases risk and creates potential liability.

YTT pruning is performed to improve tree form or structure; the recommended length of a YTT Cycle is three years because Young trees tend to grow at faster rates (on average) than more mature trees.

The YTT Cycle differs from the RP Cycle in that these trees generally can be pruned from the ground with a pole pruner or pruning shear. The objective is to increase structural integrity by pruning for one dominant leader. Of course, this is species-specific, since many trees such as Betula nigra (river birch) may naturally have more than one leader. For these and similar trees, YTT pruning is used to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree.

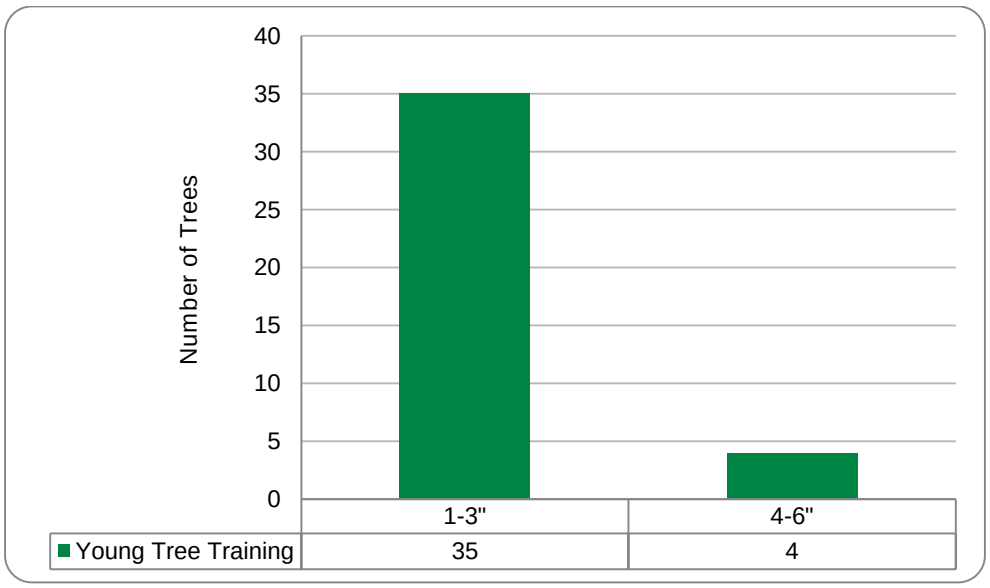


Fig. 11. Trees recommended for the Young Tree Train Cycle by diameter size class.

Discussion/Recommendations

DRG recommends that Van Buren Point implement a five-year YTT Cycle to begin after all Moderate and Low Risk trees are removed or pruned. The YTT Cycle will include existing Young trees. During the inventory, 39 trees smaller than 7 inches DBH were recommended for young tree training. Since the number of existing Young trees is relatively small, and the benefit of beginning the YTT Cycle is substantial, DRG recommends that all 39 trees be structurally pruned each year, beginning in Year Two. If trees are planted, they will need to enter the YTT Cycle after establishment, typically a few years after planting.

In future years, the number of trees in the YTT Cycle will be based on tree planting efforts and growth rates of young trees. The Van Buren Point Association should strive to prune approximately one-third of its young trees each year.

RP Cycle

The RP Cycle includes Established, Maturing, and Mature trees (mostly greater than 8 inches DBH) that need cleaning, crown raising, and reducing to remove deadwood and improve structure. Over time, routine pruning generally improves health and reduces risk as most problems can be corrected before they escalate into costlier priority tree work. Included in this cycle are Moderate and Low Risk trees that require pruning and pose some risk but have a smaller size of defect and/or less potential for target impact. The hazards found within these trees can usually be remediated during the RP Cycle.

The length of the RP Cycle is based on the size of the tree population and what was assumed to be a reasonable number of trees for a program to prune per year. The recommended RP Cycle for a tree population is generally five years but may extend to seven years if the population is large.

Discussion/Recommendations

DRG recommends that the Van Buren Point Association establish a five-year RP Cycle in which approximately one-fifth of the tree population would be pruned each year. The 2017 tree inventory identified approximately 57 trees that should be pruned each year. DRG recommends that the RP Cycle begin in Year Two of this five-year plan, after all Moderate and Low Risk trees are removed or pruned.

Inspections

Inspections are essential to uncovering potential problems with trees. They should be performed by a qualified arborist who is trained in the art and science of planting, caring for, and maintaining individual trees. Arborists are knowledgeable about the needs of trees and are well equipped to provide proper care.

Trees along the street ROW and in parks should be regularly inspected and attended to as needed based on the inspection findings. When trees need additional or new work, they should be added to the maintenance schedule and budgeted as appropriate. In addition to locating potential hazards, inspections are an opportunity to look for signs and symptoms of pests and diseases. Van Buren Point Association has a large population of trees that are susceptible to pests and diseases, including ash (*Fraxinus*), a target of EAB, oak (*Quercus*), which are susceptible to oak wilt, and species that fall prey to eastern tent caterpillar and gypsy moth. A brief discussion of key pests is found in Appendix C.

Tree Planting

Planting trees is a worthwhile goal as long as tree species are carefully selected and correctly planted. When trees are planted, they are planted selectively and with purpose. Without proactive planning and follow-up tree care, a newly planted tree may become a future problem instead of a benefit to the community.

When planting trees, it is important to be cognizant of the following:

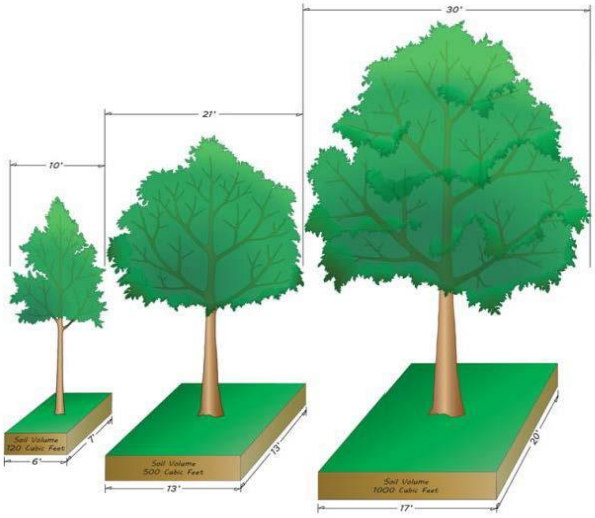
- Consider the specific purpose of the tree planting.
- Assess the site and know its limitation (i.e., confined spaces, overhead wires, and/or soil type).
- Select the species or cultivar best suited for the site conditions.
- Examine trees before buying them, and buy for quality.

Inventoried Street ROW Planting Space

The goal of tree planting is to have a vigorous, healthy tree that lives to the limits of its natural longevity. That can be difficult to achieve in an urban growing environment because irrigation is limited and the soils are typically poor quality. However, proper planning, species selection, tree planting techniques, and follow-up tree maintenance will improve the chance of tree planting success.

Findings

No individual planting sites were collected during the inventory. It was observed though within the parks and ROW there are ample spaces for new trees.



Minimum recommended requirements for tree sites based on tree size/dimensions. Illustration based on the work of Casey Trees (2008).

