CITY OF TROY, NY

Community Forest Management Plan

- Troy, NY –

2019

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Acknowledgements

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- The City of Troy, NY -

City of Troy Planning Department

Troy's Street Tree Advisory Board

City of Troy Historic District Commission

City of Troy Planning Commission

City of Troy Environmental Commission

Citizens of Troy, NY

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NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

CITY OF TROY, NY

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This Plan's vision is to create a healthy and sustainable community forest that is properly managed and cared for, benefiting the citizens of Troy with improved economic, environmental, and social well-being, maintained public safety, and expanded tree canopy and associated benefits while maintaining the City's character. The community forest will be thriving and resilient with a diverse age and species composition for continued provision of benefits. The trees will be selected and maintained using best practices as written in the proposed Street Tree Ordinance.

Source: Washington Park Association

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Source:
Live & Love
Troy

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Troy's Community Forest Management Plan Executive Summary

Source: Downtown Troy BID

The City of Troy is dedicated to building a thriving urban and community forest for a healthy and vibrant place to live, work, and play. The more than 10,000 City street and park trees throughout Troy are an asset that bring value and benefits to the community. Furthermore, trees on private property provide added benefits. Together, these public and private trees constitute an "urban and community forest". This resource provides environmental benefits, adds to property values, and contributes to an enhanced quality of life for all of Troy's residents.

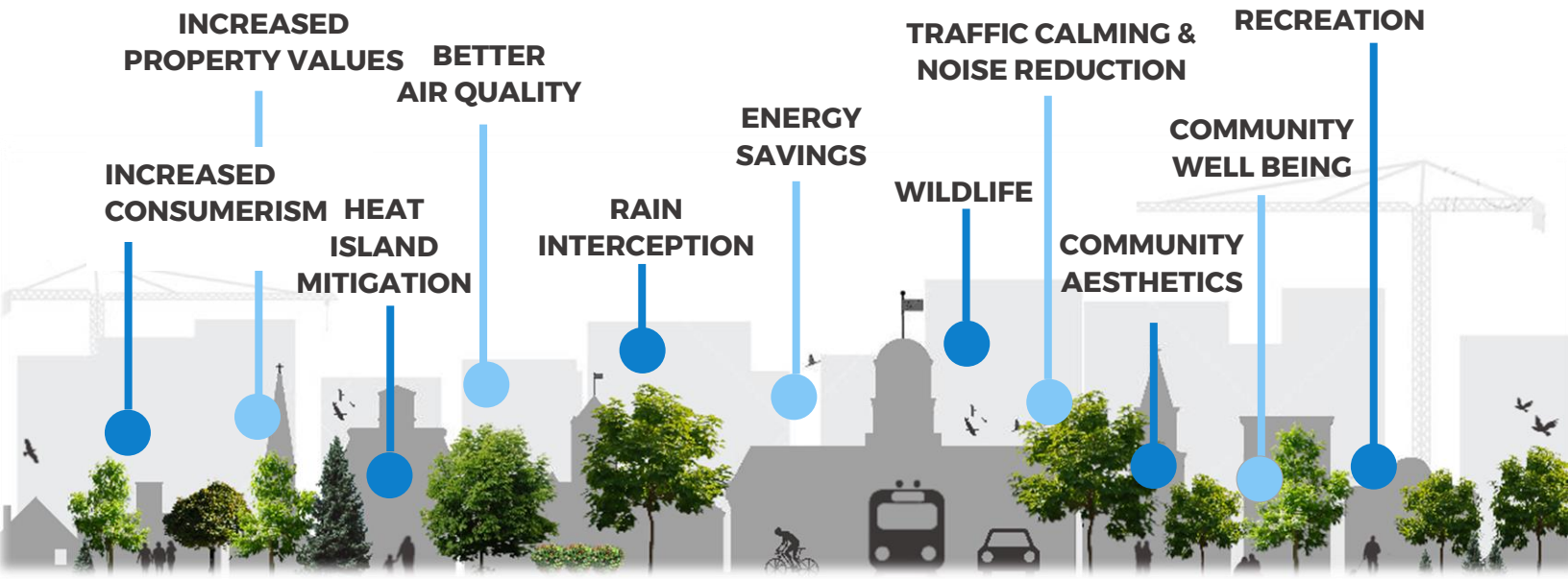
Realizing the community forest is a valued asset, Troy, herein referred to as "the City", invested in a collaborative planning process with support from the New York State Department of Environmental Conservation. The planning process involved extensive resource and program analysis to develop a clear, concise and timeline-oriented Community Forest Management Plan. The overall goal of the planning process was to develop a sustainable Community Forestry Program for the preservation and expansion of the community forest to serve the public interest by improving the community's physical, social, cultural and economic environment. This effort was led by the Planning Department and Street Tree Advisory Board, who are committed to this measured, monitored, and strategic long-term investment. The strategic planning process evaluated all aspects of a comprehensive community forestry program. Together, this team developed goals and actions to guide the City's Community Forestry Program over the next 8 years.

The development of a comprehensive Community Forest Management Plan included an analysis of the 2019 public tree and "vacant site"—i.e. potential planting sites—inventory along rights-of-way and in City parks. This Plan complements and supports the objectives of the City's adopted Comprehensive Plan, *Realize Troy*, and serves as a guide to future investment in the urban and community forest resource. As stated in the Comprehensive Plan:

Troy is endowed with a spectacular natural environment– from magnificent gorges, an expansive riverfront, to a wide array of mature open spaces. In recent years, these areas have been impacted by industrial and urban development and need to be better protected to sustain the environmental health of the City.

This Community Forest Management Plan supports the goals established in *Realize Troy*—Promote Healthy, Safe, and Green Neighborhoods; Preserve and Showcase the City's Parks, Open Spaces, and Cultural Assets; and Plan for Sustainable Infrastructure and Protect the Environment. The Comprehensive Plan specifies planning, regulatory, and enforcement policies that the City will engage to encourage the preservation and expansion of the urban forest on public land in order to maximize the City's benefits.

The Benefits & Value of the Community Forest



The 10,000 public trees in Troy provide value in terms of improved well-being and increased property values, air quality improvements, reduction in stormwater volumes and an improvement in water quality, energy savings from the shade of their canopy and protection from cool winds, and their ability to sequester and store carbon. These values, originating from research conducted by the U.S. Forest Service and implemented in i-Tree software, equate to:

$1.4mil total annual value of benefits
$140 in annual benefits per tree
$27 in benefits per capita

Framework of the Community Forest Management Plan

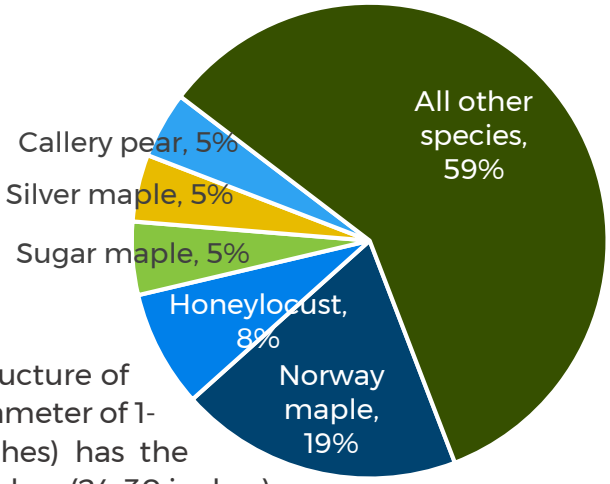
The City is devoted to sustaining and enhancing the benefits trees provide to the community by developing and following this strategic Community Forest Management Plan. At the same time, stresses from the urban environment including air pollution, pests and diseases such as emerald ash borer, invasive species, climate change, damage by vehicles, increased impervious surface, infrastructure conflicts, and soil compaction reduce the diversity and magnitude of these benefits and may lead to tree-related problems. Compounding these issues are the concerns regarding current City staffing levels, budgets necessary for adequate community forest management, and lack of policy or ordinances for tree protection. With this understanding, it was imperative that the City develop a Community Forest Management Plan to be a roadmap answering the questions of *What do we have*? *What do we want*? *How do we get what we want*? and, *How are we doing*? The following will provide an overview of the outcomes of this process to develop the Plan's recommendations.

What Do We Have?

The first step in the planning process included a baseline assessment of the community forest resource. In 2019, the City completed an inventory of all City-owned trees and potential planting spaces within the public rights-of-way and parks. An analysis of the tree inventory data was conducted to identify trends in characteristics and maintenance needs for City-owned trees.

The inventory recorded 10,021 live trees across the City, of which 70% are street trees. Citywide, there are 182 unique tree species, with the top five shown in the chart (right) consisting of Norway maple, honeylocust, sugar maple, silver maple, and callery pear. There is concern about biodiversity for the 36% of trees consisting of maples (*Acer*) in addition to the abundance of the unfavorable callery pear and threatened green ash trees which is discussed in this Plan.

Figure 1. Most common public trees



The tree inventory analysis determined that the structure of all City-owned trees consists of 18% young trees (diameter of 1-6 inches) but the established age class (6-12 inches) has the highest distribution with 27%. The mature tree age class (24-30 inches) contains the least number of trees with 747 trees (7%).

The table below summarizes the recommended maintenance approach based on the 2019 tree inventory. A total of 476 trees were identified as either in critical or immediate need of removal and a total of 938 trees require immediate pruning. Of the 10,021 live trees, 5,252 street trees are recommended for a 7-year routine pruning cycle and 2,280 park trees for the same cycle. There are 1,204 young trees that should be training pruned every three years, resulting in 401 trees per year. To compensate for tree loss and to increase canopy Citywide, it is recommended that at least 68 trees be planted per year with more ideal numbers around 200 trees per year.

Table 1. Summary of the recommended tree management program for the City of Troy

REMOVAL	476 115 361	Total Trees Critical Removals Immediate Removals
PRIORITY PRUNING	25 913	Critical Pruning Immediate Pruning
ROUTINE STREET TREE PRUNING CYCLE	5,252 750	Total Street Trees Trees Per Year
ROUTINE PARK TREE PRUNING CYCLE	2,280 326	Total Park Trees Trees Per Year
YOUNG TREE TRAINING CYCLE	1,204 401	Total Young Trees Trees Per Year
TREE PLANTING	68 200	Trees Per Year (minimum) Trees Per Year (accounts for natural mortality and recommendation to increase canopy)

What Do We Want?

Using the information gathered during the tree inventory data analysis, along with the information gathered from City staff meetings, the community forest program and the resource itself was analyzed using U.S. Forest Service auditing systems and community forest planning resources. Based on the audit, community forest management and sustainability gaps were identified to develop the following goals and action strategies in this Plan.

1) Maximize the efficiencies in maintaining trees

2) Using planning, legislation and enforcement to integrate trees more fully

3) Implement best management practices for the benefits of trees

4) Foster support for the community forest

How Do We Get What We Want?

The following recommendations were developed to achieve the goals:

- ✓ Address the critical and immediate tree removals and tree pruning needs.
- ✓ Establish a routine 7-year pruning cycle for street and park trees and 3-year cycle for young trees.
- ✓ Continue to plant trees according to best practices in appropriate locations for increased tree canopy and added ecosystem benefits.
- ✓ Adopt the Street Tree Ordinance for tree planting, protection, and preservation of City trees.
- ✓ Explore and adopt shared maintenance responsibility for street trees.
- ✓ Establish a decision matrix for tree removal requests and infrastructure conflicts.
- ✓ Establish a heritage or landmark tree preservation program.
- ✓ In collaboration with City Departments and the Street Tree Advisory Board, create a City Arborist position for the management of the community forest, outreach and response to the residents, monitoring of changes, and effective management of the community forest.
- ✓ Leverage existing efforts such as *Realize Troy* and the Complete Streets Policy for enhancing the community forest.
- ✓ Engage community stewards to actively plant and maintain trees throughout the City.
- ✓ Acquire and maintain Tree City USA status.

Are We Getting What We Want?

Using an adaptive management approach will require the consistent monitoring of all the City's criteria for community forest sustainability. The City will be able to judge if the new approaches to community forest conservation are being effective, develop relationships between management actions and outcomes, and identify significant trends. This will allow the City to adjust management actions over time as changes occur both in the physical/biological environment and in the expectations of the City's residents.

Troy's community forest is a defining and valued characteristic of making the City a desirable place to live, work, and play. It is a resource that has a history and legacy of care and management; however, the resource could be more efficiently managed and enhanced. This Community Forest Management Plan has been developed to provide the framework to effectively, proactively, and sustainably manage trees and be the catalyst for increased stewardship and accepted value of Troy's community forest.

"Urban trees and forests are considered integral to the sustainability of cities as a whole. Yet, sustainable urban forests are not born, they are made. They do not arise at random, but result from a community-wide commitment to their creation and management."

| Clark et al.: Urban Forest Sustainability

Source: Downtown Troy BID

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Source: Downtown Troy BID

Introduction to Troy's Community Forest Management Plan

Geographically, the City of Troy is situated on the western edge of Rensselaer County and on the eastern bank of the Hudson River as the seat of Rensselaer County, NY. Troy, with an estimated population of 49,400 (2018), has close ties to the nearby cities of Albany and Schenectady, forming a region called the Capital District, with a population of 1.2 million people.

Troy's location along the Hudson river has shaped much of the City's history. The City has seven miles of waterfront and early development and success were directly related to its ability to harness the power of water which powered early industrial and manufacturing growth. The use of the Hudson River and the Erie Canal as water highways connected the City to growing markets to the north, south and west enabling the City to prosper as the fourth wealthiest city in America around the turn of the century.

Changes in transportation and shipping, communication, and information technology, and the emergence of globalization in the 20th century resulted in the decline of manufacturing in many American cities, including Troy. Industrial decline has left behind many derelict and underutilized industrial areas south of downtown. In response to this shift, efforts were made to preserve Troy's cultural past and heritage and in 2014, the City updated the Comprehensive Plan for the first time in 50 years.

Revitalization efforts have amplified as a result of the Comprehensive Plan and other commitments made by the City and its residents. In turn, the City has a growing concern for the protection and enhancement of City assets such as the community forest.

Troy is a community that recognizes its trees as one of its most valuable resources and with this Community Forest Management Plan, has dedicated itself to the preservation, proper maintenance, and continued enhancement of the community forest. The trees throughout Troy are an asset that bring value and benefits to the community. The community forest provides environmental benefits, adds to property values, and contributes to an enhanced quality of life for all of Troy's residents. These community forest efforts along with the transformation of the river's edge are a tremendous opportunity to bolster the City as a whole.

Unfortunately, the trees comprising the community forest in Troy suffer from the rigors of urban life, including pests and diseases, the current and changing climate, air pollution, compacted soils, limited growing spaces, and limited resources. To overcome such rigorous conditions for the City's trees and reap the benefits of these, our most valuable assets, the care of the community forest must be strategically and efficiently planned and cared for.

This Community Forest Management Plan seeks to secure adequate tree management levels and garner the enabling support through staffing, funding, the community, and policy. Adequate tree management includes efficient and effective tree care, bolstered tree plantings to maintain age and species diversity in the public tree population, the equitable preservation and enhancement of canopy coverage Citywide to enhance the character and aesthetics of neighborhoods, and exemplary stewardship of the forest from all who live and work in Troy. The Community Forest Management Plan must be regarded as both a long-range policy guide and a living document that will respond to changing conditions over its life. It requires a close partnership between policy makers, staff, and the community. Adoption of this Community Forest Management Plan enables the City to accomplish these objectives.

Defining the Community Forest

Any inhabited area that has trees and vegetation is considered a community forest though more urbanized communities often refer to this resource as an urban forest. Based on Troy's population density, tree population, and the public interaction with and received benefits from trees, Troy's resource is referred interchangeably as an urban and community forest in this Plan. The Community Forest Management Plan focuses on the City-owned trees in public rights-of-way and parks, but also has implications for the private trees and attention to these are addressed through community outreach and education efforts.

The concept of urban and community forest management developed in the 1960s out of the death and devastation of the elm tree population throughout the United States due to Dutch Elm disease. The discipline of community forestry strongly advocates for species and age diversity in a city's tree population so that the elm tree devastation of the 1960s does not happen again. Unfortunately, native and invasive pests and diseases continue to spread.

During the last three decades, community forestry has evolved as researchers and practitioners learn more about the structure and function of trees and their unique role in providing environmental, economic, and social benefits to urban areas. Community forestry provides each of these benefits in differing circumstances—as infrastructure, as part of design and development, and as efficient and productive providers of economic development.