Tree Species Selection

Selecting a limited number of species could simplify decision-making processes; however, careful deliberation and selection of a wide variety of species is more beneficial and can save money. Planting a variety of species can decrease the impact of species-specific pests and diseases by limiting the number of susceptible trees in a population. This reduces time and money spent to mitigate pest- or disease-related problems. A variety of tree species can help limit the impacts from physical events, as different tree species react differently to stress. Species diversity helps withstand drought, ice, flooding, strong storms, and wind.

Van Buren Point Association is located in USDA Hardiness Zone 6b, which is identified as a climatic region with average annual minimum temperatures between −5°F and 0°F. Tree species selected for planting in Van Buren Point Association should be appropriate for this zone.

Tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site characteristics below ground (drainage, nutrients, road salt, root spacing, soil pH, soil texture, and soil structure). Matching a species to its favored soil conditions is the most important task when planning for a low-maintenance landscape. Plants that are well matched to their environmental site conditions are much more likely to resist pathogens and insect pests. Such plants require less maintenance overall.

The Right Tree in the Right Place is a mantra for tree planting used by the Arbor Day Foundation and many utility companies nationwide. Trees come in many different shapes and sizes, and often change dramatically over their lifetimes. Some grow tall, some grow wide, and some have extensive root systems. Before selecting a tree for planting, make sure it is the right tree—know how tall, wide, and deep it will be at maturity. Equally important to selecting the right tree is choosing the right spot to plant it. Blocking an unsightly view or creating some shade may be a priority, but it is important to consider how a tree may impact existing utility lines as it grows taller, wider, and deeper. If the tree's canopy, at maturity, will reach overhead lines, it is best to choose another tree or a different location. Taking the time to consider location before planting can prevent power disturbances and improper utility pruning practices.

A major consideration for street trees is the amount of litter dropped by Mature trees. Trees such as *Acer saccharinum* (silver maple) have weak wood and typically drop many small branches during a growing season. Others, such as *Liquidambar styraciflua* (American sweetgum), drop high volumes of fruit. In certain species, such as *Ginkgo biloba* (ginkgo), female trees produce offensive smelling/large fruit; male ginkgo trees, however, produce no fruit. Furthermore, a few species of trees, including *Crataegus* spp. (hawthorn) and *Gleditsia triacanthos* (honeylocust), may have substantial thorns. These species should be avoided in high-traffic areas.

Seasonal color should also be considered when planning tree plantings. Flowering varieties are particularly welcome in the spring. Deciduous trees that display bright colors in autumn can add a great deal of appeal to surrounding landscapes.

Appendix B lists tree species recommended for planting based on inventory findings; this list provides the expected height at maturity for each species and is designed to promote species diversity.

DRG recommends limiting the planting of mapleuntil the species distribution normalizes. Maple already represents 30% of the trees inventoried, which exceeds the recommended maximum for a genus (20% of the population).

Tips for Planting Trees

To ensure a successful tree planting effort:

- Handle trees with care. Trees are living organisms and are perishable. Protect trees from damage during transport and when loading and unloading. Use care not to break branches and do not lift trees by the trunk.
- If trees are stored prior to planting, keep the roots moist.
- Dig the planting hole according to the climate. Generally, the planting hole is two to three times wider and not quite as deep as the root ball. The root flair is at or just above ground level.
- Fill the hole with native soil unless it is undesirable, in which case soil amendments should be added as appropriate for local conditions. Gently tamp and add water during filling to reduce large air pockets and to ensure a consistent medium of soil, oxygen, and water.

- Stake the tree as necessary to prevent it from shifting too much in the wind.
- Add a thin layer (1–2 inches) of mulch to help prevent weeds and keep the soil around the tree moist. Do not allow mulch to touch the trunk.

Newly Planted and Young Tree Maintenance

Equally important to planting trees is caring for them after they are planted. After a tree is planted, maintenance is essential for several years.

Watering

Initially, watering is the key to survival; new trees typically require at least 60 days of watering to establish. Determine how frequently trees should be irrigated based on time of planting, drought status, species selection, and site condition.

Mulching

Mulch can be applied to the growspace around a newly planted tree (or even a more mature tree) to ensure that no weeds grow, that the tree is protected from mechanical damage, and that the growspace is moist. Mulch should be applied in a thin layer, generally one to two inches, and the growing area should be covered. Mulch should not touch the tree trunk, nor should it be piled up around the tree.

Life-Long Tree Care

Once the tree is established, it will require routine tree care, which includes inspections, routine pruning, watering, plant health care, and integrated pest management as needed.

The city should employ qualified arborists to provide most of the routine tree care. An arborist can determine the type of pruning necessary to maintain or improve the health, appearance, and safety of trees. These techniques may include; eliminating branches that rub against each other; removing limbs that interfere with wires and buildings or that obstruct streets, sidewalks or signage; removing dead, damaged, or weak limbs that pose a hazard or may ultimately decay; removing diseased or insect-infested limbs; creating better structure to lessen wind resistance and reduce the potential for storm damage; and removing branches—or thinning—to increase light penetration.

An arborist can help decide whether a tree should be removed and, if so, to what extent removal is needed. Additionally, an arborist can perform—and provide advice on—tree maintenance when disasters such as storms or droughts occur. Storm-damaged trees can often be dangerous to remove or trim. An arborist can assist in advising or performing the job in a safe manner while reducing further risk of damage to a property.

Plant Health Care, a preventive maintenance process, helps keep trees in good health and helps trees defend themselves against insects, disease, and site problems. Arborists can help determine proper plant health so that the Van Buren Point's tree population will remain healthy and provide benefits to the community for as long as possible.

Integrated Pest Management is a process that involves common sense and sound solutions for treating and controlling pests. These solutions incorporate basic steps: identifying the problem, understanding pest biology, monitoring trees, and determining action thresholds. The practice of Integrated Pest Management can vary depending on each site and each individual tree. A qualified arborist will be able to make sure that the Van Buren Point's trees are properly diagnosed and that a beneficial and realistic action plan is developed.

The arborist can also help with cabling or bracing for added support to branches with weak attachment, aeration to improve root growth, and installation of lightning protection systems.

Educating the community in basic tree care is a good way to promote the Van Buren Point's urban forestry program and encourage tree planting on private property. The city should encourage citizens to water trees on the ROW adjacent to their homes and to reach out to the city if they notice any changes in the trees, such as: signs or symptoms of pests, early fall foliage, or new mechanical or vehicle damage.

Community Outreach

The data that have been collected and analyzed to develop this plan contribute significant information about the tree population and can be utilized to guide the proactive management of that resource. These data can also be utilized to promote the value of the urban forest and tree management program in the following ways:

- Tree inventory data can be used to justify necessary priority and proactive tree maintenance activities as well as tree planting and preservation initiatives.
- Species data can be used to guide the development of tree species selection for planting projects with the goals of improving species diversity and limiting the introduction of invasive pests and diseases.
- Information in this plan can be used to advise citizens about threats to urban trees, such as EAB and oak wilt.

There are various avenues for outreach. Maps can be created and posted on websites, and in the community center. Public service announcements can be developed. Articles can be written and programs about trees and the benefits they provide can be developed. Arbor Day and Earth Day celebrations can become staples of the community. Signs can be hung from trees to highlight the contributions trees make to the community. Contests can even be created to increase awareness of the importance of trees. Trees provide oxygen we need to breathe, shade to cool our neighborhoods, and canopies to stand under when it rains.

Van Buren Point's data are good barometers for identifying ways to provide tangible and meaningful outreach about the urban forest.

Inventory and Plan Updates

DRG recommends that the inventory and management plan be updated so that the Van Buren Point can sustain its program and accurately project future program and budget needs:

- Conduct inspections of trees after all Extreme weather events. Record changes in tree condition, maintenance needs, and risk/risk rating in the inventory database. Update the tree maintenance schedule and acquire the funds needed to promote public safety. Schedule and prioritize work based on risk.
- Perform routine inspections of public trees as needed. Windshield surveys (inspections performed from a vehicle) in line with *ANSI A300 (Part 9)* (ANSI 2011) will help city staff stay apprised of changing conditions. Update the tree maintenance schedule and the budget as needed so that identified tree work may be efficiently performed. Schedule and prioritize work based on risk.
- If the recommended work cannot be completed as suggested in this plan, modify maintenance schedules and budgets accordingly.
- Update the inventory database as work is performed. Add new tree work to the schedule when work is identified through inspections or a citizen call process.

- Re-inventory the street ROW and parks, and update all data fields after five to seven years.
- Revise the *Tree Management Plan* after five or seven years when the re-inventory has been completed.

Maintenance Schedule

Utilizing data from the 2017 Van Buren Point tree inventory, an annual maintenance schedule was developed that details the number and type of tasks recommended for completion each year. Davey Resource Group made budget projections using industry knowledge and public bid tabulations. Estimated costs for Van Buren Point's five-year tree management program is presented in Table 2.

The schedule provides a framework for completing the inventory maintenance recommendations over the next five years. Following this schedule can help tree care activities evolve from an on-demand system to a more proactive tree care program.

To implement the maintenance schedule, the Van Buren Point's tree maintenance budget should be no less than $20,000 for the first year of implementation, and no less than $13,000 for the following four years. Annual budget funds are needed to ensure that hazard trees are remediated and that critical YTT and RP Cycles can begin. With proper professional tree care, the safety, health, and beauty of the urban forest will improve.

If routing efficiencies and/or contract specifications allow for the accomplishment of more tree work, or if the schedule requires modification to meet budgetary or other needs, then the schedule should be modified accordingly. Unforeseen situations, such as Extreme weather events, may arise and change the maintenance needs of trees. Should conditions or maintenance needs change, budgets and equipment will need to be adjusted to meet the new demands.

FY 2018	**$19,885**
• **Routine Pruning Cycle: ⅕ of Public Trees Cleaned** • **8 Moderate or Low Risk Removals** • **Young Tree Train Cycle: 13 Trees** • **7 Tree Recommended for Planting and Follow-up Care** • **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**	
FY 2019	**$12,020**
• **Routine Pruning Cycle: ⅕ of Public Trees Cleaned** • **Young Tree Train Cycle: 13 Trees** • **7 Trees Recommended for Planting and Follow-Up Care** • **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**	
FY 2020	**$12,020**
• **Routine Pruning Cycle: ⅕ of Public Trees Cleaned** • **Young Tree Train Cycle: 13 Trees** • **7 Trees Recommended for Planting and Follow-Up Care** • **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**	
FY 2021	**$12,020**
• **Routine Pruning Cycle: ⅕ of Public Trees Cleaned** • **Young Tree Train Cycle: 13 Trees** • **7 Trees Recommended for Planting and Follow-Up Care** • **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**	
FY 2022	**$12,020**
• **Routine Pruning Cycle: ⅕ of Public Trees Cleaned** • **Young Tree Train Cycle: 13 Trees** • **7 Trees Recommended for Planting and Follow-Up Care** • **Inclusion of Newly Found Priority Tree Work (Removal or Pruning): Costs To Be Determined**	

Table 2. Estimated Costs for Five-Year Urban Forestry Management Program

Estimated Costs for Each Activity			Year 1		Year 2		Year 3		Year 4		Year 5		Five-Year Cost
Activity	Diameter	Cost/Tree	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	
Moderate and Low Risk Removals	1-3"	$28	1	$28	0	$0	0	$0	0	$0	0	$0	$28
	4-6"	$58	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	7-12"	$138	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	13-18"	$314	3	$941	0	$0	0	$0	0	$0	0	$0	$941
	19-24"	$605	2	$1,210	0	$0	0	$0	0	$0	0	$0	$1,210
	25-30"	$825	1	$825	0	$0	0	$0	0	$0	0	$0	$825
	31-36"	$1,045	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	37-42"	$1,485	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	43"+	$2,035	1	$2,035	0	$0	0	$0	0	$0	0	$0	$2,035
Activity Total(s)			8	$5,038	0	$0	0	$0	0	$0	0	$0	$5,038
Stump Removals	1-3"	$18	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	4-6"	$28	1	$28	0	$0	0	$0	0	$0	0	$0	$28
	7-12"	$44	4	$176	0	$0	0	$0	0	$0	0	$0	$176
	13-18"	$72	8	$572	0	$0	0	$0	0	$0	0	$0	$572
	19-24"	$94	8	$748	0	$0	0	$0	0	$0	0	$0	$748
	25-30"	$110	5	$550	0	$0	0	$0	0	$0	0	$0	$550
	31-36"	$138	3	$413	0	$0	0	$0	0	$0	0	$0	$413
	37-42"	$160	1	$160	0	$0	0	$0	0	$0	0	$0	$160
	43"+	$182	1	$182	0	$0	0	$0	0	$0	0	$0	$182
Activity Total(s)			31	$2,827	0	$0	0	$0	0	$0	0	$0	$2,827
Routine Pruning (5-year cycle)	1-3"	$20	2	$40	2	$40	2	$40	2	$40	2	$40	$200
	4-6"	$30	8	$240	8	$240	8	$240	8	$240	8	$240	$1,200
	7-12"	$75	12	$900	12	$900	12	$900	12	$900	12	$900	$4,500
	13-18"	$120	12	$1,440	12	$1,440	12	$1,440	12	$1,440	12	$1,440	$7,200
	19-24"	$170	11	$1,870	11	$1,870	11	$1,870	11	$1,870	11	$1,870	$9,350
	25-30"	$225	6	$1,350	6	$1,350	6	$1,350	6	$1,350	6	$1,350	$6,750
	31-36"	$305	2	$610	2	$610	2	$610	2	$610	2	$610	$3,050
	37-42"	$380	2	$760	2	$760	2	$760	2	$760	2	$760	$3,800
	43"+	$590	2	$1,180	2	$1,180	2	$1,180	2	$1,180	2	$1,180	$5,900
Activity Total(s)			57	$8,390	57	$8,390	57	$8,390	57	$8,390	57	$8,390	$41,950
Young Tree Training Pruning (3-year cycle)	1-3"	$20	12	$240	12	$240	12	$240	12	$240	12	$240	$1,200
	4-8"	$30	1	$30	1	$30	1	$30	1	$30	1	$30	$150
Activity Total(s)			13	$270	13	$270	13	$270	13	$270	13	$270	$1,350
Replacement Tree Planting	Purchasing	$170	7	$1,190	7	$1,190	7	$1,190	7	$1,190	7	$1,190	$5,950
	Planting	$110	7	$770	7	$770	7	$770	7	$770	7	$770	$3,850
Activity Total(s)			14	$1,960	14	$1,960	14	$1,960	14	$1,960	14	$1,960	$9,800
Replacement Young Tree Maintenance	Mulching	$100	7	$700	7	$700	7	$700	7	$700	7	$700	$3,500
	Watering	$100	7	$700	7	$700	7	$700	7	$700	7	$700	$3,500
Activity Total(s)			14	$1,400	14	$1,400	14	$1,400	14	$1,400	14	$1,400	$7,000
Activity Grand Total			137		98		98		98		98		
Cost Grand Total				$19,885		$12,020		$12,020		$12,020		$12,020	$67,965

CONCLUSIONS

Every hour of every day, public trees in Van Buren Point are supporting and improving the quality of life. Annually, the trees provide a benefit equal to $85,000. When properly maintained, trees provide abundant environmental, economic, and social benefits far in excess of the time and money invested in planting, pruning, protection, and removal.