Residents traditionally have indicated that they consider the trees in the community a priority. In urban environments, the community forest is sometimes the only day-to-day interaction with nature that many residents enjoy.

As Troy continues to grow, the community forest needs a strong advocate. This will happen with the education and support of the City's constituency, staff, and elected officials via an approved community forest management plan. The community forest is unique in the array of benefits it provides to the community, and a management plan will effectively collect and showcase these values.

While a management plan is useful in helping educate and ensure future viability, it also will set up useful parameters for the daily operations and care of the community forest. A fresh look at all of the policies currently in place will bring into focus what is necessary for day-to-day activities to ensure long-term viability and safety of the community forest.

Source: Frear Park Conservancy

TROY'S COMMUNITY FORESTRY BACKGROUND

Troy is situated among an abundant natural environment that includes gorges, an expansive waterfront, and a wide array of open spaces. The City is directly tied to its natural environment and Troy's residents value these assets. As stated in the City's Comprehensive Plan, *Realize Troy*, in order to protect the natural environment while supporting fiscal sustainability, a range of strategies such as growing the urban forest canopy, improving the health of the river ecosystems, introducing green infrastructure, and adopting conservation measures in development projects should be implemented.

Regarding growth of the urban forest canopy, it is the City's responsibility to maintain trees within the public rights-of-way and on City-owned parks, open spaces, and facilities. Troy's Planning Department leading this Community Forest Management Plan effort, is responsible for the planning, development, coordination and promotion of the physical, social, and economic well-being of the City. A multifaceted approach is implemented in Troy for the care and enhancement of community forestry. In addition to the Planning Department, the Department of Public Works currently reviews and performs tree maintenance requests, the Street Tree Advisory Board provides support relating to the City's urban forestry efforts, and the City works closely with Capital Roots and their Urban Greening program.

Though it is the City's responsibility for tree care within public rights-of-way, the preservation and growth of Citywide urban forest canopy should be the concern of both the City and the community residents. Currently, the City does not have an ordinance for street trees, nor does it have a designated tree management professional such as a city arborist, city forester, or urban forester. With this baseline assessment of the City's community forest program, the Community Forest Management Plan was developed to provide recommendations for staffing levels, tree maintenance priority corridors, the sharing of the tree maintenance responsibility, strengthened tree management and preservation best practices and ordinances, an improved tree permit process, distinguished roles of the Street Tree Advisory Board, Tree City USA achievement, and enhanced community engagement and stewardship.

Existing City plans and efforts impact and influence Troy's community forest. In addition to the 2018 *Realize Troy* Comprehensive Plan, the City adopted the Climate Smart Communities Pledge in 2012 and in 2014, the Complete Streets Ordinance and Policy was adopted. In 2003, the City established the Stormwater Management Program (SWMP) to comply with the New York State Department of Environmental Conservation (NYSDEC) Municipal Separate Storm Sewer System (MS4) program. Though the City has completed an inventory of all public trees in 2019, it has never been accredited with the Arbor Day Foundation's Tree City USA award. Implementation of this Community Forest Management Plan will acquire this recognition and complement ongoing City efforts while achieving goals of a thriving, healthy, and sustainable community forest.

Plans and efforts shaping Troy's community forest.
Historic photo of downtown Troy (left), Realize Troy comprehensive plan, Northern River Street Historic District (second from right) and the Community Forest Management Plan. Photo Source: Rensselaer County Historical Society

"The time has come for urban communities to stop seeing the trees and start looking at the forest. I say this because the comprehensive environmental benefits can be achieved only through a forest management program…"

John P. Rousakis, Savannah, GA Mayor in 1978 at the 1st U.S. National Urban Forestry Conference

Sources: City of Troy (top) Capital Roots (bottom)

Benefits Provided by Trees

The quality of life of the citizens in any community depends on the community forest, as trees make a vital and affordable contribution to the sense of community, pedestrian-friendly neighborhoods, energy savings, and air quality. Community forest management is critical to meeting the City's commitment to climate change, stormwater reduction and improved water quality, carbon sequestration, wildlife habitat enhancement, and water conservation. Trees are one of the few infrastructure investments that grow in value over time. The following data was derived from Alliance for Community Trees.[1]

Reduce Stormwater, Conserve Water and Soil

A tree's fibrous roots, extending into the soil, are premier pollution filtration and soil erosion prevention systems. Intensely urbanized areas are covered with many impermeable surfaces. In contrast to an impervious hardscape, a healthy urban forest can reduce annual storm water runoff up to 7 percent. Highly efficient trees also utilize or absorb toxic substances such as lead, zinc, copper, and biological contaminants. Trees reduce the need for additional local stormwater filtration systems.

Reduce Stress and Improve the Quality of Life

Neighborhoods with generous canopies of trees are uplifting and good for public health. Greater contact with natural environments correlates with lower levels of stress, improving performance. Students' concentration levels go up when they are able to look out onto a green landscape. Studies show that children with attention deficit disorder function better after activities in green settings. A green environment also improves worker productivity.

Build Safe Communities and Decrease Crime

Police and crime prevention experts agree that trees and landscaping cut the incidence of theft, vandalism, and violence by enhancing neighborhoods. Thriving trees on well-maintained streets indicate pride of ownership. Public housing residents with nearby trees and natural landscapes reported 25 percent fewer acts of domestic aggression and violence. Apartment buildings with high levels of greenery had 52 percent fewer crimes than those without any trees. Buildings with medium amounts of greenery had 42 percent fewer crimes.

[1] Alliance for Community Trees. 2011. Benefits of trees and urban forests: A research list. http://actrees.org/files/Research/benefits_of_trees.pdf

Positively Influence Climate to Ensure Sustainability

Trees absorb carbon dioxide and store carbon in wood, which helps to reduce greenhouse gases. Carbon emissions from vehicles, industries, and power plants are a primary contributor to increased air temperatures in metropolitan areas. Trees in the United States store 700 million tons of carbon valued at $14 billion with an annual carbon sequestration rate of 22.8 million tons per year valued at $460 million annually.

Clean the Air and Breathe Easier

Shade trees reduce pollution and return oxygen to the atmosphere. In addition to carbon dioxide, trees' leaves or needles absorb pollutants, such as ozone, nitrogen dioxide, sulfur dioxide, and some particulate matter.

Save Energy and Lower Energy Costs for Buildings

As natural screens, trees can insulate homes and businesses from extreme temperatures, keep properties cool, and reduce air conditioning utility bills. A 20 percent canopy of deciduous trees over a house results in annual cooling savings of 8 to 18 percent and annual heating savings of 2 to 8 percent. By planting shade trees on sunny exposures, residents and businesses can save up to 50 percent on hot-day energy bills.

Reduce the Need for Street Maintenance

Shaded streets last longer and require far less pavement maintenance, reducing long- term costs. Canopy diminishes pavement fatigue, cracking, rutting, and other damage. A study from University of California at Davis found that 20 percent shade cover on a street improves pavement condition by 11 percent, which is a 60 percent savings for resurfacing over 30 years.

Raise Property Values

Trees are sound investments, for businesses and residents alike, and their value increases as they grow. Sustainable landscapes can increase property values up to 37 percent. The value of trees appreciates over time, because the benefits grow as they do. For businesses, trees have added value, including higher revenues. Shoppers seek out leafy promenades that frame storefronts. Research shows that shoppers spend more—between 9 and 12 percent more—on products in tree-lined business districts.

Cooler Pavement Diminishes Urban Heat Islands

Broad canopy trees lower temperatures by shading buildings, asphalt, and concrete. They deflect radiation from the sun and release moisture into the air. The urban heat island effect is the resulting higher temperature of areas dominated by buildings, roads, and sidewalks. Cities are often 5˚ to 10˚F hotter than undeveloped areas, because hot pavement and buildings have replaced cool vegetated land. In addition, high temperatures increase the volatility of automobile oil and oil within the asphalt itself, releasing the fumes into the atmosphere. Shade trees can reduce asphalt temperatures by as much as 36˚F, which diminishes the fumes and improves air quality.

Protect Wildlife and Restore Ecosystems

Planting and protecting trees can provide habitat for hundreds of birds and small animals. Urbanization and the destruction of valuable ecosystems have led to the decline of many of species. Adding trees, particularly native trees, provides valuable habitat for wildlife.

Calm Traffic and Make Neighborhoods Safer and Quieter

People drive more slowly and carefully through tree-lined streets, because trees create the illusion of narrower streets. One study found a 46 percent decrease in crash rates across urban arterial and highway sites after landscape improvements were installed. The presence of trees in a suburban landscape reduced the cruising speed of drivers by an average of 3 miles per hour. Faster drivers and slower drivers both drove at decreased speeds in the presence of trees.

Trees reduce noise pollution, buffering as much as half of urban noise. By absorbing sounds, a belt of trees 100 feet wide and 50 feet tall can reduce highway noise by 6 to 10 decibels. Buffers composed of trees and shrubs can reduce 50 percent of noise.

More information about the benefits of trees, links to the latest research papers, and other research regarding urban forestry can be found at the Invest From the Ground Up resource web page (http://investfromthegroundup.org/resources/research/).

A comprehensive analysis of the ecosystem services and benefits provided by the trees inventoried in 2019 are provided in the Value and Benefits of Troy's Trees section.

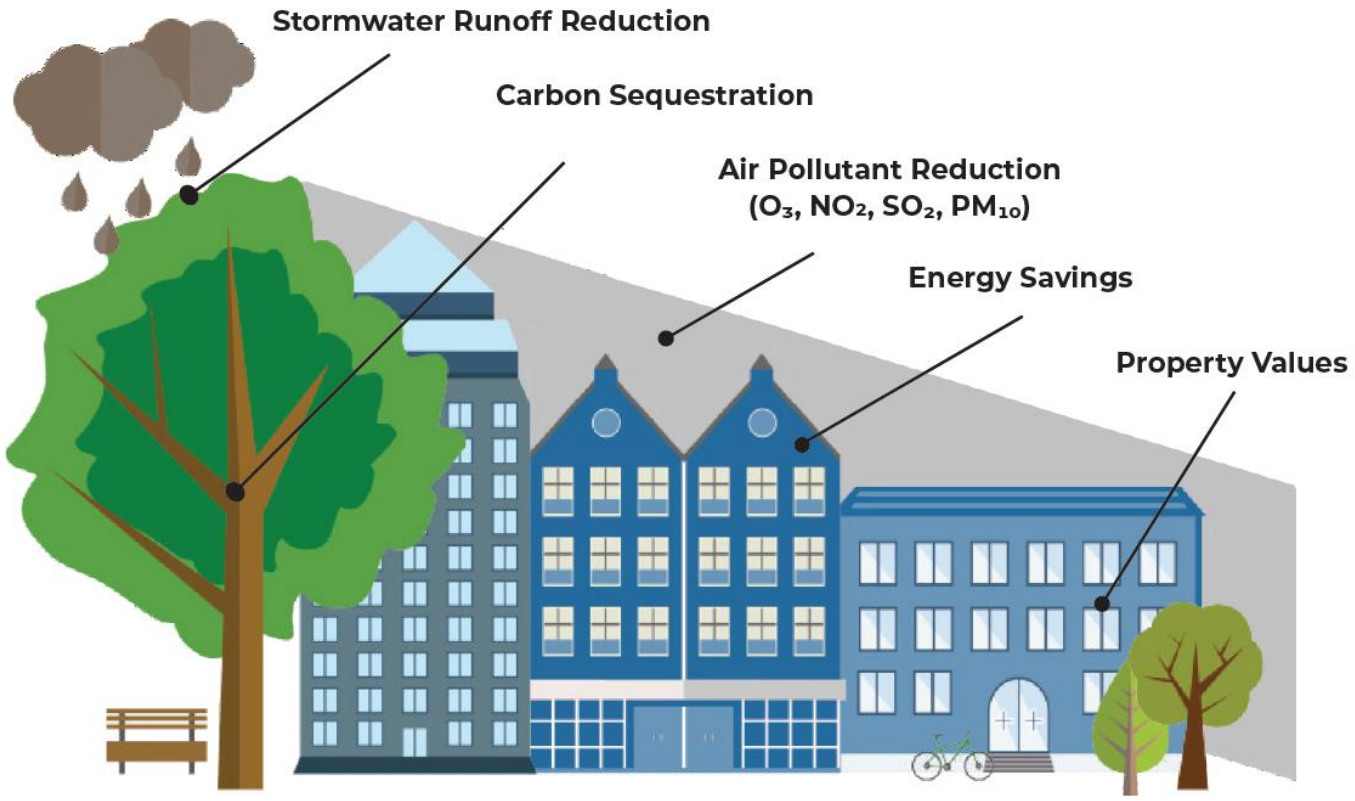


Figure 2. The economic, environmental, and social benefits provide by community forests.

THE COMMUNITY FOREST MANAGEMENT PLAN APPROACH

Understanding the benefits and functions of the community forest, the City has developed this Community Forest Management Plan ("Plan").

> *"Without a plan, the governments and individuals responsible for taking care of an urban forest will not be effective in meeting the true needs of the trees and the community. A plan establishes a clear set of priorities and objectives related to the goal of maintaining a productive and beneficial community forest."* | American Public Works Association, 2007

Plan Purpose

Many different City planning and management actions, especially those that occur during redevelopment, have a large impact on the character and condition of the urban and community forest. A thriving and well-maintained urban forest provides a wide variety of benefits to the community. To help ensure that Troy's urban forest will continue to prosper, the City has developed this long-term plan to account for the needs of trees in the urban environment. To develop and maintain desired urban forest resource and program conditions, necessary management actions need to be executed in a timely manner. This Plan provides an overall strategy that will help the City maximize the benefits the urban forest will provide in the years to come.

- ✓ Establish a baseline for the state of the community forest resource, resource management, community framework, and institutional framework.
- ✓ Provide recommendations for a more healthy, vibrant, and sustainable urban forest.
- ✓ Provide the criteria and indicators for achieving goals of sustainable community forest management.
- ✓ Provide the methods for measuring and monitoring Plan implementation success.
- ✓ Be a living document by providing the framework and guidance for adaptive management.

Plan Framework

The best approach to managing a community forest is to develop an organized, proactive program using information (such as data gathered from a tree inventory and outlined in a tree management plan) to set goals and measure progress. This information can be utilized to establish tree care priorities, build strategic planting plans, draft cost-effective budgets based on projected needs, and ultimately minimize the need for costly, reactive solutions to crises or urgent risk mitigation.

In August 2019, Troy's tree and vacant planting site inventory was completed. At the same time, development of this Community Forest Management Plan was underway. This Plan considers the diversity, distribution, and general condition of the inventoried trees, but also provides a prioritized system for managing public trees. The following outline provides the framework of this Plan:

Tasks:

1. Inventory of trees, stumps, and planting sites along public rights-of-way (ROW) and within the City's 14 pocket parks and all trees in landscaped areas of the City's large parks (Riverfront, Frear, Prospect, Knickerbocker).
2. Analysis of tree inventory data.
3. Development of a plan that prioritizes the recommended tree maintenance.

This plan is divided into the following sections:

A. State of the Community Forest Resource (Tree and Vacant Site Inventory Analysis):
   - Summarizes the tree inventory data and presents trends, results, and observations.
   - Summarizes the economic, environmental, and social benefits that trees provide to the community.
B. State of the Community Forest Program:
   - Provides the tree management program recommendations, schedules, and budgets regarding tree removals, maintenance, and planting.
   - Provides an overview of the City's operations, structure, and community engagement relating to community forest management.
C. Tree Maintenance & Planting Recommendations, Work Plan, & Budget
   - Utilizes the inventory data to develop a prioritized maintenance schedule and projected budget for the recommended tree maintenance over an eight-year period.
D. Short & Long-Term Community Forestry Goals
   - In addition to maintenance recommendations, this section provides the road map for Troy to establish a thriving, healthy, and sustainable community forest.

The Guiding Principles of the Community Forest Management Plan

Implementation of this Community Forest Management Plan will adhere to the following guiding principles:

- ✓ Recognize that the trees of the community forest are more than aesthetic enhancements.
- ✓ Trees are the backbone of the urban ecosystem and an essential part of the community's green infrastructure.
- ✓ Promote the health and growth of the community forest by following scientifically established best practices for tree selection, planting, watering, and pruning.
- ✓ Promote a robust community forest through policies and practices that reduce its vulnerability to known diseases or pest infestations, and future threats, including the anticipated effects of climate change.
- ✓ Engage in a continuous process of long-range planning for the growth and maintenance of the community forest.
- ✓ Promote public appreciation of the community forest through educational outreach programs.
- ✓ Support local businesses, institutions, organizations and individuals in their efforts to grow and maintain the community forest through community education.
- ✓ Proceed in a manner that is inclusive and transparent.

State of the Community Forest Resource

To identify the City's community forest resource baseline by analyzing and summarizing the 2019 tree and vacant site inventory data to inform the recommendations in this Plan.

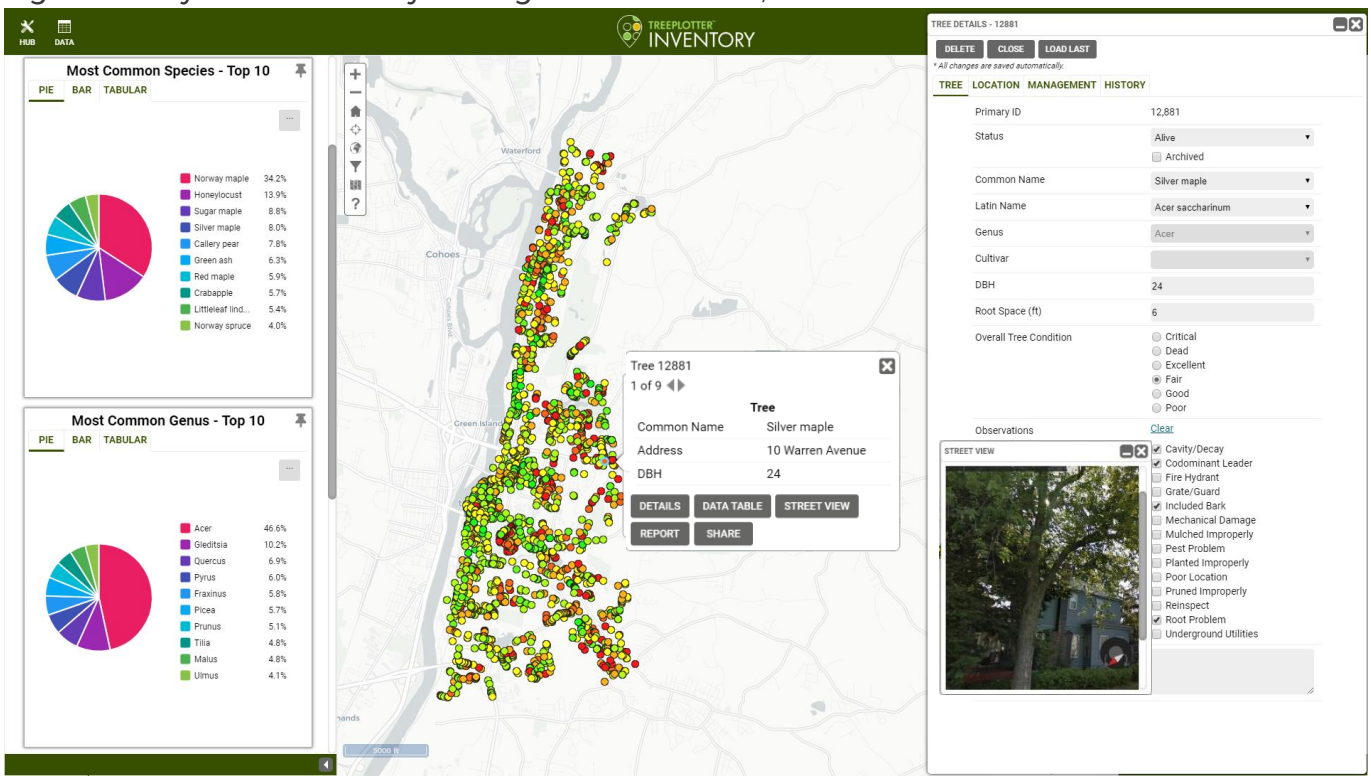
Source: Downtown Troy BID

Summary of City-Owned Trees

In August 2019, PlanIT Geo's Inventory Arborists, certified by the International Society of Arboriculture, assessed and inventoried trees, stumps, and possible planting sites ("vacant sites") within the public rights-of-way (ROW), all trees within the City's 14 pocket parks, and all trees within landscaped areas of the City's large parks (Riverfront, Frear, Prospect, Knickerbocker parks).

The following summaries were completed using the data available in the City's tree inventory management software, TreePlotter, to inform the Community Forest Management Plan recommendations. The data can be viewed at www.pg-cloud.com/TroyNY. Additional features and functionality are available to users with an account.

Figure 3. Troy's tree inventory management software, TreePlotter



Summary of the Tree Inventory Analysis

It should be noted that the tree inventory analysis was completed in March of 2019 and conditions and values may have changed since the completion of this analysis and Plan. As of March 2019, the tree inventory consisted of the following:

14,132	Data points	7,083	Live street trees (71%)
10,021	Total live trees	2,938	Live park trees (29%)
3,558	Potential planting sites	182	Unique tree species
75	Unique genera	36%	Maple (*Acer*) trees
14.3"	Average diameter	67"	Largest diameter
42%	Good condition	81	Priority 1 trees

Assessment of Inventory Data

Data analysis and professional judgment are used to generalize the state of the inventoried tree population ("State of the Community Forest Resource"). Recognizing trends in the data can help guide short-term and long-term management planning. In this plan, the following attributes from the inventoried tree population were assessed:

Assessing Tree Structure

- *Land Use*: These summaries provide an overview of the distribution of trees across the City. Land use may determine existing and potential limitations, such as frequency of watering and available root space, and opportunities, such as volunteer groups or business district incentive programs. Land use may contribute to the tree's condition and growth potential.
- *Location Site* and *Root Space*: This data provides information about the existing and potential constraints or available space for continued healthy growth for a given species. An analysis of condition and these location attributes may inform future planting procedures and species selection.
- *Species and Genera Diversity*: The variety of genera and species in a specific population affects the population's ability to withstand threats from invasive pests and diseases. Diversity also impacts tree maintenance needs, costs, and timing and informs tree planting goals and canopy continuity.
- *Diameter Size Class Distribution*: The statistical distribution of a given tree population's trunk-size class, measured at 4.5-feet above grade or diameter at breast height (DBH) is used to indicate the relative age of a tree population. The diameter size class distribution affects the valuation of tree-related benefits as well as the projection of maintenance needs and costs, planting goals, and canopy continuity.

Attributes Informing Maintenance Needs

- *Condition:* The general health of a tree population, indicates how well trees are performing given their site-specific conditions. General health affects both short-term and long-term maintenance needs and costs as well as canopy continuity.
- *Relative Performance Index (RPI)*: RPI is a comparison of a species' condition rating of "Good" and the tree population's "Good" rating. Using the percent of Good trees for a given species divided by the tree population percentage of Good trees gives a value of equal to 1, less than 1, or greater than 1. A value equal to 1 means the particular species is as healthy as the overall tree population. A value less than 1 means the species isn't as healthy as the overall tree population. A value greater than 1 means the species is healthier than the overall tree population. RPI answers the question of how well a species is performing in terms of health compared to the entire inventoried population.
- *Observations*: Qualitative assessments recorded by the Inventory Arborist regarding a tree feature or feature in proximity to the tree that may affect the tree's existing or future health and/or impact tree maintenance or future. These may be observations caused by abiotic or biotic factors or by anthropogenic agents. Summaries of observations inform future species selection and/or improved planting and maintenance practices.
- *Wire Conflict*: These observations provide information about the preference for a tree at a given site. If routine wire clearance maintenance is conducted for a given tree, a better suited tree for the site may be chosen as the replacement tree after the existing tree reaches senescence and is removed.

- *Hardscape Damage*: These observations inform future tree species selection for a given site and/or the mitigation approach for the tree and/or the hardscape damaged.
- *Maintenance Priority* & *Maintenance Type* descriptions are provided in the Tree Maintenance Recommendations section.

The Structure of City-Owned Trees

The structure of the City-owned trees in rights-of-way and parks describes the tree population in terms of its distribution, number of trees, species composition, growing space, and size classes. These summaries assist urban forest managers in strategic tree management, planting, and community outreach to ensure long lasting canopy and benefits distributed equally across the City. The following summaries include both street and park trees unless otherwise noted.

Tree Distribution

Tree distribution can affect maintenance costs, schedules, and potential risks such as pests or diseases and the effects of climate change such as droughts. Adequate distribution of trees also contributes to the City's pursuit for equitable distribution of tree canopy and associated benefits and equal access to the resource by all residents.

Figure 4. Distribution of live trees

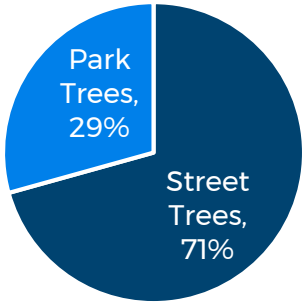


Figure 6. Distribution of live trees by Location Site

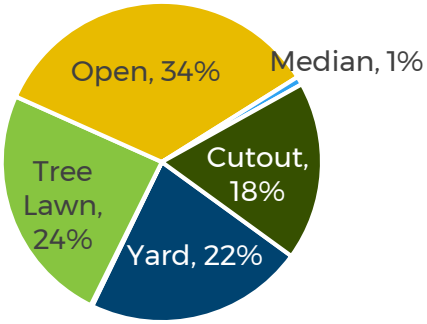


Figure 5. Distribution of live trees by land use

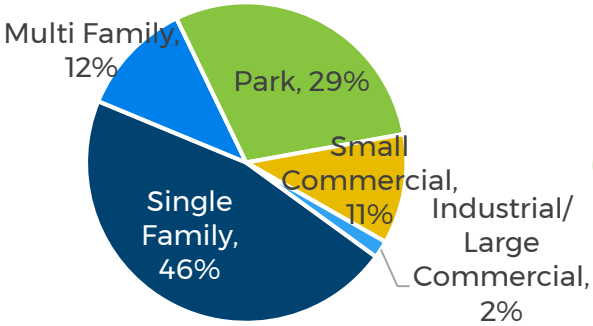
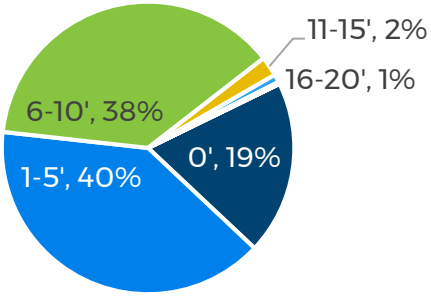


Figure 7. Distribution of live trees by Root Space



Results

Street trees comprise the majority of the inventory with 71% or 7,083 live trees. Of the street trees, 46% (4,635) are in the public rights-of-way adjacent to Single Family land use. Most trees inventoried are in an "Open" Location Site with a total of 3,466 trees (34%) though most trees (40%, 3,982 trees) were recorded as having 1-5 feet of observable root space.

Discussion/Recommendations

Overall, the distribution of trees is a healthy mix of park-street trees distributed evenly across land uses. It is common for less trees to exist in the dense industrial and large commercial land use areas. The low count of median tree plantings is a result of street design that may change as the City continues to implement its Complete Streets Program. One concern is the number of trees growing in planting areas with 1-5 feet of root space. This may cause issues with sidewalks, depending on the species, or infrastructure interference. It should be noted that underground root accommodations may be in place to not affect infrastructure but were not observed. Adequate root space should be considered for new tree installations, sidewalk and infrastructure amendments and installations, and as part of new Public Works' projects.

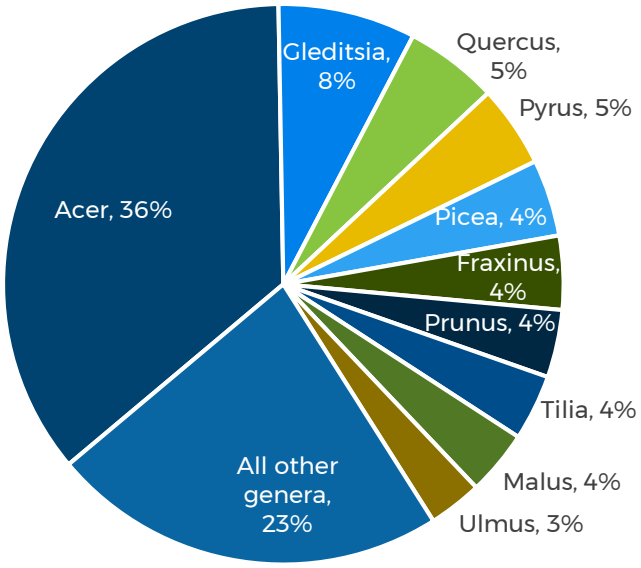
Tree Diversity and Composition

Tree composition data are essential since the types of trees present in a community greatly affect the amount of benefits produced, tree maintenance activities, budgets, planting goals, canopy connectivity, and the City's ability to respond to threats from invasive pests and diseases. Low species diversity (large proportion of the population consisting of trees of the same species) can lead to severe losses in the event of species-specific epidemics such as the devasting results of Dutch elm disease (DED, *Ophiostoma novo-ulmi*) and more recently, emerald ash borer (EAB, *Agrilus planipennis*). Unfortunately, many ash (*Fraxinus)* trees were planted as replacements to elms (*Ulmus*) lost from DED. Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is another potential threat to some of the most prevalent urban shade trees. Tree species diversity is crucial to the resilience of the community forest from these and future unknown threats.

Table 2. Live tree genera diversity Citywide

Genus	**Count**	**% Live Trees**
Acer	3,591	36%
Gleditsia	796	8%
Quercus	539	5%
Pyrus	474	5%
Picea	444	4%
Fraxinus	427	4%
Prunus	391	4%
Tilia	381	4%
Malus	375	4%
Ulmus	310	3%
All other genera	2,293	23%
TOTAL	**10,021**	**100%**

Figure 8. Live tree genera diversity Citywide

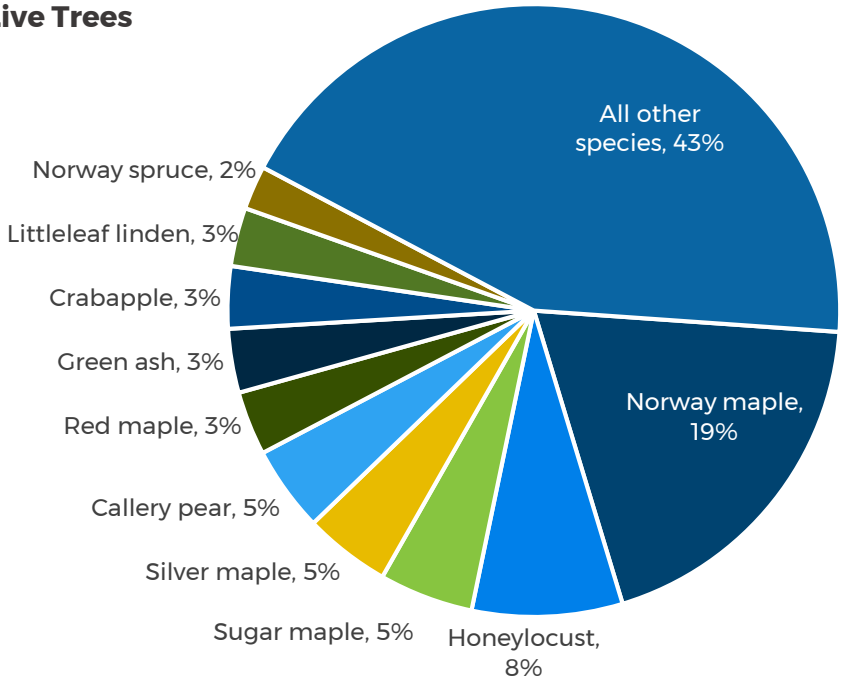


The following provides a summary of the top ten species identified during the 2019 tree inventory data analysis.

Table 3. Tree species diversity

Common Name	**Count**	**% of Live Trees**
Norway maple	1,925	19%
Honeylocust	796	8%
Sugar maple	498	5%
Silver maple	457	5%
Callery pear	452	5%
Red maple	338	3%
Green ash	338	3%
Crabapple	329	3%
Littleleaf linden	310	3%
Norway spruce	232	2%
All other species	4,346	43%
TOTAL	**10,021**	**100%**

Figure 9. Tree species diversity



Results

Based on the inventory data there exists a total of 75 unique genera with the top five comprised of *Acer* (36%), *Gleditsia* (8%), *Quercus* (5%), *Pyrus* (5%), and *Picea* (4%). The top five genera make up 58% (5,844 trees) of the 10,021 total live trees recorded in the 2019 inventory.