Managing trees in urban areas is often complicated. Navigating the recommendations of experts, the needs of residents, pressures of local economics and politics, concerns for public safety and liability, physical aspects of trees, forces of nature and Extreme weather events, and the expectation that these issues are resolved all at once is a considerable challenge.

Van Buren Point Association must carefully consider these challenges to fully understand the needs of maintaining an urban forest. With the knowledge and wherewithal to address the needs of the city's trees, the town is well positioned to thrive. If the management program is successfully implemented, the health and safety of Van Buren Point's trees and citizens will be maintained for years to come.

GLOSSARY

aboveground utilities (data field): Shows the presence or absence of overhead utilities at the tree site.

address number (data field): The address number was recorded based on the visual observation by the Davey Resource Group arborist at the time of the inventory of the actual address number posted on a building at the inventoried site. In instances where there was no posted address number on a building or sites were located by vacant lots with no GIS parcel addressing data available, the address number assigned was matched as closely as possible to opposite or adjacent addresses by the arborist(s) and an "X" was added to the number in the database to indicate that the address number was assigned.

American National Standards Institute (ANSI): ANSI is a private, nonprofit organization that facilitates the standardization work of its members in the United States. ANSI's goals are to promote and facilitate voluntary consensus standards and conformity assessment systems, and to maintain their integrity.

***ANSI A300*:** Tree care performance parameters established by ANSI that can be used to develop specifications for tree maintenance.

arboriculture: The art, science, technology, and business of commercial, public, and utility tree care.

block side (data field): Address information for a site that includes the *on street*, *from street*, and *to street*. The *on street* is the street that the site is actually located on. The *from street* is the cross street one is moving away from when moving in the direction of traffic flow. The *to street* is the cross street one is moving toward when moving in the direction of traffic flow.

canopy assessment: See **urban tree canopy (UTC) assessment**.

canopy cover: As seen from above, it is the area of land surface that is covered by tree canopy.

canopy spread (data field): Estimates the width of a tree's canopy in 5-foot increments.

canopy: Branches and foliage that make up a tree's crown.

clean (primary maintenance need): Based on *ANSI A300 (Part 1)*, selective removal of dead, dying, broken, and/or diseased wood to minimize potential risk.

clearance requirements (data field): Illustrates the need for pruning to meet clearance standards over streets and sidewalks, or where branches are considered to be interfering with the movement of vehicles or pedestrians or where they are obstructing signs and street or traffic lights.

community forest: see **urban forest**.

condition (data field): The general condition of each tree rated during the inventory according to the following categories adapted from the International Society of Arboriculture's rating system: Excellent (100%), Very Good (90%), Good (80%), Fair (60%), Poor, (40%), Critical (20%), Dead (0%).

cycle: Planned length of time between vegetation maintenance activities.

defect: See **structural defect**.

diameter: See **tree size**.

diameter at breast height (DBH): See **tree size**.

espalier (secondary maintenance need): Type of pruning that combines supporting and training branches to orient a plant in one plane.

Extreme Risk tree: Applies in situations where tree failure is imminent, there is a high likelihood of impacting the target, and the consequences of the failure are "severe." In some cases, this may mean immediate restriction of access to the target zone area in order to prevent injury.

failure: In terms of tree management, failure is the breakage of stem or branches, or loss of mechanical support of the tree's root system.

further inspection (data field): Notes that a specific tree may require an annual inspection for several years to make certain of its maintenance needs. A healthy tree obviously impacted by recent construction serves as a prime example. This tree will need annual evaluations to assess the impact of construction on its root system. Another example would be a tree with a defect requiring additional equipment for investigation.

genus: A taxonomic category ranking below a family and above a species and generally consisting of a group of species exhibiting similar characteristics. In taxonomic nomenclature, the genus name is used, either alone or followed by a Latin adjective or epithet, to form the name of a species.

geographic information system (GIS): A technology that is used to view and analyze data from a geographic perspective. The technology is a piece of an organization's overall information system framework. GIS links location to information (such as people to addresses, buildings to parcels, or streets within a network) and layers that information to give you a better understanding of how it all interrelates.

global positioning system (GPS): GPS is a system of earth-orbiting satellites that make it possible for people with ground receivers to pinpoint their geographic location.

grow space size (data field): Identifies the minimum width of the tree grow space for root development.

grow space type (data field): Best identifies the type of location where a tree is growing. During the inventory, grow space types were categorized as island, median, open/restricted, open/unrestricted, raised planter, tree lawn/parkway, unmaintained/natural area, or well/pit.

hardscape damage (data field): Indicates trees damaged by hardscape or hardscape damaged by trees (for example, cracking, damage to curbs, lifting of sidewalk pavement one inch or more).

High Risk tree: The High Risk category applies when consequences are "significant" and likelihood is "very likely" or "likely," or consequences are "severe" and likelihood is "likely." In a population of trees, the priority of High Risk trees is second only to Extreme Risk trees.

IPED (data field): Invasive pest detection protocol. A standardized method for evaluating a tree for possible insects or disease.

invasive, exotic tree: A tree species that is out of its original biological community. Its introduction into an area causes or is likely to cause economic or environmental harm, or harm to human health. An invasive, exotic tree has the ability to thrive and spread aggressively outside its natural range. An invasive species that colonizes a new area may gain an ecological edge since the insects, diseases, and foraging animals that naturally keep its growth in check in its native range are not present in its new habitat.

inventory: See **tree inventory**.

location (data fields): A collection of data fields collected during the inventory to aid in finding trees, including address number, street name, site number, side, and block side.

location rating (data field): Describes/rates the position of a tree based on existing land use of the site, the functional and aesthetic contributions of the tree to the site, and surrounding structures or landscapes. Categories for location value include: Excellent, Good, Fair, and Poor. The location rating, along with species, size, and condition ratings, is used in determining a tree's value.

Low Risk tree: The Low Risk category applies when consequences are "negligible" and likelihood is "unlikely"; or consequences are "minor" and likelihood is "somewhat likely." Some trees with this level of risk may benefit from mitigation or maintenance measures, but immediate action is not usually required.

mapping coordinate (data field): Helps to locate a tree; X and Y coordinates were generated for each tree using GPS.