Regarding species diversity, there exists a total of 182 unique tree species. The top ten species comprise 57% of the inventory consisting of Norway maple (19%), honeylocust (8%), sugar maple (5%), silver maple (5%), callery pear (5%), red maple (3%), green ash (3%), crabapple (3%), littleleaf linden (3%), and Norway spruce (2%).

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 community forest, a single genus no more than 20%, and a single family no more than 30%. Based on this rule, Norway maples (*Acer platanoides*) exceed the recommended 10% maximum for a single species in a population, comprising 19% of the inventoried tree population. Regarding the genus threshold, maples (*Acer*) far exceed the recommended 20% maximum for a single genus in a population, comprising 36% of the inventoried trees.

Discussion/Recommendations

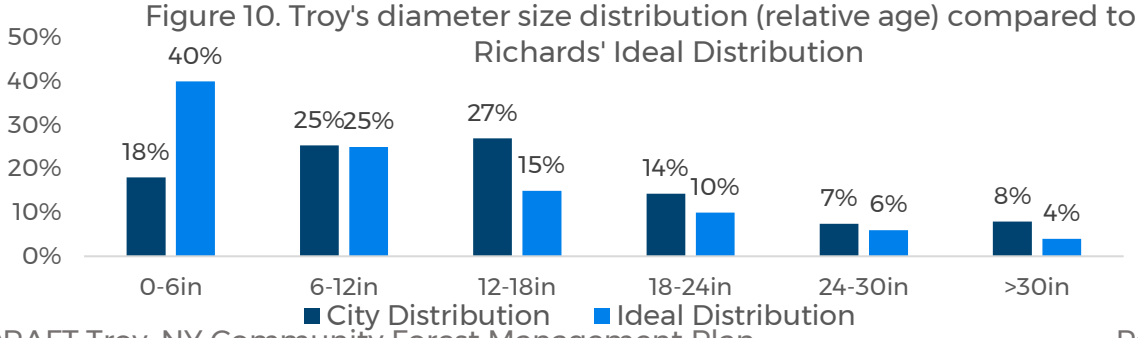
Norway maple dominates the streets (20%) and parks (18%) which is a concern because the abundance of this species in the community forest makes it a limiting species. For a sustainable and resilient community forest, Norway maples, and maples in general, should be limited in new tree installations.

Considering the large quantity of *Acer* (maple) in the City's population, along with its susceptibility to Asian longhorned beetle and granulate ambrosia beetle (*Xylosandrus crassiusculus*), the planting of *Acer* should be limited to minimize the potential for loss in the event these pests appear in the City's community forest. The City should also be considered of the abundance of green ash which is susceptible to emerald ash borer. The City should adhere to the EAB Plan developed by the Street Tree Advisory Board and update a recommended tree species list.

Diameter Size Class Distribution (Relative Age)

The distribution of tree ages influences the structure of the urban forest as well as the present and future costs to the City or property owners. An uneven-age urban forest offers continued flow of benefits and a more uniform workflow allowing managers to more accurately allocate annual maintenance funds. The inventoried trees were categorized into the following diameter size classes: young trees (0-3 and 3-6 inches DBH or diameter at breast height measured at 4.5 feet), established (6-12 inches DBH), maturing (12-18 and 18-24 inches DBH), and mature trees (24-30 and >30 inches). 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.

Figure 10. Troy's diameter size distribution (relative age) compared to the Richards' Ideal Distribution



Results

The diameter classes were chosen so that the tree population could be analyzed according to Richards' ideal distribution (1983).[2] Based on the analysis, the distribution trends towards less ideal; young trees comprise less than half the recommended distribution with 18% instead of 40%. Overall, Troy's distribution of trees greater than 12 inches DBH exceeds the ideal distribution.

Discussion/Recommendations

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 (less than 8 inches DBH), while a smaller fraction (approximately 10%) should be in the large-diameter size class (greater than 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 11. Summary of Troy's tree size distribution compared to the ideal distribution

0-6in	LOW
6-12in	GOOD
12-18in	HIGH
18-24in	HIGH
24-30in	GOOD
>30in	HIGH

Troy has too few young trees and an overabundance of maturing trees (12-24 inches DBH) and a slightly overabundant population of mature trees (>24 inches DBH) suggesting an overly maturing tree population. A goal for Troy's community forest should be to have an uneven-aged distribution of trees at the street, park, and citywide levels. An aging tree population poses a potential increase in maintenance and removal demands and may leave a void in tree canopy and associated benefits if tree planting levels are not elevated. The City is below the threshold for young trees and it will also suffer a loss of ecosystem services that were provided by the mature trees if tree plantings do not increase.

It is recommended that Troy support a strong planting and maintenance program to ensure that young, healthy trees are in place to fill in gaps in tree canopy and replace older declining trees. The City must promote tree preservation and proactive tree care to ensure the long-term survival of older trees. Additionally, tree planting and tree care will allow the distribution to normalize over time.

The distribution of individual tree ages within a tree population influences present and future costs as well as the flow of benefits. If a City assumes responsibility of tree maintenance within public rights-of-way, an ideal age/size distribution in the tree population allows managers to allocate annual maintenance costs uniformly over many years and assures continuity in overall tree canopy coverage and associated benefits which are often dependent on the growing space of individual trees (e.g. open grown versus restricted growing areas).

[2] Richards, N. A. 1983. "Diversity and Stability in a Street Tree Population." *Urban Ecology* 7(2):159–171.

The Condition & Maintenance Needs of City-Owned Trees

Tree characteristics and outside forces affect the management needs for urban and community trees. An analysis of the condition and maintenance requirements enables managers to plan the community forest and target outreach to property owners and the community as a whole. Tree condition indicates how well trees are managed and how well they perform given site-specific conditions. Tree maintenance needs are inventoried for public safety reasons and for the health and longevity of the trees. Understanding the maintenance needs assists tree managers in establishing daily work plans.

Tree Condition

The condition of individual trees was assessed 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 Excellent, Good, Fair, Poor, Critical, or Dead. In this Plan, the general health of the inventoried tree population was characterized by the most prevalent condition assigned during the inventory. Comparing the condition of the inventoried tree population with relative tree age (or size class distribution) can provide insight into the stability of the population.

Figure 12. Condition of all trees

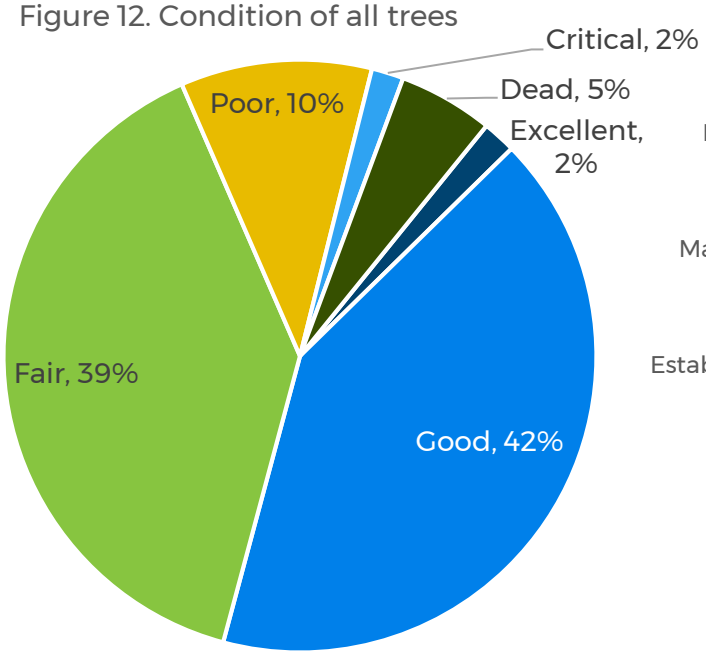


Figure 13. Condition of all trees by relative age class

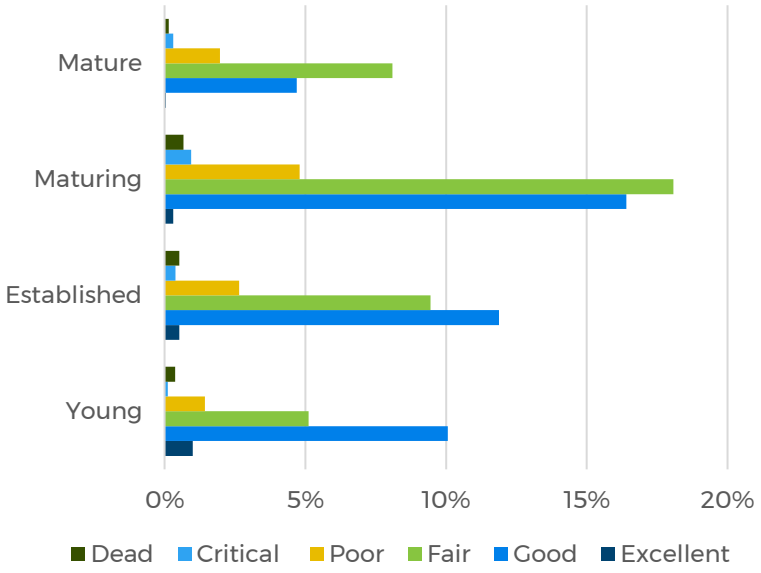


Figure 14. Condition of street trees by relative age class

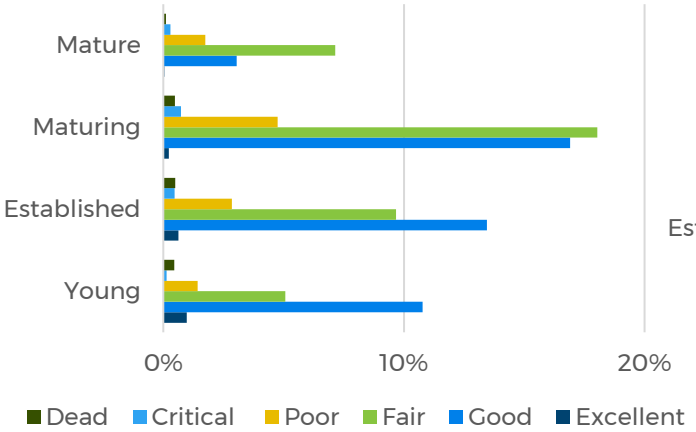
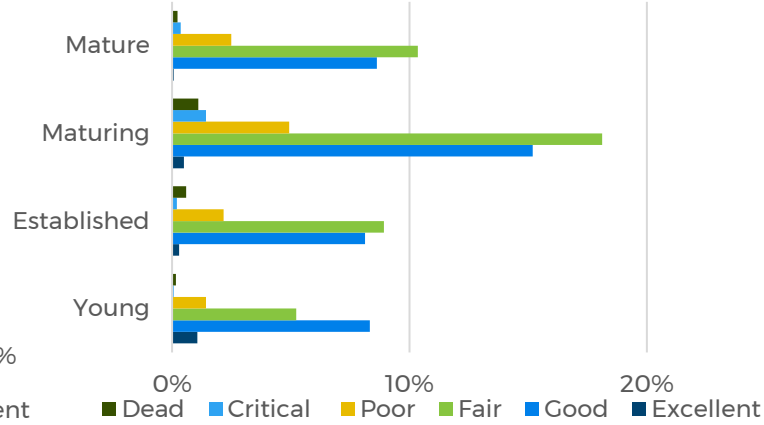


Figure 15. Condition of park trees by relative age class



Results

Tree condition was analyzed Citywide and by location within City parks or public rights-of-way. The overall condition of all trees (both streets and parks) is split evenly between Good (42%) and Fair (39%). Only 2% of all trees are in Critical condition and 5% were recorded as Dead at the time of the inventory.

In addition, the condition was summarized by relative age classes. Comparing the condition of the inventoried tree population with relative tree age (or size class distribution) can provide insight into the stability of the population. As seen in Figure 13, Citywide, most of the young and established trees are in Good condition with 10% and 12%, respectively. The majority of maturing and mature trees are in Fair condition with 18% and 8%, respectively. When comparing Figure 14 and Figure 15 (street versus park trees), a larger percentage of young (11%), established (13%), and maturing trees (17%) are in Good condition in the public rights-of-way compared to parks; whereas, a larger percentage of mature trees are in Good condition in parks (9%).

Discussion/Recommendations

The young, established, and maturing trees in the ROW are in better condition overall compared to the same size class in parks. This may be a result of more frequent care and attention placed on street trees compared to parks. It was observed that mature trees are in better condition in parks compared to the ROW which might be a result of the more abundant growing space commonly available in park settings.

The condition of Troy's inventoried tree population is typical for a Citywide tree population and specifically for the street and park trees. The data analysis has provided the following insight into maintenance needs and historical maintenance practices.

The similar trend in condition across the tree population reveals that growing conditions and/or past management of trees were consistent.

- Younger trees rated in Fair or Poor condition may benefit from improvements in structure that may improve their health over time. Pruning should follow ANSI A300 (Part 1) standards.[3]
- Poor condition ratings among 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 community forest. Following guidelines developed by ISA and those recommended by ANSI A300 (Part 5) standards[4] will ensure that tree maintenance practices ultimately improve the health of the community forest.

[3] ANSI, American National Standards Institute. 2017. ANSI A300 (Part 1)-2017 Pruning
[4] ANSI A300 (Part 5)-2012: Management of Trees and Shrubs During Site Planning, Site Development, and Construction

Relative Performance Index

Relative Performance Index (RPI) is a comparison of a species' condition rating of "Good" and the tree population's "Good" rating. Using the percent of Good trees for a given species divided by the tree population percentage of Good trees gives a value of equal to 1, less than 1, or greater than 1. A value equal to 1 means the particular species is as healthy as the overall tree population. A value less than 1 means the species isn't as healthy as the overall tree population. A value greater than 1 means the species is healthier than the overall tree population. RPI answers the question of how well a species is performing in terms of health compared to the entire inventoried population.

Table 4. Relative Performance Index (RPI) of the most common tree species

Common Name	Relative Performance Index
Norway maple	0.92
Honeylocust	1.08
Sugar maple	0.99
Callery pear	1.13
Silver maple	0.88
Green ash	0.79
Red maple	1.02
Littleleaf linden	1.13
Norway spruce	1.11
Northern red oak	1.11

RESULTS

The table provides a summary of the RPI's in order of abundance in the tree population. Norway maples are most abundant but have a lower RPI (0.92) compared to northern red oak (1.11), honeylocust (1.08), or littleleaf linden (1.13), among others. Though callery pear has a relatively high RPI (1.13), there is concern for the species due to the species' branching structure prone to limb breaks in winds, heavy snow, and/or heavily-leafed limbs. Green ash has the lowest RPI with 0.79 which may be due to the potential presence of emerald ash borer causing tree decline and a lower condition rating overall.

Figure 16: Leaf images of the top ten most common trees in Troy, NY

1) Norway maple, 2) honeylocust, 3) sugar maple, 4) callery pear, 5) silver maple, 6) green ash, 7) red maple, 8) littleleaf linden, 9) Norway spruce, 10) northern red oak (PlanIT Geo photo stock)

Tree Observations

Tree observations were recorded during the 2019 inventory to further describe a tree's health, structure, or location when more detail was needed.

Results

A total of 20,962 observations were recorded during the 2019 tree and vacant site inventory. A total of 9,172 sites (65%) are noted with at least one observation while 4,960 sites (35%) have no observation recorded. Cavities and/or decay were most frequently observed and recorded (55%) during the 2019 tree inventory.

Table 5. Summary of observations tree inventory observations

Observation	Count	% of all Sites
Cavity/Decay	7,727	55%
Codominant Leader	5,656	40%
Included Bark	3,905	28%
Mechanical Damage	1,069	8%
Root Problem	1,024	7%
Pruned Improperly	652	5%
Poor Location	414	3%
Pest Problem	229	2%
Mulched Improperly	108	1%
Underground Utilities	65	0%
Reinspect	36	0%
Fire Hydrant	35	0%
Grate/Guard	27	0%
Planted Improperly	15	0%
Trees with no observation	4,960	35%
Sites with any observation	**9,172**	**65%**
Total observations	**20,962**	**148%**
Total Sites	14,132	100%

Discussion/Recommendations

Trees noted as having defects such as cavity or decay, poor tree architecture (codominant leader), weakly attached branches (included bark), root problems, and/or pest problems should be regularly inspected in addition to the trees noted for reinspection. Corrective actions should be taken when warranted. If the tree's condition worsens, removal may be required. It should be noted that of the 20,962 observations, 2,258 (11%) observations could have potentially been avoided. These observations include mechanical damage, improper pruning, poor location, improper mulching, and improper planting.

The costs for treating deficient trees must be considered to determine whether removing and replacing the tree is the more viable option.

Utility Conflicts

In an urban setting, space is limited both above and below ground. Trees in this environment may conflict with utility wires which may pose risks to public health and safety. Existing or possible conflicts between trees and powerlines were recorded during the 2019 inventory. The presence of overhead utility lines above a tree or planting site was noted. Additionally, hardscape damage was noted when present. It is important to consider this data when planning pruning activities and selecting tree species for planting.

Results

A total of 2,682 (19%) trees were noted with having a conflict with wires. The description of the service line was not included in the tree inventory and therefore, these observations need to be further evaluated. A total of 1,606 (11%) sites were noted for hardscape damage. This may include sidewalk or pavement upheaval.

Table 6. Summary of utility and tree conflicts

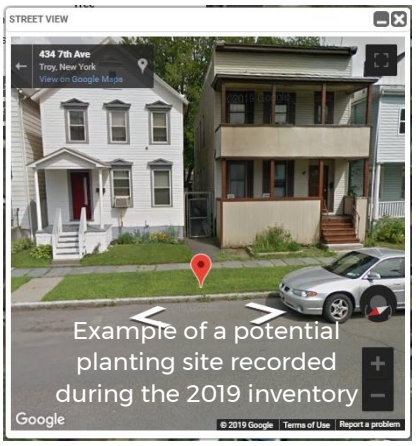
Conflict	Presence of Conflict	Percent
Wire Conflict	2,682	19%
Hardscape Damage	1,606	11%
TOTAL	4,288	30%

Discussion/Recommendations

Planting only small-growing trees within 20 feet of overhead utilities, medium-size trees within 20–40 feet, and large-growing trees outside 40 feet will help improve future tree conditions, minimize future utility line conflicts, and reduce the costs of maintaining trees under utility lines. Future tree installations should consider the growing space, root space, and site conditions to accommodate a tree's potential growth capacity. Existing hardscape conflicts should be remedied when warranted and follow the recommendations provided in this Plan.

Potential Tree Planting Sites

During the 2019 inventory, vacant sites, also referred to as "potential tree planting sites", were inventoried. These inventoried sites are not meant to be fully stocked within the planning horizon of this Plan but are meant to provide information for the City to utilize in all tree planting planning.



Example of a potential planting site recorded during the 2019 inventory

Potential tree planting sites within public rights-of-way (ROW) and in City parks were recorded based on the available growing space, proximity to existing trees, distance from existing above and below-ground utilities, distance from intersections, and other possible obstructions. An inventory of potential tree planting sites can provide information regarding a City's stocking level.

Stocking is a traditional forestry term used to measure the density and distribution of trees. For an urban/community forest such as Troy's, stocking level is used to estimate the total number of sites along the street ROW that could contain trees. The following summary provides available potential planting sites for street ROW and parks and does not provide specific recommendations regarding stocking level. A recommendation for a "no net loss" program is provided in the Tree Maintenance Schedule and Budget worksheet which suggests planting a total of 476 trees (68 trees per year for seven years) to account for the Priority 1 and Priority 2 removals. Additional tree plantings should be considered as part of the City's goal to increase tree canopy cover and provide additional benefits to the community. Additionally, more trees can assist the City in achieving stormwater reduction and water quality goals. Lastly, based on the analysis of the tree diameter classes Citywide, the City should be planting more trees for a more ideal distribution of tree sizes that reduce tree maintenance surges and increase the flow of ecosystem services equally across the City. Planting efforts should consider engaging the community by engaging them in species selection and locations as well as planting and care.

Table 7. Summary of potential planting sites by land use and size of the site

LAND USE	Large	Medium	Small	TOTAL
Industrial/ Large Commercial	12	32	12	**56**
Multi Family	28	104	310	**442**
Single Family	528	734	1,134	**2,396**
Small Commercial	67	69	326	**462**
Park/ Vacant/ Other	51	30	121	**202**
TOTAL	**686**	**969**	**1,903**	**3,558**

Results

A total of 3,558 potential tree planting sites have been recorded in the 2019 inventory. It is not necessarily recommended to stock these sites immediately or even in the seven year cycle but provide the City with information if the opportunity arises. The Single Family land use has the highest overall count of potential planting sites across all three planting site categories.

Value and Benefits of Troy's Trees

The community forest plays an important role in supporting and improving the quality of life in urban areas. A tree's shade and beauty contribute to a community's quality of life and soften the often hard appearance of urban landscapes and streetscapes. When properly maintained, trees provide communities abundant environmental, economic, and social benefits that far exceed the time and money invested in planting, pruning, protection, and removal.

The trees growing along the public streets constitute a valuable community resource. They provide numerous tangible and intangible benefits such as pollution control, energy reduction, stormwater management, property value increases, wildlife habitat, education, and aesthetics.

The services and benefits of trees in the urban and suburban setting were once considered to be unquantifiable. However, by using extensive scientific studies and practical research, these benefits can now be confidently calculated using tree inventory information. The results of applying a proven, defensible model and method that determines tree benefit values for the City of Troy's tree inventory data are summarized in this Plan using the U.S. Forest Service's i-Tree's Streets application. The results of Troy's tree inventory provide insight into the overall health of the City's public trees and the management activities needed to maintain and increase the benefits of trees into the future.

Tree Tools software was developed by the U.S. Department of Agriculture, Forest Service (USDA FS) with the help of several industry partners. Learn more at www.itreetools.org.

Benefit Analysis of Troy's Trees

To identify the dollar value provided and returned to the community, the City's tree inventory data were formatted for use in the i-Tree Streets benefit-cost assessment tool. i-Tree Streets, a component of i-Tree Tools, analyzes an inventoried tree population's structure to estimate the costs and benefits of that tree population. The assessment tool creates an annual benefit report that demonstrates the value street trees provide.

These quantified benefits and the reports generated are described below.

- **Aesthetic/Other Benefits**: Shows the tangible and intangible benefits of trees reflected by increases in property values (in dollars).
- **Stormwater**: Presents reductions in annual stormwater runoff due to rainfall interception by trees measured in gallons.
- **Carbon Stored**: Tallies all of the carbon dioxide (CO2) stored in the urban forest over the life of its trees as a result of sequestration. Carbon stored is measured in pounds.
- **Energy**: Presents the contribution of the urban forest towards conserving energy in terms of reduced natural gas use in the winter (measured in therms [thm]) and reduced electricity use for air conditioning in the summer (measured in Megawatt-hours ([MWh]).
- **Carbon Sequestered**: Presents annual reductions in atmospheric CO2 due to sequestration by trees and reduced emissions from power plants due to reductions in energy use. This is measured pounds and has been translated to tons for this report. The model accounts for CO2 released as trees die and decompose and CO2 released during the care and maintenance of trees.
- **Air Quality**: Quantifies the air pollutants (ozone [O3], nitrogen dioxide [NO2], sulfur dioxide [SO2], particulate matter less than 10 micrometers in diameter [PM10]) deposited on tree surfaces, and reduced emissions from power plants (NO2, PM10, volatile organic

compounds [VOCs], SO2) due to reduced electricity use in pounds. The potential negative effects of trees on air quality due to biogenic volatile organic compounds (BVOC) emissions is also reported.

- **Importance Value (IV)**: IVs are calculated for species that comprise more than 1% of the population. The Streets IV is the mean of three relative values (percentage of total trees, percentage of total leaf area, and percentage of canopy cover) and can range from 0 to 100, with an IV of 100 suggesting total reliance on one species. IVs offer valuable information about a community's reliance on certain species to provide functional benefits. For example, a species might represent 10% of a population but have an IV of 25% due to its substantial benefits, indicating that the loss of those trees would be more significant than just their population percentage would suggest.

The data collected from the inventory of trees completed in August 2019 were analyzed in i-Tree Streets for an understanding of the value and benefits of Troy's City-owned trees. The following provides a summary of the results.

Table 8. Summary of the annual benefits provided by Troy's public trees*

Benefits	Total ($)	Quantity	$/tree	$/capita
Aesthetic/Other	$512,116	N/A	$55.47	$10.22
Stormwater	$155,211	19.4 million gallons	$16.81	$3.10
CO2	$15,194	4.5 million pounds	$1.65	$0.30
Energy	$569,857	904 MWh, 314,761 Therms	$61.72	$11.37
Air Quality	$107,742	21,000 pounds	$11.67	$2.15
Total Benefits	**$1,360,121**		**$147.31**	**$27.13**

*Distribution of benefits per tree and per capita based on 9,233 trees and a population of 50,129 people

Table 9. Summary of benefit data for the common trees in the City of Troy's tree inventory

Most Common Trees*	# of ROW	Canopy	Benefits Provided by Street Trees					Imp.	Repl.	
			Aesthetic or Other	Storm-water	Net CO_2 Benefits	Energy	Air Quality	Value+	Value	
Common Name	Trees** & %	(acres)	Average $/Tree					(IV)	($)	RPI++
Norway maple	1,405, 20%	50	81	19	3	70	14	21.37	$7,767,264	0.92
Honeylocust	642, 9%	24	65	17	2	84	15	9.21	$3,609,936	1.08
Silver maple	356, 5%	24	40	47	3	123	26	10.01	$1,974,503	0.88
Sugar maple	227, 3%	15	76	30	2	83	15	7.77	$1,743,012	0.99
Green ash	233, 3%	10	54	18	2	78	15	3.93	$1,034,523	0.79
Northern red oak	77, 1%	11	61	32	3	99	19	3.89	$2,101,294	1.11
Red maple	257, 4%	7	37	16	1	61	11	3.31	$1,812,649	1.02
Pin oak	150, 2%	9	80	27	3	82	17	3.35	$812,251	1.05
Littleleaf linden	289, 4%	4	34	8	1	44	7	2.23	$1,291,384	1.13
Tree of heaven	59, 1%	3	77	11	1	64	10	1.43	$144,599	0.97
Norway spruce	176, 2%	4	19	13	1	45	9	1.81	$1,326,913	1.11
Callery pear	407, 6%	3	62	4	1	19	4	2.38	$334,141	1.13
Other street trees	2,805, 40%	57	5,895	1,776	158	6,790	1,270	29.30	$8,471,335	
ROW TOTAL	**7,083**	**220**	**6,583**	**2,019**	**179**	**7,641**	**1,431**	**100.00**	**$32,423,805**	**1.00**

* Crabapple is common but not available for the i-Tree Streets analysis
** Count of ROW Trees does not include park trees, dead, or stumps
*** Based on 7,083 living street trees
\+ Importance Value: 0-100 (higher IV = more important species)
++ Relative Performance Index (values of 1 or > = relative good performance)

Results

Based on the 2019 inventory of trees in public rights-of-way (ROW) and in parks, Troy's City-owned tree population provides a total of $1,360,121 in annual benefits by increasing property values, reducing stormwater volumes, sequestering carbon and storing carbon dioxide, conserving energy use, and improving air quality. This value results in approximately $147 in benefits provided by each tree annually and approximately $27 worth of benefits are shared by each resident in the City.

Due to the abundance of Norway maples, this tree species has the highest Importance Value (21.37) and canopy cover area (50 acres) though it doesn't have the highest Relative Performance Index. Callery pear is the third most abundant species but contributes significantly less in terms of benefits and has the lowest replacement value with $333,141.

Tree Species Importance Values (IV)

Understanding the importance of a tree species to the community is based on its presence in the ROW, but also its ability to provide environmental and economic benefits to the community. The IV calculated by i-Tree Streets considers the total number of trees of a species, its percentage in the population, and its total leaf area and canopy cover. The IV can range from 0 to 100, with an IV of 100 suggesting total reliance on one species. If IV's are greater or less than the percentage of a species in the ROW, it indicates that the loss of that species may be more important or less important than its population percentage implies.

Table 10. Tree species with the highest importance values (IV)

Common Name	Importance Value
Norway maple	21.37
Silver maple	10.01
Honeylocust	9.21
Sugar maple	7.77
Green ash	3.93
Northern red oak	3.89
Pin oak	3.35
Red maple	3.31
Callery pear	2.38
Littleleaf linden	2.23

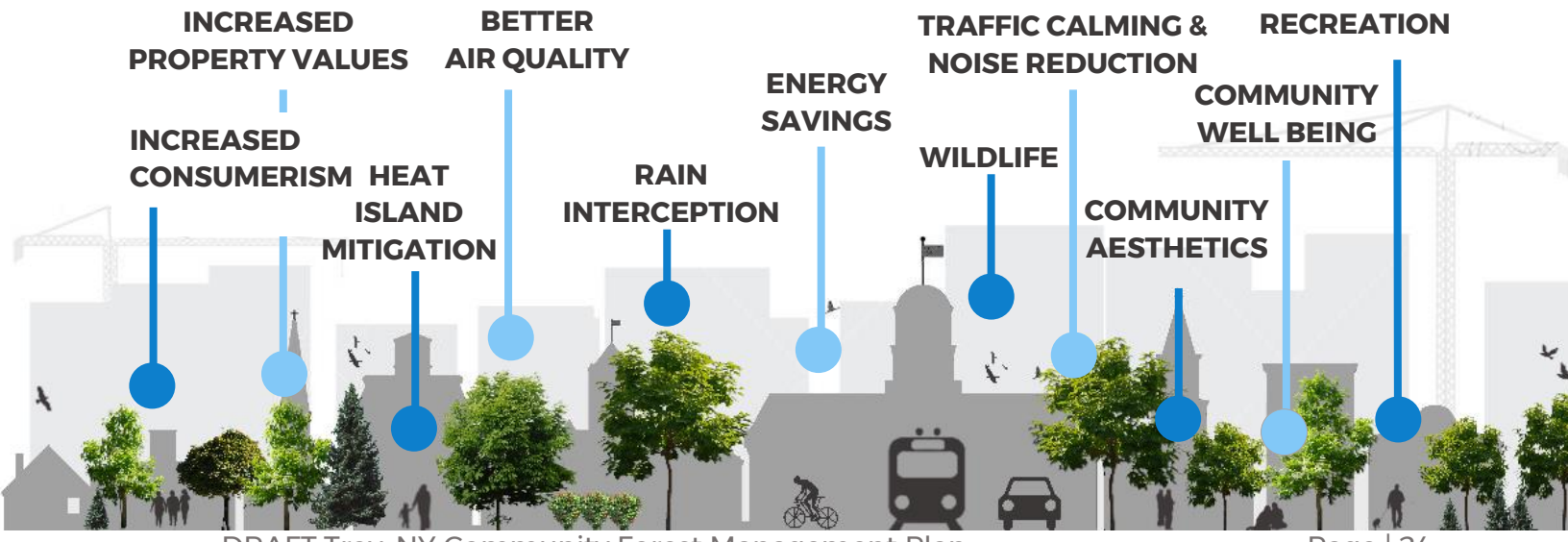
Results

The i-Tree Streets assessment found that Norway maple has the greatest IV in the ROW population at 21.37 and based on the species diversity analysis, it comprises 20% of the ROW tree population (1,405 of 7,083 live trees). This indicates that the loss of the Norway maple population would be economically detrimental. The second highest IV was for silver maple (10.01), followed by honeylocust (9.21) and sugar maple (7.77). Callery pear is the third most common species in the ROW with 407 trees (6%) but has one of the lowest IV's of the top ten most prevalent tree species with a value of 2.23. Callery pear are smaller in size and canopy at maturity and therefore, provide less environmental benefits to the community, which all factor into assigning IV. The IV for black cherry is less than its percentage of the population, indicating that if black cherry was lost, its economic impact would not be as significant.

Figure 17. City's tree inventory management software

The City's tree management software for viewing and managing tree inventory data and pictures gathered from the software of two of the most common species—Norway maple (top) and honeylocust (bottom)

Figure 18. Illustration of the benefits provided by Troy's community forest



To provide tree management recommendations and summarize the programs impacting and influencing the community forest to inform the recommendations in this Plan.