Moderate Risk tree: The Moderate Risk category applies when consequences are "minor" and likelihood is "very likely" or "likely"; or likelihood is "somewhat likely" and consequences are "significant" or "severe." In populations of trees, Moderate Risk trees represent a lower priority than High or Extreme Risk trees.

monoculture: A population dominated by one single species or very few species.

none (risk rating): Equal to zero. It is used only for planting sites and stumps.

none (secondary maintenance need): Used to show that no secondary maintenance is recommended for the tree. Usually a vacant planting site or stump will have a secondary maintenance need of *none*.

notes (data field): Describes additional pertinent information.

observations (data field): When conditions with a specific tree warrant recognition, it was described in this data field. Observations include cavity decay, grate guard, improperly installed, improperly mulched, improperly pruned, mechanical damage, memorial tree, nutrient deficiency, pest problem, poor location, poor root system, poor structure, remove hardware, serious decline, and signs of stress.

ordinance: See **tree ordinance**.

overhead utilities (data field): The presence of overhead utility lines above a tree or vacant planting site.

palm prune (primary maintenance need): Routine horticultural pruning to remove any dead, dying, or broken fronds.

plant tree (primary maintenance need): If collected during an inventory, this data field identifies vacant planting sites as small, medium, or large (indicating the ultimate size that the tree will attain), depending on the growspace available and the presence of overhead wires.

pollard (secondary maintenance need): Pruning method in which tree branches are initially headed and then reduced on a regular basis without disturbing the callus knob.

primary maintenance need (data field): The type of tree work needed to reduce immediate risk.

pruning: The selective removal of plant parts to meet specific goals and objectives.

raise (secondary maintenance need): Signifies a maintenance need for a tree. Raising the crown is pruning to remove low branches that interfere with sight and/or traffic. It is based on *ANSI A300 (Part 1)*.

reduce (secondary maintenance need): Signifies a maintenance need for a tree. Reducing the crown is selective pruning to decrease height and/or spread of the crown in order to provide clearance for electric utilities and lighting.

removal (primary maintenance need): Data field collected during the inventory identifying the need to remove a tree. Trees designated for removal have defects that cannot be cost-effectively or practically treated. Most of the trees in this category have a large percentage of dead crown.

restore (secondary maintenance need): Signifies a maintenance need for a tree. Restoring is selective pruning to improve the structure, form, and appearance of trees that have been Extremely headed, vandalized, or damaged.

right-of-way (ROW): See **street right-of-way**.

risk: Combination of the probability of an event occurring and its consequence.

risk rating: Level 2 qualitative risk assessment will be performed on the ANSI A300 (Part 9) and the companion publication Best Management Practices: Tree Risk Assessment, published by International Society of Arboriculture (2011). Trees can have multiple failure modes with various risk ratings. One risk rating per tree will be assigned during the inventory. The failure mode having the greatest risk will serve as the overall tree risk rating. The specified time period for the risk assessment is one year.

secondary maintenance need (data field): Recommended maintenance for a tree, which may be risk oriented, such as raising the crown for clearance, but generally was geared toward improving the structure of the tree and enhancing aesthetics.

side value (data field): Each site is assigned a side value to aid in locating the site. Side values include: *front*, *side to*, *side away*, *median* (includes islands), and *rear* based on the site's location in relation to the lot's street frontage. The *front* side is the side that faces the address street. *Side to* is the name of the street the arborist is walking towards as data are being collected. The *side from* is the name of the street the arborist is walking away from while collecting data. *Median* indicates a median or island. The *rear* is the side of the lot opposite the front.

site number (data field): All sites at an address are assigned a *site number*. Sites numbers are not unique; they are sequential to the side of the address only (the only unique number is the tree identification number assigned to each site). Site numbers are collected in the direction of vehicular traffic flow. The only exception is a one-way street. Site numbers along a one-way street are collected as if the street were actually a two-way street, so some site numbers will oppose traffic.

species: Fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of interbreeding.

stem: A woody structure bearing buds and foliage, and giving rise to other stems.

stems (data field): Identifies the number of stems or trunks splitting less than one foot above ground level.

street name (data field): The name of a street right-of-way or road identified using posted signage or parcel information.

street right-of-way (ROW): A strip of land generally owned by a public entity over which facilities, such as highways, railroads, or power lines, are built.

street tree: A street tree is defined as a tree within the right-of-way.

structural defect: A feature, condition, or deformity of a tree or tree part that indicates weak structure and contributes to the likelihood of failure.

stump removal (primary maintenance need): Indicates a stump that should be removed.

thin (secondary maintenance need): Signifies a maintenance need for a tree. Thinning the crown is the selective removal of water sprouts, epicormic branches, and live branches to reduce density.

topping: Topping, reducing tree size using internodal cuts without regard to tree health or structural integrity, is not an acceptable pruning practice.

tree: A perennial, woody plant that may grow more than 20 feet tall. Characteristically, it has one main stem, although many species may grow as multi-stemmed forms.

tree benefit: An economic, environmental, or social improvement that benefits the community and results mainly from the presence of a tree. The benefit received has real or intrinsic value associated with it.

tree height (data field): If collected during the inventory, it is the height of the tree estimated by the arborist and recorded in 10-foot increments.

tree inventory: Comprehensive database containing information or records about individual trees typically collected by an arborist.

tree ordinance: Tree ordinances are policy tools used by communities striving to attain a healthy, vigorous, and well-managed urban forest. Tree ordinances simply provide the authorization and standards for management activities.

tree size (data field): A tree's diameter measured to the nearest inch in one-inch size classes at 4.5 feet above ground, also known as diameter at breast height (DBH) or diameter.

urban forest: All of the trees within a municipality or community. This can include the trees along streets or rights-of-way; in forests, greenspaces, and parks; and on private property.

urban tree canopy (UTC) assessment: A study performed of land cover classes to gain an understanding of the tree canopy coverage, particularly as it relates to the amount of tree canopy that currently exists and the amount of tree canopy that could exist. Typically performed using aerial photographs, GIS data, or Lidar.

utility (secondary maintenance need): Selective pruning to prevent the loss of service, comply with mandated clearance laws, prevent damage to equipment, avoid access impairment, and uphold the intended usage of the facility/utility space.

vista prune (secondary maintenance need): Pruning to enhance a specific view without jeopardizing the health of the tree.

young tree train (YTT, primary maintenance need): Data field based on *ANSI A300 (Part 1)*, pruning of young trees to correct or eliminate weak, interfering, or objectionable branches to improve structure. These trees, up to 20 feet in height, can be worked with a pole pruner by a person standing on the ground.

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APPENDIX A
DATA COLLECTION AND SITE LOCATION METHODS

Data Collection Methods

Davey Resource Group collected tree inventory data using a system that utilizes a customized ArcPad program loaded onto pen-based field computers equipped with geographic information system (GIS) and global positioning system (GPS) receivers. The knowledge and professional judgment of Davey Resource Group's arborists ensure the high quality of inventory data.

Data fields are defined in the glossary of the management plan. At each site, the following data fields were collected:

- Aboveground utilities
- Clearance requirements
- Condition
- Further inspection
- Location
- Primary maintenance needs
- Mapping coordinates
- Observations
- Notes
- Risk assessment
- Risk rating
- Secondary maintenance needs
- Species
- Stems
- Tree size*

* measured in inches in diameter at 4.5 feet above ground (or diameter at breast height [DBH])

Maintenance needs are based on ANSI A300 (Part 1) (ANSI 2008). Risk assessment and risk rating are based on *Urban Tree Risk Management (Pokorny et al. 1992) ----OR---Best Management Practices: Tree Risk Assessment* (International Society of Arboriculture [ISA] 2011).

The data collected were provided in an ESRI® shapefile, Access™ database, and Microsoft Excel™ spreadsheet on a CD-ROM that accompanies this plan.