Source: Downtown Troy BID

Tree Management Recommendations and Budgets

This tree management program recommended within the Community Forest Management Plan was developed to uphold Troy's comprehensive vision for preserving its community forest. This seven-year program is based on the tree inventory data. Recommendations for priority maintenance corridors and shared responsibility of tree maintenance with the adjacent property owner are discussed in the Equity of Community Forest Management section. The management program provided in this section describes the recommended approach for proper tree care if no changes are made in tree care responsibility.

This 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. While implementing a tree care program is an ongoing process, tree work must always be prioritized to reduce public safety risks. It is recommended to complete the work identified during the inventory based on the assigned Maintenance Priority—Critical (Priority 1), Immediate (Priority 2), Routine (Priority 3), and Young (Priority 4). However, it is also essential to routinely monitor the tree population to identify other high priority or high risk trees so that they may be systematically addressed. While regular pruning cycles and tree planting is important, priority work (especially for high priority and high risk trees) must sometimes take precedence to ensure that risk is expediently managed. The following maintenance recommendations were recorded during the 2019 inventory:

- *Maintenance Priority:* Informs the maintenance practices and specific trees to address in order of priority. These priorities are categorized as Critical (Priority 1), Immediate (Priority 2), Routine (Priority 3), and Young (Priority 4). Priority 1 and Priority 2 maintenance may refer to the removal of the dead, diseased, damaged, or uprooted tree and/or the removal of a probable or imminent risk such as a broken limb or split leader. Priority 3 maintenance is the routine pruning to manage risk or health, develop structure, provide clearance, manage shape, improve aesthetics, manage fruit or flower production, and/or manage wildlife habitat. Priority 4 maintenance refers to the structural pruning of young, developing trees to remove diseased, damaged, or crossing branches; to form a central branch leader; to improve branching structure; to establish the lowest permanent branch; and/or remove sucker growth and epicormic shoots. Additional Priority 4 maintenance for young trees may include watering, amending or adding mulch, adding or removing stakes or ties, and/or soil amendments or fertilizer treatment.
- *Maintenance Type:* Provides additional information about the maintenance priority recommendation. Understanding the maintenance type helps to establish maintenance routes, schedules, and budgets.

Priority and Proactive Tree Maintenance

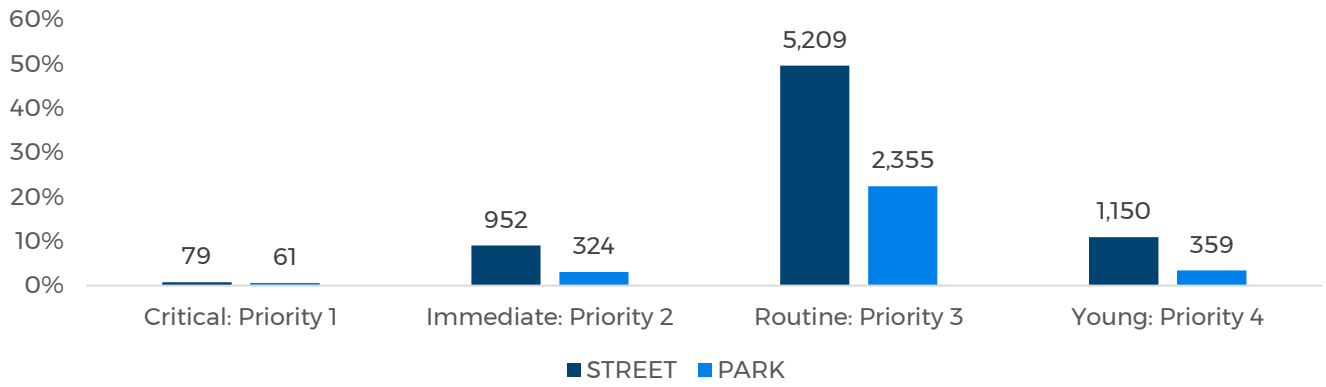
In this Plan, priority tree maintenance includes tree removals and pruning of trees with an assessed Maintenance Priority of Critical (Priority 1) or Immediate (Priority 2). Proactive tree maintenance includes pruning of trees with a Maintenance Priority of Routine (Priority 3) and a Maintenance Priority of Young (Priority 4) for trees that are young and developing. Tree planting, inspections, and community outreach are also considered proactive maintenance.

Maintenance Priority

Although tree removal is usually considered a last resort and may sometimes create a reaction from the community, there are circumstances in which removal is necessary. Trees fail from

natural causes, such as diseases, insects, and weather conditions, and from physical injury due to vehicles, vandalism, and root disturbances. It is recommended 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 warrant removal. Even though large short-term expenditures may be required, it is important to secure the funding needed to complete priority tree removals. Expedient removal reduces risk and promotes public safety. The following sections briefly summarize the recommended removals identified during the inventory completed in August 2019.

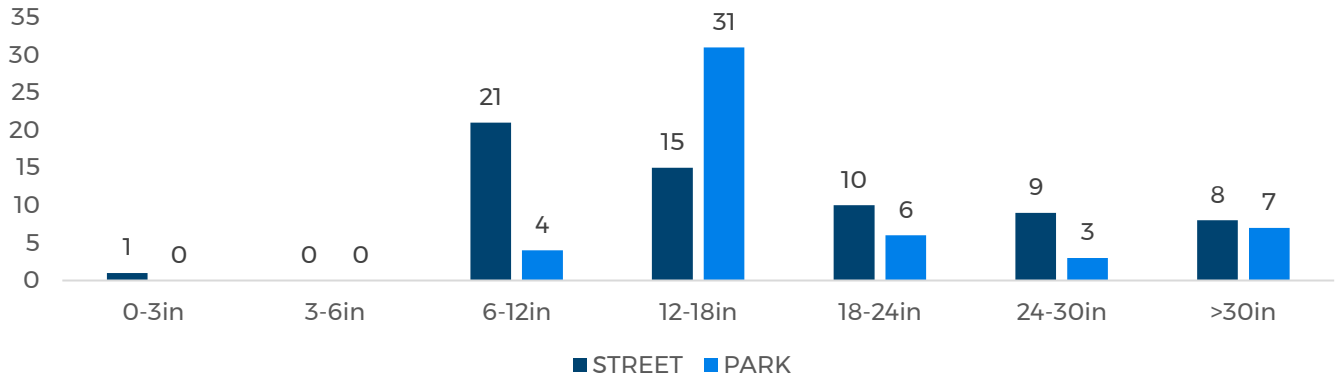
Figure 19. Summary of Maintenance Priority counts and percentages for street and park trees



RESULTS

A total of 140 trees were identified as requiring Critical (Priority 1) maintenance of which 79 trees reside in the public rights-of-way and 61 within the City's parks. Of the 79 street trees, 64 are listed as Critical tree removal.

Figure 20. Count of Critical removals by diameter class for street and park trees



RESULTS

The majority of Critical trees requiring removal within the public rights-of-way are in the 6-12-inch diameter class (21 trees). In the parks, 51 of the 61 trees with a Critical Maintenance Priority are recommended for removal and are primarily in the 12-18-inch diameter class (31 trees).

Table 11. Summary of Critical and Immediate removals and pruning Citywide

	Critical		Immediate	
DBH Class	**Removal**	**Pruning**	**Removal**	**Pruning**
0-3in	1	0	12	0
3-6in	0	0	13	29
6-12in	25	3	93	193
12-18in	46	5	121	335
18-24in	16	5	65	166
24-30in	12	2	25	96
>30in	15	10	32	94
TOTAL	**115**	**25**	**361**	**913**

Results

Table 11 above summarizes the Critical and Immediate removals and pruning Citywide (street and park trees) by diameter (DBH) class. These categories are summarized together due to the importance of promptly addressing Critical and Immediate concerns. There are total of 115 Critical removals of which 46 are in the 12-18-inch diameter class. A total of 121 trees in the same diameter class are noted for Immediate removal. These summaries are applied to the Tree Management Recommendations and Budgets section.

Discussion/Recommendations

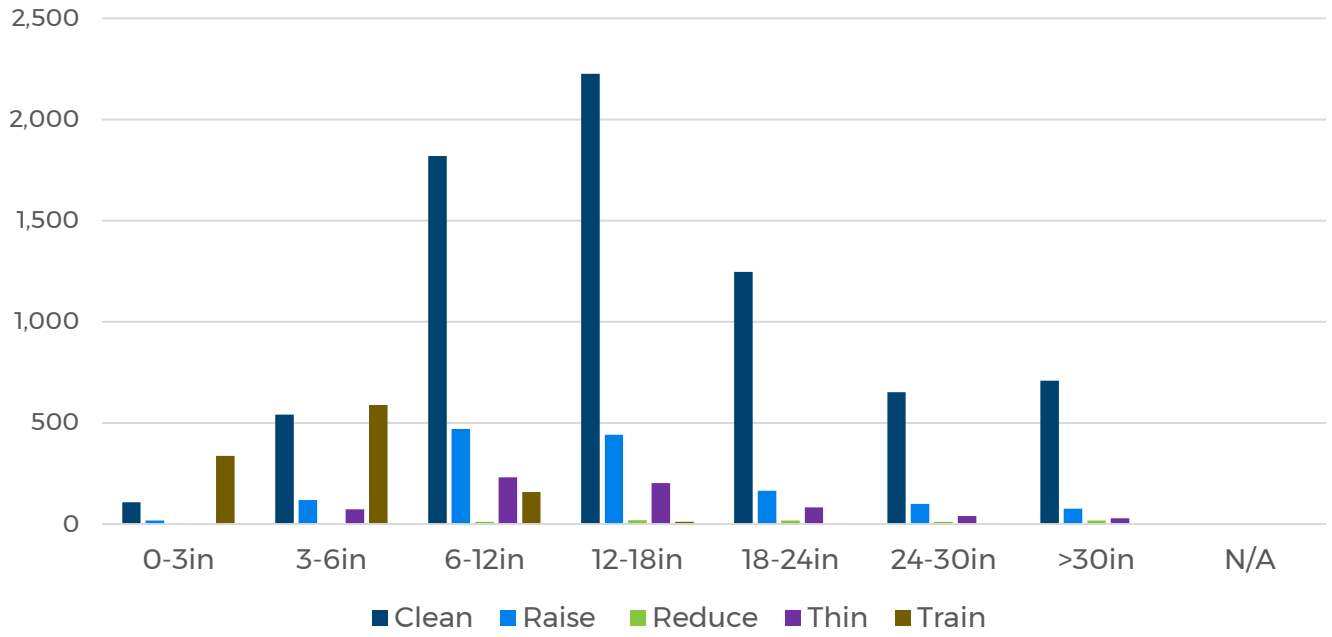
Trees identified as requiring Critical (Priority 1) maintenance with a Maintenance Type recommendation to Remove should be addressed immediately. The count of trees by diameter class nor the size of the tree necessarily dictate priority. Priority should be based on a variety including but not limited to the tree's size, condition, location, potential targets, and other factors. The City should use the TreePlotter software application to locate these trees and prioritize. Following mitigation of the Critical (Priority 1) maintenance, trees listed as Immediate (Priority 2) should be addressed based on the Maintenance Type and other factors previously stated. Immediate (Priority 2) maintenance may coincide with Critical (Priority 1) maintenance if the trees are in close proximity to one another or other factors that support cost and time efficiency and promptness of tree issue mitigation.

Unless already slated for removal, trees noted as having poor tree architecture or weakly attached branches and codominant stems or missing or decayed wood should be inspected on a regular basis. These observations can be filtered in the City's TreePlotter software application to identify the location of these trees for monitoring. Summaries of observations are provided further in this analysis. Corrective action should be taken for these observations when warranted. If their condition worsens, tree removal may be required. Proactive tree maintenance that actively mitigates elevated-risk situations will promote public safety. Updating the tree inventory data can streamline workload management and lend insight into setting accurate budgets and staffing levels. Inventory updates should be made electronically and can be implemented using the City's TreePlotter or similar software applications.

Proactive Tree Maintenance

The following summaries provide information regarding routine pruning of trees to prevent future issues and to improve the overall health of the tree. This information is used to inform the recommended Routine (Priority 3) maintenance tasks to establish the maintenance cycles and associated costs.

Figure 21. Summary of Maintenance Type for all trees by diameter class



Results

The majority of trees that are not Critical or Immediate Priority have been assigned "Clean" as a routine tree maintenance recommendation. This recommendation has the highest count for each of the diameter classes except for the 0-3-inch class where "Train" has been assigned to improve young tree structure.

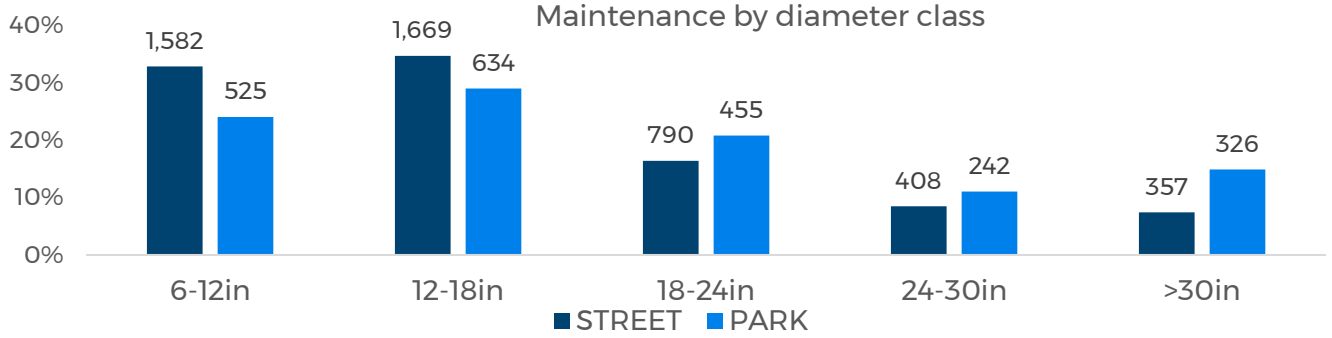
Discussion/Recommendations

This information is used to inform the Routine (Priority 3) maintenance summarized in the following section.

Proactive Tree Maintenance – Priority 3 (Routine)

The previous section summarized the general Maintenance Type assigned to trees not requiring Critical or Immediate maintenance. This general type of maintenance applies to the routine pruning of trees for maintaining the health of the tree and the safety of the public. As such, trees with this Maintenance Type recommendation were assigned a Maintenance Priority of "Routine (Priority 3)". Routine pruning generally requires cleaning the canopy of both small and large trees to remove 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. The following chart provides a summary of the Priority 3 trees by diameter class since the size of the tree and their frequency can affect maintenance costs.

Figure 22. Summary of street and park tree Priority 3 (Routine) Maintenance by diameter class



Results

Street and park trees greater than 6 inches in DBH were summarized to understand the distribution of Priority 3 (Routine) trees. Of the 6,988 trees recommended for Routine (Priority 3) maintenance, 4,806 are street trees and 2,182 are park trees. The 12-18-inch diameter class contain the highest counts of Priority 3 trees in both the rights-of-way and in parks with 35% and 29%, respectively. The diameter class with the lowest count of trees recommended for Priority 3 pruning in the ROW is the >30-inch class with 357 trees. For parks, the 24-30-inch diameter class has the lowest count with 242 trees.

Discussion/Recommendations

The Routine (Priority 3) Maintenance summary provides an overview of the trees that specifically require routine pruning to remove defects such as dead and/or broken branches that may be present even when the rest of the tree is sound and/or the pruning of branches for clearance of roadways, pedestrians, parking, signs, and/or utilities. These summaries do not provide the complete picture of what is required for a Citywide routine pruning cycle of public rights-of-way trees because it does not include all eligible trees, only trees specifically identified during the 2019 inventory. The following section provides the appropriate tree numbers that were used in provided the recommended tree maintenance cycle.

Street and Park Tree Pruning Cycles

The goals of pruning cycles are to visit, assess, and prune trees on a regular schedule to improve health and reduce risk. It is recommended that pruning cycles begin after all Critical (Priority 1) and Immediate (Priority 2) trees are corrected through removal or pruning. However, due to the long-term benefits of pruning cycles, the pruning cycles should be implemented as soon as possible. To ensure that all trees receive the type of pruning they need to mature with better structure and lower associated risk, two pruning cycles are recommended: the routine pruning cycle and the young tree pruning 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 young tree cycle once they become established. As young trees reach maturity, they will be shifted from the young tree cycle into the routine pruning cycle. When a tree reaches the end of its useful life, it should be removed and eliminated from the routine pruning cycle.

For many communities, a proactive tree management program is considered unfeasible. An on-demand response to urgent situations is often the approach. Research has shown that a proactive program that includes a routine pruning cycle will improve the overall health of a tree population. 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 helps detect and eliminate most defects 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. This recommended pruning cycle is provided though recommendations in this Plan include the development of tree maintenance priority corridors and a shared responsibility of tree maintenance between the City and the adjacent property owners. As stated above, the pruning cycles should be adjusted as trees are planted and removed and as trees mature and transition from the young tree pruning category to the routine pruning category. The first installment of this approach for routine pruning is provided in the following figure.

Routine Pruning Cycle Overview

Figure 23. Summary of the pruning cycle decision process for street and park trees

Street Tree Pruning Cycle	Trees	Trees	Park Tree Pruning Cycle
Total data points	14,132	14,132	Total data points
trees >6"	11,747	11,747	trees >6"
and not park trees	8,977	2,770	and only park trees
and not a planting site	6,079	2,614	and not a planting site
and not dead, stump, or removed	5,760	2,454	and not dead, stump, or removed
and not Critical or Young Priority	5,492	2,366	and not Critical or Young Priority
and not with Maintenance Type "Remove"	**5,252**	**2,280**	and not with Maintenance Type "Remove"

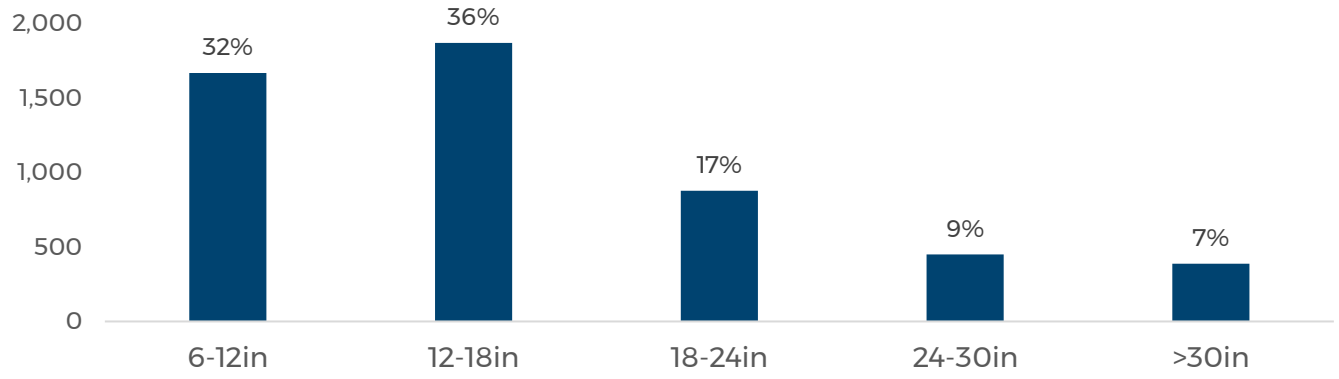
By filtering the data in the City's tree inventory software, TreePlotter, the total number of trees applicable for a pruning cycle were determined. To summarize the figure above, living street and park trees greater than 6 inches DBH (trees <6 inches are separated for young tree pruning cycles) that may have an Immediate Priority but are not recommended for removal and are not listed for Critical or Young Maintenance Priorities are eligible for a routine established and mature-tree pruning cycle. Street and park trees are separated because of the structure of the City's tree maintenance program and to enable the development of schedules and pruning grids.

Street Tree Routine Pruning Cycle

The routine pruning cycle for street trees includes established, maturing, and mature trees (mostly greater than 6 inches DBH) that need cleaning, crown raising, and reducing to remove deadwood and improve structure. Over time, routine pruning can reduce reactive maintenance, minimize instances of elevated risk, and provide the basis for a more defensible risk management program.

The length of the street tree routine pruning 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. Generally, the routine pruning cycle recommended for a tree population is five years but may extend to seven years if the population is large.

Figure 24. Street trees recommended for the routine pruning cycle summarized by diameter class (inches)



Street Tree Pruning Cycle Recommendations & Schedule

It is recommended that the City establish a seven-year routine pruning cycle for street trees in which approximately one-seventh of the tree population is to be pruned each year. The 2019 tree inventory identified approximately 5,252 trees that should be pruned over a seven-year

cycle. This results in an average of 750 trees to be pruned each year over the course of the cycle. It is recommended that the routine pruning cycle begin in Year Three of this seven-year plan, after all Critical (Priority 1) and Immediate (Priority 2) trees are addressed.

The inventory found that most trees (5,252 street trees of 7,083 total street trees, 74%) needed routine pruning. Figure 24 shows that a variety of tree sizes will require pruning; however, most of the street trees that require routine pruning were smaller than 18 inches DBH.

Park Tree Routine Pruning Cycle & Recommendations

In addition to the street tree pruning cycle, a routine maintenance schedule is recommended for park trees. Based on Figure 23 on the previous page, a total of 2,280 park trees are suitable for a routine pruning cycle (living park trees >6 inches DBH and not a Critical or Young Priority).

Figure 25. Summary of the diameter classes of the park trees for routine pruning

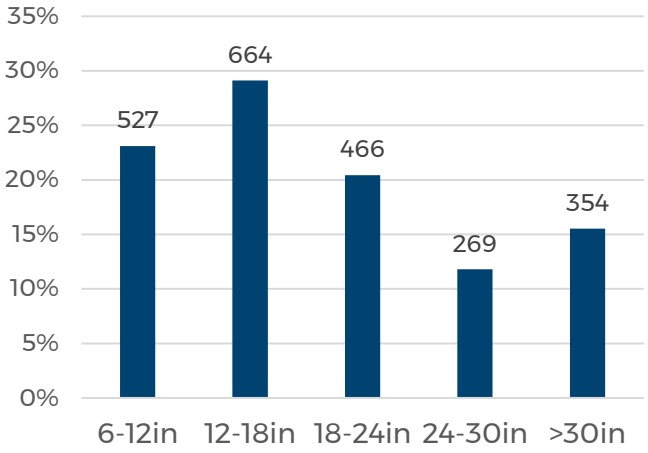
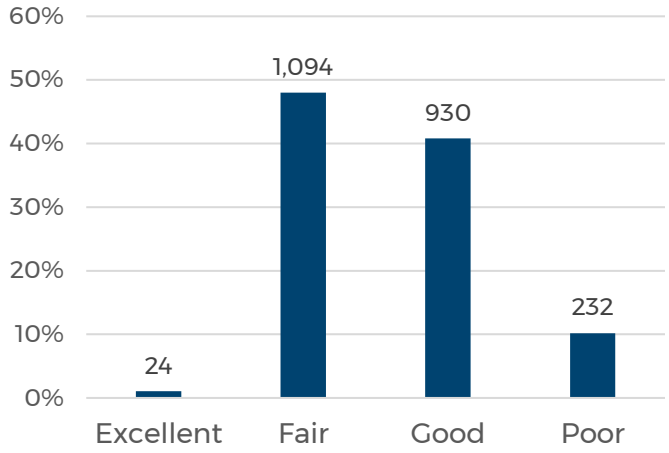


Figure 26. Summary of the condition of park trees for routine pruning



The City park name was not included in the data collection, so the total number of park trees to prune each year should be divided among the 14 pocket parks and four large parks for the seven-year maintenance period. With 2,280 total park trees suitable for routine pruning, approximately 326 park trees should be pruned per year. Based on the figure above, the 12-18-inch diameter class comprises most of the park tree routine pruning with 664 trees or 29%. The park trees suitable for routine pruning includes only living trees though some of the park trees are in less than Fair condition (232 Poor trees) and should be monitored and evaluated for removal rather than routine pruning in subsequent years. Any Immediate Priority maintenance should be completed before those trees are added to the pruning cycle.

Young Tree Pruning Cycle & Recommendations

Trees included in the young tree training pruning cycle are generally less than 6 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, crossing/interfering limbs, or dead/diseased/damaged limbs. If these problems are not corrected, they may worsen as the tree grows, increasing risk and creating potential liability. Young tree training pruning is performed to improve tree form or structure; the recommended length of the young tree pruning cycle is three years because young trees tend to grow at faster rates (on average) than more mature trees. The young tree cycle differs from the routine pruning 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. Young tree training pruning is species-specific, since many trees may naturally have more than one leader. For such trees, young tree training pruning is performed to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree. In addition to training pruning, young trees may also require additional maintenance such as added or amended mulch, watering, added or removed stakes and ties, and/or clearance of debris and litter. These activities can potentially be remedied during the young tree training pruning.

Figure 27. Count of young trees for training pruning cycle along streets and in parks

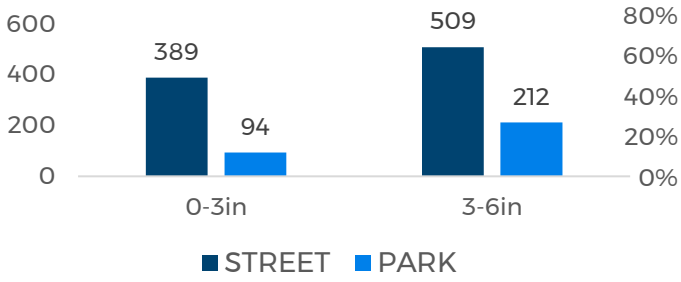
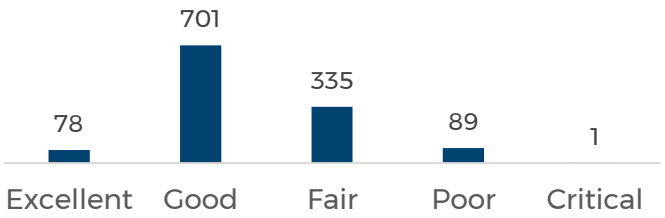


Figure 28. Condition of street and park trees considered for the young tree training pruning cycle



Young tree training pruning is recommended Citywide (street and park trees) for trees less than 6 inches in diameter and is shown in the Tree Maintenance Schedule and Budget table as such. There are 898 street trees and 306 park trees in these diameter classes which total 1,204 trees suitable for the training pruning cycle. The process for identifying these suitable trees is described in Figure 23.

Young trees that are less than Good condition should be monitored and appropriately addressed to ensure health. Young trees that cannot recover should not be included in the cycle and should instead be removed and replaced.

Summary of Recommended Tree Management Activities

Utilizing data from the 2019 tree inventory, an annual maintenance schedule was developed that details the number and type of tasks recommended for completion each year. The budget projections are based on industry standards and public bid tabulations. Actual costs were not specified by Troy. A summary of the maintenance schedule is presented; a complete table of estimated costs for Troy's seven-year tree management program follows. The schedule provides a framework for completing the inventory maintenance recommendations over the next seven years. Following this schedule can shift tree care activities from an on-demand system to a more proactive tree care program.

As seen in Appendix L, the Tree Maintenance Schedule and Budget, to implement the street and park tree maintenance schedule of Priority 1 and 2 removals, Priority 1 and 2 pruning, routine pruning, training pruning, and replacement planting, the City's tree maintenance budget should be no less than $168,918 for the first year of implementation, no less than $298,542 for the second year, no less than $714,753 for the third year, and no less than $306,130 for the final four years of the maintenance schedule.

This maintenance schedule addresses the 115 Priority 1 (Critical) removals, 361 Priority 2 (Immediate) removals, 25 Priority 1 (Critical) pruning, and 913 Priority 2 (Immediate) pruning trees within the first three years, beginning in 2020. This includes trees in the public rights-of-way and in parks with this Maintenance Priority. A total of 1,204 street and park trees are less

than 6 inches in diameter and require young tree maintenance for establishing proper branching structure and tree health. This maintenance activity is included in the maintenance schedule and it is recommended to prune these trees on a three-year cycle (~400 trees per year). The routine pruning cycle of 5,252 street trees—or 750 trees per year for seven years—begins in the third year. See Figure 23 on page 31 for a description of how 5,252 street trees were determined for the seven-year street tree routine pruning cycle. The routine pruning cycle for parks begins in year three and is approximately 326 trees per year for the seven-year cycle to be distributed across the City's 14 pocket parks and four large parks.

Annual budget funds are needed to ensure that high risk trees are remediated and that crucial routine pruning and young tree pruning cycles can begin. With proper professional tree care, the safety, health, and beauty of the community forest will improve.

If routing efficiencies and/or contract specifications allow for the completion 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 severe 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.

This information should be presented to the City when discussing tree maintenance priority corridors, shared responsibility of tree maintenance, budgets, and staffing levels.

Table 12. Summary of tree maintenance activity costs

Activity	2020	2021	2022	2023	2024	2025	2026	TOTAL
Priority 1 Removals	$8,175	$30,450	$78,575	$0	$0	$0	$0	$117,200
Priority 2 Removals	$21,275	$89,250	$212,525	$0	$0	$0	$0	$323,050
Stump Removals	$2,488	$10,062	$24,468	$0	$0	$0	$0	$37,018
Priority 1 Pruning	$1,020	$2,080	$3,740	$0	$0	$0	$0	$6,840
Priority 2 Pruning	$11,250	$41,990	$102,915	$0	$0	$0	$0	$156,155
Street Tree Routine Pruning	$0	$0	$109,180	$109,180	$109,180	$109,180	$109,180	$545,900
Park Tree Routine Pruning	$0	$0	$58,640	$58,640	$58,640	$58,640	$58,640	$293,200
Training Prune	$10,430	$10,430	$10,430	$10,430	$10,430	$10,430	$10,430	$73,010
Replacement Plantings	$21,080	$21,080	$21,080	$21,080	$21,080	$21,080	$21,080	$147,560
Replacement Tree Training	$0	$0	$0	$13,600	$13,600	$13,600	$13,600	$54,400
Annual Mature Tree & Planting Mortality	$93,200	$93,200	$93,200	$93,200	$93,200	$93,200	$93,200	$652,400
TOTAL	$168,918	$298,542	$714,753	$306,130	$306,130	$306,130	$306,130	**$2,406,733**

CITY OF TROY COMMUNITY FORESTRY PROGRAM

To inform the recommendations provided in this Community Forest Management Plan, a systematic analysis was conducted by utilizing the Criteria and Indicators for Strategic Urban Forest Management and Planning approach.[5]

In 2011, Kenney, van Wassenaer, and Satel published a set of 25 Criteria and Indicators (C&I) for the assessment of a community's urban forest resource and its management program. Based on the work of Clark *et al*. (1997), this assessment methodology allows for a comparison of the current status of various criteria related to a community's urban forest resource, community and institutional framework, and resource management approach in relation to key objectives and indicators of success. For Troy's Plan, a total of 31 criteria were developed for a more comprehensive analysis and planning process. An assessment using this framework can identify critical gaps in a community's urban forestry program, establish goals, and help to prioritize management activities and resource allocation. When utilized at the outset of the community forest planning process, a C&I assessment can also serve as a baseline for future monitoring efforts. This baseline can be referred to at the end of each of the Plan's management periods (eight years planning, seven year pruning cycle) to track progress towards program goals. The C&I approach, along with specific targets established in the Plan, is a critical component of the active adaptive management process. The U.S. Forest Service's Urban Forest Sustainability & Management Audit (description in Appendix B), research, and applications of industry standards were used to complete the Criteria and Indicators. The complete list of criteria and indicators used for development of Troy's Community Forest Management Plan are provided in Appendix C. Additional information about the planning approach is provided in Appendix A.

To inform the C&I process, extensive research was conducted regarding City operations and workflows. Community forestry impacts and is influenced by a multitude of City departments. The following provides an overview of some of the key players, though others such as Parks and Recreation, Public Utilities, Housing and Community Development, Code Enforcement, Legal Department, Economic Development, Planning Commission, Historic District Commission, Troy Industrial Development Authority, Environmental Commission, and the Zoning Board of Appeals should be recognized.

City of Troy Planning Department

The Planning Department is responsible for the planning, development, coordination and promotion of the physical, social and economic well-being of the City. The department serves as staff and adviser to the City Planning Commission, the Historic District Commission, the Zoning Board of Appeals, the Troy Industrial Development Authority, the Troy Local Development Corporation, the Environmental Commission, their successor agencies or others, as may be assigned by the Mayor. The Empire Zone programs are also administered by the Planning Department. This Department also works closely with the Street Tree Advisory Board. A recent example includes the pursuit of this Community Forest Management Plan.