Site Location Methods

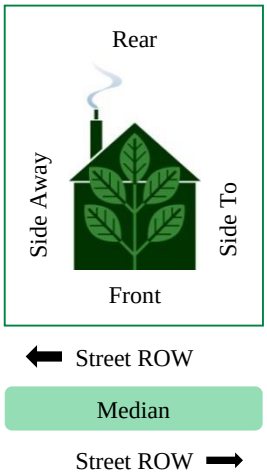
Equipment and Base Maps

Inventory arborists use FZ-G1 Panasonic Toughpad® unit(s).

Base map layers were loaded onto these unit(s) to help locate sites during the inventory.

Street ROW Site Location

Individual street ROW sites (trees or stumps) were located using a methodology that identifies sites by *address number*, *street name*, *or side*. This methodology was developed by Davey Resource Group to help ensure consistent assignment of location.



Side values for street ROW sites.

Address Number and Street Name

The *address number* was recorded based on visual observation by the arborist at the time of the inventory (the address number was posted on a building at the inventoried site). Where there was no posted address number on a building, or where the site was located by a vacant lot with no GIS parcel addressing data available, the arborist used his/her best judgment to assign an address number based on opposite or adjacent addresses. An "X" was then added to the number in the database to indicate that it was assigned (for example, "37X Choice Avenue").

Sites in medians or islands were assigned an address number using the address on the right side of the street in the direction of collection closest to the site. Each segment was numbered with an assigned address that was interpolated from addresses facing that median/island. If there were multiple median/islands between cross streets, each segment was assigned its own address.

The *street name* assigned to a site was determined by street ROW parcel information and posted street name signage.

Side Value and Site Number

Each site was assigned a *side value*. Side values include: *front*, *side*, *median* (includes islands), or *rear* based on the site's location in relation to the lot's street frontage (Figure 1). The *front side* is the side that faces the address street. *Side to* is the name of the street the arborist walks towards as data are being collected. *Side from* is the name of the street the arborist walks away from while collecting data. *Median* indicates a median or island. The *rear* is the side of the lot opposite the front.

Park and/or Public Space Site Location

Park and/or public space site locations were collected using the same methodology as street ROW sites; however, the *on street*, *from street*, and *to street* would be the park and/or public space's name (not street names).

APPENDIX B
SUGGESTED TREE SPECIES

Proper landscaping and tree planting are critical components of the atmosphere, livability, and ecological quality of a community's urban forest. The tree species listed below have been evaluated for factors such as size, disease and pest resistance, seed or fruit set, and availability. The following list is designed to assist all relevant community personnel in selecting appropriate tree species. These trees have been selected because of their aesthetic and functional characteristics and their ability to thrive in soil and climate (USDA Zones 5 and 6) conditions found throughout New York.

Deciduous Trees

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer saccharum	sugar maple	'Legacy'
Acer nigrum	black maple	
Betula alleghaniensis*	yellow birch	
Betula lenta*	sweet birch	
Betula nigra	river birch	Heritage®
Carpinus betulus	European hornbeam	'Franz Fontaine'
Carya illinoensis*	pecan	
Carya lacinata*	shellbark hickory	
Carya ovata*	shagbark hickory	
Castanea mollissima*	Chinese chestnut	
Celtis laevigata	sugarberry	
Celtis occidentalis	common hackberry	'Prairie Pride'
Cercidiphyllum japonicum	katsuratree	'Aureum'
Diospyros virginiana*	common persimmon	
Fagus grandifolia*	American beech	
Fagus sylvatica*	European beech	(Numerous exist)
Ginkgo biloba	ginkgo	(Choose male trees only)
Gleditsia triacanthos inermis	thornless honeylocust	'Shademaster'
Gymnocladus dioica	Kentucky coffeetree	Prairie Titan®
Juglans nigra*	black walnut	
Larix decidua*	European larch	
Liquidambar styraciflua	American sweetgum	'Rotundiloba'
Liriodendron tulipifera*	tuliptree	'Fastigiatum'
Magnolia acuminata*	cucumbertree magnolia	(Numerous exist)
Magnolia macrophylla*	bigleaf magnolia	
Metasequoia glyptostroboides	dawn redwood	'Emerald Feathers'
Nyssa sylvatica	blackgum	
Platanus occidentalis*	American sycamore	
Platanus × acerifolia	London planetree	'Yarwood'
Quercus alba	white oak	

Large Trees: Greater than 45 Feet in Height at Maturity (Continued)

Scientific Name	Common Name	Cultivar
Quercus bicolor	swamp white oak	
Quercus coccinea	scarlet oak	
Quercus lyrata	overcup oak	
Quercus macrocarpa	bur oak	
Quercus montana	chestnut oak	
Quercus muehlenbergii	chinkapin oak	
Quercus imbricaria	shingle oak	
Quercus phellos	willow oak	
Quercus robur	English oak	Heritage®
Quercus rubra	northern red oak	'Splendens'
Quercus shumardii	Shumard oak	
Styphnolobium japonicum	Japanese pagodatree	'Regent'
Taxodium distichum	common bald cypress	'Shawnee Brave'
Tilia americana	American linden	'Redmond'
Tilia cordata	littleleaf linden	'Greenspire'
Tilia × euchlora	Crimean linden	
Tilia tomentosa	silver linden	'Sterling'
Ulmus parvifolia	Chinese elm	Allée®
Zelkova serrata	Japanese zelkova	'Green Vase'

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Aesculus × carnea	red horsechestnut	
Alnus cordata	Italian alder	
Asimina triloba*	pawpaw	
Cladrastis kentukea	American yellowwood	'Rosea'
Corylus colurna	Turkish filbert	
Eucommia ulmoides	hardy rubber tree	
Koelreuteria paniculata	goldenraintree	
Ostrya virginiana	American hophornbeam	
Parrotia persica	Persian parrotia	'Vanessa'
Phellodendron amurense	Amur corktree	'Macho'
Pistacia chinensis	Chinese pistache	
Prunus maackii	Amur chokecherry	'Amber Beauty'
Prunus sargentii	Sargent cherry	
Pterocarya fraxinifolia*	Caucasian wingnut	
Quercus acutissima	sawtooth oak	
Quercus cerris	European turkey oak	
Sassafras albidum*	sassafras	

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer buergerianum	trident maple	Streetwise®
Acer campestre	hedge maple	Queen Elizabeth™
Acer cappadocicum	coliseum maple	'Aureum'
Acer ginnala	Amur maple	Red Rhapsody™
Acer griseum	paperbark maple	
Acer oliverianum	Chinese maple	
Acer pensylvanicum*	striped maple	
Acer triflorum	three-flower maple	
Aesculus pavia*	red buckeye	
Amelanchier arborea	downy serviceberry	(Numerous exist)
Amelanchier laevis	Allegheny serviceberry	
Carpinus caroliniana*	American hornbeam	
Cercis canadensis	eastern redbud	'Forest Pansy'
Chionanthus virginicus	white fringetree	
Cornus alternifolia	pagoda dogwood	
Cornus kousa	kousa dogwood	(Numerous exist)
Cornus mas	corneliancherry dogwood	'Spring Sun'
Corylus avellana	European filbert	'Contorta'
Cotinus coggygria*	common smoketree	'Flame'
Cotinus obovata*	American smoketree	
Crataegus phaenopyrum*	Washington hawthorn	Princeton Sentry™
Crataegus viridis	green hawthorn	'Winter King'
Franklinia alatamaha*	Franklinia	
Halesia tetraptera*	Carolina silverbell	'Arnold Pink'
Laburnum × watereri	goldenchain tree	
Maackia amurensis	Amur maackia	
Magnolia × soulangiana*	saucer magnolia	'Alexandrina'
Magnolia stellata*	star magnolia	'Centennial'
Magnolia tripetala*	umbrella magnolia	
Magnolia virginiana*	sweetbay magnolia	Moonglow®
Malus spp.	flowering crabapple	(Disease resistant only)
Oxydendrum arboreum	sourwood	'Mt. Charm'
Prunus subhirtella	Higan cherry	'Pendula'
Prunus virginiana	common chokecherry	'Schubert'
Staphylea trifolia*	American bladdernut	
Stewartia ovata	mountain stewartia	
Styrax japonicus*	Japanese snowbell	'Emerald Pagoda'
Syringa reticulata	Japanese tree lilac	'Ivory Silk'

Note: * denotes species that are not recommended for use as street trees.

Coniferous and Evergreen Trees

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Abies balsamea	balsam fir	
Abies concolor	white fir	'Violacea'
Cedrus libani	cedar of Lebanon	
Chamaecyparis nootkatensis	Nootka falsecypress	'Pendula'
Cryptomeria japonica	Japanese cryptomeria	'Sekkan-sugi'
× Cupressocyparis leylandii	Leyland cypress	
Ilex opaca	American holly	
Picea omorika	Serbian spruce	
Picea orientalis	Oriental spruce	
Pinus densiflora	Japanese red pine	
Pinus strobus	eastern white pine	
Pinus sylvestris	Scotch pine	
Pinus taeda	loblolly pine	
Pinus virginiana	Virginia pine	
Psedotsuga menziesii	Douglas-fir	
Thuja plicata	western arborvitae	(Numerous exist)
Tsuga canadensis	eastern hemlock	

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Chamaecyparis thyoides	Atlantic whitecedar	(Numerous exist)
Juniperus virginiana	eastern redcedar	
Pinus bungeana	lacebark pine	
Pinus flexilis	limber pine	
Pinus parviflora	Japanese white pine	
Thuja occidentalis	eastern arborvitae	(Numerous exist)

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Ilex × attenuata	Foster's holly	
Pinus aristata	bristlecone pine	
Pinus mugo mugo	mugo pine	

This suggested species list was compiled through the use of the excellent references *Dirr's Hardy Trees and Shrubs* (Dirr 2003) and *Manual of Woody Landscape Plants (5th Edition)* (Dirr 1998). Cultivar selections are recommendations only and are based on Davey Resource Group's experience; tree availability will vary by nursery.

APPENDIX E
INVASIVE PESTS AND DISEASES

In today's worldwide marketplace, the volume of international trade brings increased potential for pests and diseases to invade our country. Many of these pests and diseases have seriously harmed rural and urban landscapes and have caused billions of dollars in lost revenue and millions of dollars in clean-up costs. Keeping these pests and diseases out of the country is the number one priority of the United States Department of Agriculture's (USDA) Animal and Plant Inspection Service (APHIS).

Although some invasive species naturally enter the United States via wind, ocean currents, and other means, most invasive species enter the country with some help from human activities. Their introduction to the U.S. is a byproduct of cultivation, commerce, tourism, and travel. Many species enter the United States each year in baggage, cargo, contaminants of commodities, or mail.

Once they arrive, hungry pests grow and spread rapidly because controls, such as native predators, are lacking. Invasive pests disrupt the landscape by pushing out native species, reducing biological diversity, killing trees, altering wildfire intensity and frequency, and damaging crops. Some pests may even push species to extinction. The following sections include key pests and diseases that adversely affect trees in America at the time of this plan's development. This list is not comprehensive and may not include all threats.

It is critical to the management of community trees to routinely check APHIS, USDA Forest Service, and other websites for updates about invasive species and diseases in your area and in our country so that you can be prepared to combat their attack.

APHIS, Plant Health, Plant Pest Program Information
•www.aphis.usda.gov/plant_health/plant_pest_info

The University of Georgia, Center for Invasive Species and Ecosystem Health
•www.bugwood.org

USDA National Agricultural Library
•www.invasivespeciesinfo.gov/microbes

USDA Northeastern Areas Forest Service, Forest Health Protection
•www.na.fs.fed.us/fhp

Asian Longhorned Beetle

The Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is an exotic pest that threatens a wide variety of hardwood trees in North America. The beetle was introduced in Chicago, New Jersey, and New York City, and is believed to have been introduced in the United States from wood pallets and other wood-packing material accompanying cargo shipments from Asia. ALB is a serious threat to America's hardwood tree species.

Adult Asian longhorned beetle

Photograph courtesy of New Bedford Guide 2011

Adults are large (3/4- to 1/2-inch long) with very long, black and white banded antennae. The body is glossy black with irregular white spots. Adults can be seen from late spring to fall depending on the climate. ALB has a long list of host species; however, the beetle prefers hardwoods, including several maple species. Examples include: *Acer negundo* (box elder); *A. platanoides* (Norway maple); *A. rubrum* (red maple); *A. saccharinum* (silver maple); *A. saccharum* (sugar maple); *Aesculus glabra* (buckeye); *A. hippocastanum* (horsechestnut), *Betula* (birch), *Platanus* × *acerifolia* (London planetree), *Salix* (willow), and *Ulmus* (elm).

Dutch Elm Disease

Considered by many to be one of the most destructive, invasive diseases of shade trees in the United States, Dutch elm disease (DED) was first found in Ohio in 1930; by 1933, the disease was present in several East Coast cities. By 1959, it had killed thousands of elms. Today, DED covers about two-thirds of the eastern United States, including Illinois, and annually kills many of the remaining and newly planted elms. The disease is caused by a fungus that attacks the vascular system of elm trees blocking the flow of water and nutrients, resulting in rapid leaf yellowing, tree decline, and death.

Branch death, or flagging, at multiple locations in the crown of a diseased elm

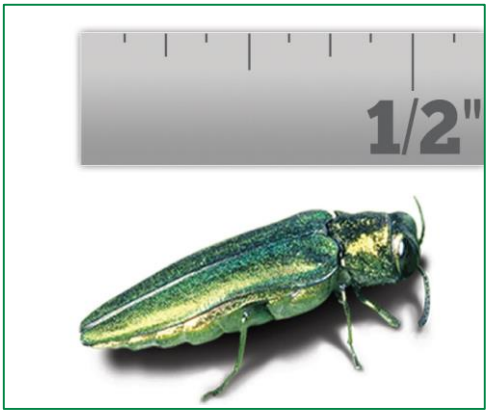
Photograph courtesy of Steven Katovich, USDA Forest Service, Bugwood.org (2011)

There are two closely-related fungi that are collectively referred to as DED. The most common is *Ophiostoma novo-ulmi*, which is thought to be responsible for most of the elm deaths since the 1970s. The fungus is transmitted to healthy elms by elm bark beetles. Two species carry the fungus: native elm bark beetle (*Hylurgopinus rufipes*) and European elm bark beetle (*Scolytus multistriatus)*.

The species most affected by DED is the *Ulmus americana* (American elm).

Emerald Ash Borer

Emerald ash borer *(EAB) (Agrilus planipennis*) is responsible for the death or decline of tens of millions of ash trees in 14 states in the American Midwest and Northeast. Native to Asia, EAB has been found in China, Japan, Korea, Mongolia, eastern Russia, and Taiwan. It likely arrived in the United States hidden in wood-packing materials commonly used to ship consumer goods, auto parts, and other products. The first official United States identification of EAB was in southeastern Michigan in 2002.



Close-up of the emerald ash borer

Photograph courtesy of APHIS (2011)

Adult beetles are slender and 1/2-inch long. Males are smaller than females. Color varies but adults are usually bronze or golden green overall with metallic, emerald-green wing covers. The top of the abdomen under the wings is metallic, purplish-red and can be seen when the wings are spread.

The EAB-preferred host tree species are in the genus *Fraxinus* (ash).

Gypsy Moth

The gypsy moth (GM) *(Lymantria dispar*) is native to Europe and first arrived in the United States in Massachusetts in 1869. This moth is a significant pest because its caterpillars have an appetite for more than 300 species of trees and shrubs. GM caterpillars defoliate trees, which makes the species vulnerable to diseases and other pests that can eventually kill the tree.

Close-up of male (darker brown) and female (whitish color) European gypsy moths

Photograph courtesy of APHIS (2011b)

Male GMs are brown with a darker brown pattern on their wings and have a 1/2-inch wingspan. Females are slightly larger with a 2-inch wingspan and are nearly white with dark, saw-toothed patterns on their wings. Although they have wings, the female GM cannot fly.

The GMs prefer approximately 150 primary hosts but feed on more than 300 species of trees and shrubs. Some trees are found in these common genera: *Betula* (birch), *Juniperus* (cedar), *Larix* (larch), *Populus* (aspen, cottonwood, poplar), *Quercus* (oak), and *Salix* (willow).

Granulate Ambrosia Beetle

Adult granulate ambrosia beetle

Photograph courtesy of Paul M. Choate, University of Florida (Atkinson et al. 2011)

The granulate ambrosia beetle (*Xylosandrus crassiusculus*), formerly the Asian ambrosia beetle, was first found in the United States in 1974 on peach trees near Charleston, South Carolina. The native range of the granulate ambrosia beetle is probably tropical and subtropical Asia. The beetle is globally present in countries such as equatorial Africa, Asia, China, Guinea, Hawaii, India, Japan, New South Pacific, Southeast Indonesia, Sri Lanka, and the United States. In the United States, this species has spread along the lower Piedmont region and coastal plain to East Texas, Florida, Louisiana, and North Carolina. Populations were found in Oregon and Virginia in 1992, and in Indiana in 2002.

Adults are small and have a reddish-brown appearance with a downward facing head. Most individuals have a reddish head region and a dark-brown to black elytra (hard casings protecting the wings). Light-colored forms that appear almost yellow have also been trapped. A granulated (rough) region is located on the front portion of the head and long setae (hairs) can be observed on the back end of the wing covers. Females are 2–2.5mm and males are 1.5mm long. Larvae are C-shaped with a defined head capsule.

The granulate ambrosia beetle is considered an aggressive species and can attack trees that are not highly stressed. It is a potentially serious pest of ornamentals and fruit trees and is reported to be able to infest most trees and some shrubs (azalea, rhododendron) but not conifers. Known hosts in the United States include: *Acer* (maple); *Albizia* (albizia); *Carya* (hickory); *Cercis canadensis* (eastern redbud); *Cornus* (dogwood); *Diospyros* (persimmon); *Fagus* (beech); *Gleditsia* or *Robinia* (locust); *Juglans* (walnut); *Koelreuteria* (goldenrain tree); *Lagerstroemia* (crapemyrtle); *Liquidambar styraciflua* (sweetgum); *Liriodendron tulipifera* (tulip poplar); *Magnolia* (magnolia); *Populus* (aspen); *Prunus* (cherry); *Quercus* (oak); and *Ulmus parvifolia* (Chinese elm). *Carya illinoinensis* (pecan) and *Pyrus calleryana* (Bradford pear) are commonly attacked in Florida and in the southeastern United States.

Hemlock Woolly Adelgid

The hemlock woolly adelgid (HWA, *Adelges tsugae*) was first described in western North America in 1924 and first reported in the eastern United States in 1951 near Richmond, Virginia.

Hemlock woolly adelgids on a branch

Photograph courtesy of USDA Forest Service (2011a)

In their native range, populations of HWA cause little damage to the hemlock trees, as they feed on natural enemies and possible tree resistance has evolved with this insect. In eastern North America and in the absence of natural control elements, HWA attacks both *Tsuga canadensis* (eastern or Canadian hemlock) and *T. caroliniana* (Carolina hemlock), often damaging and killing them within a few years of becoming infested.

The HWA is now established from northeastern Georgia to southeastern Maine and as far west as eastern Kentucky and Tennessee.

Oak Wilt

Oak wilt was first identified in 1944 and is caused by the fungus *Ceratocystis fagacearum*. While considered an invasive and aggressive disease, its status as an exotic pest is debated since the fungus has not been reported in any other part of the world. This disease affects the oak genus and is most devastating to those in the red oak subgenus, such as *Quercus coccinea* (scarlet oak), *Q. imbricaria* (shingle oak), *Q. palustris* (pin oak), *Q. phellos* (willow oak), and *Q. rubra* (red oak). It also attacks trees in the white oak subgenus, although it is not as prevalent and spreads at a much slower pace in these trees.

Oak wilt symptoms on red and white oak leaves

Photograph courtesy of USDA Forest Service (2011a)

Just as with DED, oak wilt disease is caused by a fungus that clogs the vascular system of oaks and results in decline and death of the tree. The fungus is carried from tree to tree by several borers common to oaks, but the disease is more commonly spread through root grafts. Oak species within the same subgenus (red or white) will form root colonies with grafted roots that allow the disease to move readily from one tree to another.

Sudden Oak Death

The causal agent of sudden oak death (SOD, also known as *Phytophthora* canker disease), *Phytophthora ramorum*, was first identified in 1993 in Germany and the Netherlands on ornamental rhododendrons. In 2000, the disease was found in California. Since its discovery in North America, SOD has been confirmed in forests in California and Oregon and in nurseries in British Columbia, California, Oregon, and Washington. SOD has been potentially introduced into other states through exposed nursery stock. Through ongoing surveys, APHIS continues to define the extent of the pathogen's distribution in the United States and limit its artificial spread beyond infected areas through quarantine and a public education program.

Drooping tanoak shoot

Photograph courtesy of Indiana Department of Natural Resources (2012)

Identification and symptoms of SOD may include large cankers on the trunk or main stem accompanied by browning of leaves. Tree death may occur within several months to several years after initial infection. Infected trees may also be infested with ambrosia beetles (*Monarthrum dentiger* and *M. scutellarer*), bark beetles (*Pseudopityophthorus pubipennis*), and sapwood rotting fungus (*Hypoxylon thouarsianum*). These organisms may contribute to the death of the tree. Infection on foliar hosts is indicated by dark grey to brown lesions with indistinct edges. These lesions can occur anywhere on the leaf blade, in vascular tissue, or on the petiole. Petiole lesions are often accompanied by stem lesions. Some hosts with leaf lesions defoliate and eventually show twig dieback.

This pathogen is devastating to *Quercus* (oaks) but also affects several other plant species.

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