City of Troy Street Tree Advisory Board

Members of the Street Tree Advisory Board are appointed by the Mayor with the general charge of overseeing the development of plans and the planting of City street trees and open spaces to strengthen existing streetscape images, create identifiable images for particular types of streets, and to create a more pleasant environment in the City of Troy. As described in the

[5] W. Kenney, P. Wassenaer, A. Satel. Criteria and Indicators for Strategic urban Forest Planning and Management. ISA Arboriculture & Urban Forestry Scientific Journal. 2011, 37(3): 108-117.

proposed Street Tree Ordinance, the Street Tree Advisory Board aims to oversee these plans and planting as well as the following:

- Oversee annual tree planting plans.
- Oversee the 2019 tree inventory project and use of the data for making tree planting recommendations for selected areas.
- Prepare and update a list of trees suitable for street tree planting in the City.
- Make recommendations to the Planning Commission relating to all landscape issues.
- Make recommendations to the City Engineer relating to the planting, maintenance, and removal of City shade trees as deemed necessary.
- Form subcommittees that may include interested citizens to addressed identified issues with the City's urban and community forest.
- Help to create greater community awareness regarding the value and care of the City's trees.

The Street Tree Advisory Board works closely with the City's Planning Department and Department of Public Works as well as the Capital Roots program.

Department of Public Works

The Department of Public Works is responsible for the receipt, review, and response to tree service requests including tree maintenance, tree removal, and tree assessments to determine service. Recommendations for updates to this process are provided in the Community Engagement section.

The Department's Bureau of Street Maintenance has the responsibility for public services which includes tree removals within the rights-of-way along approximately 147 miles of streets. The Department's Bureau of Engineering is responsible for all public works engineering projects in the City which includes services such as surveys, studies, construction supervision, engineering solutions, mapping, permit administration, technical research, and planning for all DPW Bureaus.

The DPW and specifically these Bureaus play a vital role in the management, preservation, and enhancement of the community forest. Information regarding the tree removal process and tree preservation recommendations are provided in the Community Engagement section.

Capital Roots

The Capital Roots started in 1975 as a community service project of Garden Way, the former manufacturer of Troy-Bilt Lawn and Garden Equipment. Today, Capital Roots manages a variety of projects and programs such as the Urban Green Program.

Urban greening refers to public landscaping and urban forestry projects that create mutually beneficial relationships between city dwellers and their environments. Since the creation of the Urban Greening program in 1989, Capital Roots has planted thousands of trees and implemented many public landscaping projects throughout New York's Capital Region, including the City of Troy. Each planting season, Capital Roots engages dozens of volunteers, many of whom are high school students, in city-wide tree planting projects.

Specific to Troy, in October of 2016, Capital Roots staff, volunteers and the City of Troy's Street Tree Advisory Board joined together to plant 50 trees throughout the City. Trees of all varieties were planted in Lansingburgh and North Central and Downtown Troy. Capital Roots has been planting street trees in the City of Troy for decades and more recently than the 2016 example.

Capital Roots utilizes the NYS DEC Urban and Community Forestry Grant Program to receive tree planting funds. Trees are planted directly by the City and also through requests received from applications submitted by the community. This includes home and business owners interested in having trees planted. The continued partnership with Capital Roots is crucial to implementation of this Community Forest Management Plan.

See the Community Engagement section for additional information regarding City partners.

Source: Capital Roots

A successful plan and community forestry program blend the various needs, opportunities, perspectives, and preferences of stakeholders and listens to the community.

Source: Capital Roots

Guidance & Recommendations for Street Tree Service Requests

The City is responsible for the management of trees in the public rights-of-way ("ROW", or "street trees"), including design, installation, and stewardship of trees and landscapes and permitting of actions that could impact these trees. The City is responsible for over 10,000 street trees (plus 3000+ park trees in maintained areas) and has goals to increase canopy cover while enhancing the health and sustainability of trees. At the City's current staffing levels, adequate tree maintenance cannot be attained. The City should review the recommendations in this Community Forest Management Plan regarding priority maintenance corridors and consider a shared responsibility of street tree management with the adjacent property owners.

The City does have a tree service request form online that is in place to manage, monitor, and/or preserve the community forest within the rights-of-way. Currently the online service request form includes options to request services for a dead, dying, defective, and/or diseased tree as well as for services relating to root problems. The form does not expand on "defective" which may include tree limb clearance issues, broken limbs, trunk cracks, or trunk seams that could be evaluated and possibly amended to preserve the tree rather than remove the tree.

As stated in Chapter 251, Streets and Sidewalks, section 251-4 of Troy's City Code, the adjacent property owner or occupant is responsible for the repair or replacement of damaged or impaired sidewalks. There exists a conflict that is not uncommon in communities; the City desires to plant trees and increase canopy cover but trees may pose future costs in terms of sidewalk repair for the adjacent property owner. Often, when trees begin to impede the sidewalks, the decision or a request is made to remove the tree responsible.

To better address the concerns of the community while pursuing goals of a thriving, healthy, and sustainable community forest, improved approaches to street tree service requests are recommended.

1. Preparation

To carry out an effective tree service request program, certain preparations are required.

A. Street Tree Ordinance

The first recommended preparation task regarding tree service and removal requests made by the general public is the adoption of a Street Tree Ordinance for the City of Troy. A Street Tree Ordinance regulates various aspects of tree maintenance, removal, and planting in a city's public right-of-way (and/or parks) for the appropriate preservation of trees for environmental, social, and economic benefits provided by the collective community forest.

In 2016, the City's Street Tree Advisory Board developed a draft Street Tree Ordinance. This ordinance is attached as part of the Community Forest Management Plan in Appendix M and includes suggested revisions or amendments and the process for ordinance adoption.

B. Department Responsibilities & Structure

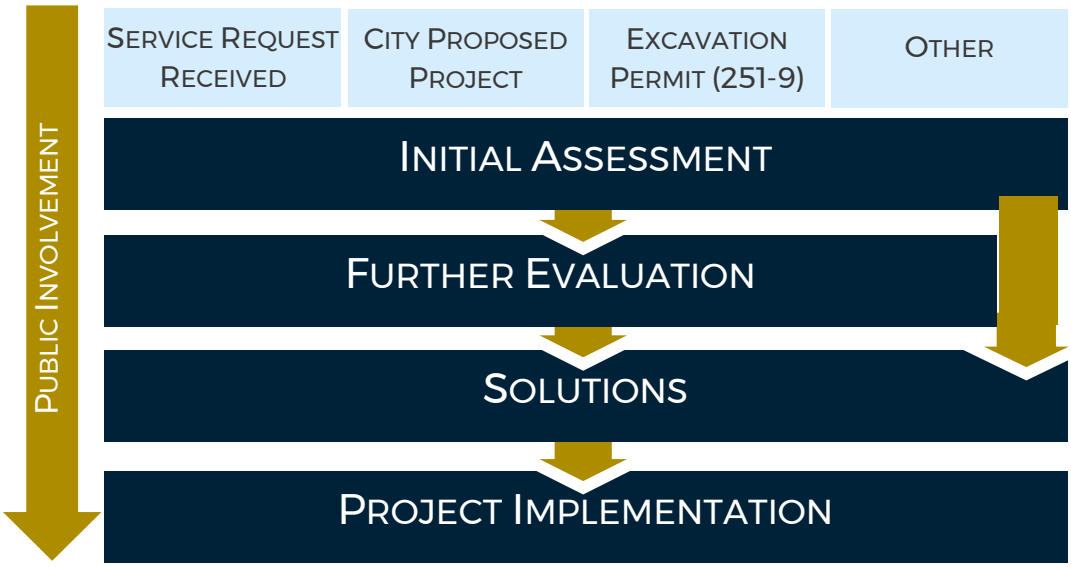
The daily demands of City operations and procedures limit the amount of time available for the review of street tree service and removal requests. Alternatives to tree removal are sometimes overlooked or not known due to insufficient time, training, or experience. Also, storm events and potential tree pest or disease outbreaks may cause a surge in service requests. For these reasons and others, it is recommended to clearly define responsibilities, structure and workflows regarding service requests and implemented measures.

Currently, the City's Department of Public Works is responsible for the receipt, review, and response to tree service requests. It is recommended that the Street Tree Advisory Board have a primary role and responsibility in the review of service requests regarding tree pruning, removal, inspection, and planting. It is also recommended to have the DPW staff trained to identify obvious and inconspicuous tree defects, signs, and symptoms that may warrant a tree for removal. Understanding these observations can help to identify alternatives to tree removal if available. The DPW staff and supporting staff should also be trained in the updated decision matrix that is described in the next section.

C. Decision Matrix

During the development of the Community Forest Management Plan, the need to clarify the decision process to address tree and sidewalk conflicts became apparent. Having clear direction for making a decision about the tree removal request can reduce community complaints. In some cases, the adjacent property owner, occupant, and neighbors can all be involved in the process and have differing views and desired outcomes. Also, a clear decision matrix can help to reduce inter- and inner-department uncertainty and establish or adhere to consistency and fairness. DPW has used checklists and forms internally, but these traditionally have not been available to the public. To make the decision process around the retention or removal of trees more transparent and consistent, a clarified process, decision matrix, and diagram should be developed to highlight the key decision points.

Proposed Decision Matrix for Tree Removal Requests (Figure 29)



Initial Assessment

The following applies to tree removal requests and proposed projects.

The initial assessment of trees, sidewalks (or other infrastructure), and site at the service request location or project location provides consistency and predictability by collection the appropriate information. It is recommended to have the City of Troy's Street Tree Advisory Board involved in the initial assessment process and/or a City staff member with an International Society of Arboriculture Certified Arborist accreditation.

- Tree Preservation Potential. What is the tree quality or health, and is it worth preserving? If the City of Troy adopts a Heritage or Landmark Tree Program, is the tree part of this program?

- Tree Mitigation Exploration. If the request to remove the tree is a result of infrastructure damage and the tree exhibits poor health or vigor, can the tree's health or vigor be mitigated by any means other than removal?
- Public Safety Risk. Is the tree a potential hazard that cannot be mitigated by any means other than removal? This includes any tree or tree part that poses a high risk of damage to persons or property located in public places. Use the International Society of Arboriculture's tree risk evaluation standards.
- Initial Assessment Timing. It is recommended that the initial assessment be conducted within 3-4 weeks of receiving a service request for removal. If the assessment is required due to a proposed project, the assessment should occur no later than 30% design or equivalent of design effort (e.g. during the Environmental Assessment period).
- Tracking. Consider tracking service requests in the City's TreePlotter tree inventory software or similar program.
- For an example Initial Assessment Checklist, see Appendix K.

Initial Tree Decision

If the tree removal request was made due to the condition of the tree or other reason not relating to the damage or impediment of infrastructure such as sidewalk, the City's Street Tree Advisory Board and/or City Certified Arborist staff may conduct the initial tree decision. If infrastructure is part of the assessment and/or the tree removal request was initiated for a proposed project, the City Engineer or appropriate staff should also be part of the initial tree decision. The appropriate staff will visit the tree and/or proposed project location and assess the tree (and sidewalk, if applicable) conditions. The following actions will result from the assessment:

- Remove Tree. The tree removal request was made not as a result of the tree impacting or damaging infrastructure and the tree is identified as unhealthy or unsafe with no remediation possible.
  - Remove the tree and consider the "no net loss" policy of replacing the tree. Some cities implement a 2:1 replacement to removal ratio. The replacement policy should be based on the adopted Street Tree Ordinance. Replacement of trees can occur on site, same street, or City-approved location. A fee in-lieu should also be considered as an option which should be stated in the Street Tree Ordinance.
  - Removal of the tree should be prioritized based on other work orders, the risk assessment of the tree, and other factors.
  - The service request, decision, work order, tree information, and tree removal information should be tracked in the City's TreePlotter software or similar program.
- Retain Tree. Based on the assessment, the tree is not in decline or the issues can be remediated. Alternatively, if the City establishes a Heritage Tree or Landmark Tree Program and the tree in question is part of the program, the tree may be preserved depending on the tree condition and presence of hazards or risks.
  - Document the decision, inform the property owner or project developer.
  - Conduct the remediation activity to the tree if needed.
  - Prioritize and track this information in the TreePlotter or similar program.
  - Conduct follow-ups with the property owner and monitor the tree if necessary.
- Remove Tree and Replace Sidewalk. The service request or proposed project identifies a tree that is causing sidewalk conflicts and the tree has been deemed unhealthy and no

remediation is possible. The City should reference the Street Tree Ordinance as to what is defined as unhealthy or hazardous once the ordinance is adopted.

- Remove the tree and consider the "no net loss" policy of replacing the tree. Some cities implement a 2:1 replacement to removal ratio. The replacement policy should be based on the adopted Street Tree Ordinance. Replacement of trees can occur on site, same street, or City-approved location. A fee in-lieu should also be considered as an option which should be stated in the Street Tree Ordinance.
- Removal of the tree should be prioritized based on other work orders, the risk assessment of the tree, and other factors.
- The service request, decision, work order, tree information, and tree removal information should be tracked in the City's TreePlotter software or similar program.
- Replace the sidewalk using appropriate design standards and materials and consider designing according to standards that will protect any replacement trees and provide ample soil volume and root space for the new or existing trees.

- Retain Tree and Maintain Sidewalk. A tree removal service request was made as a result of infrastructure conflict and the assessment determined that the tree is to be retained and the infrastructure (i.e. sidewalk) is to be corrected. The sidewalk will be of standard width and a tree pit of standard width (at minimum) can be installed or retained.
    - Coordinate with the adjacent property owner the timing and approach for maintaining the sidewalk. Some cities offer incentives or funding to support sidewalk maintenance when the issue causing the sidewalk damage has been identified to be caused by a City-owned right-of-way tree. Be sure to inform the property owner of alternative sidewalk amendments such as width reduction, alternative materials, etc.
    - If any root pruning is needed to amend the sidewalk, the City's Street Tree Advisory Board, a City Certified Arborist, and/or a property owner hired consulting Certified Arborist should evaluate to determine the appropriate root pruning, branch pruning, soil amendments, etc. required.
    - Documentation in TreePlotter or similar software as stated before is recommended.
- Evaluate Tree and/or Sidewalk Further. During the initial tree decision, it is not appropriate for extensive explorations of pavement, soils, or tree root systems. There are limitations to the initial assessment and decision. The purpose of the initial assessment is to identify where these future actions are required so that the appropriate schedule and funding can be determined.
    - Documentation in TreePlotter or similar software as stated before is recommended.

Further Evaluation

The team conducting further evaluation may include an arborist, landscape architect, engineer, or other professionals with expertise relevant to the project details and situation. In addition to collecting information about the trees and infrastructure (i.e. sidewalk) the following additional items may be considered:

> Level of impact, future risks, cost/benefit, anticipated sidewalk maintenance if the tree is kept, public/environmental benefit, community values, policy guidance, neighborhood context, historic districts, planned construction, funding forecasts.

Solutions

The following best practices and approaches are provided as examples. The City should review and update these as new or improved practices and materials emerge.

- If Tree Removed, Obtain Valuation. If the tree must be removed, the City should provide guidelines to replace the removed tree. Guidelines should be based on the proposed Street Tree Ordinance. Ideally, the tree would be replaced at the same location if the site is suitable for trees in the first place. If not possible, the City should have a procedure in place for the relocation of replacement trees.
- If Tree is Retained, Determine Management Approach. Since the initial assessment offered the opportunity to closely examine the tree and the site, future management approaches and decisions should be discussed and document. These include future tree replacement species for when the tree does over mature and decline or conduct corrective actions to provide clearance for pedestrians, vehicles, utilities, etc.
- Identify Potential Sidewalk Solutions. Appendix F in this Community Forest Management Plan provides information and resources regarding sidewalk solution options. Information gathered during the initial assessment and subsequent site visits will support the selection of options that should be presented to the property owner to ensure goals of sidewalk repair and tree preservation are kept.
- Identify Opportunities to Improve Conditions for New Trees. When trees are planted by the City, the appropriate tree species for the location should be determined and the City should adhere to best practices in site and tree pit preparation to provide enough soil volume to support tree root growth and minimize future pavement damage by roots. If a tree is being planted at or near where the tree removal request was made, an evaluation of why the request was made should be considered. This may include such things as tree leaf litter, messy fruit, poor structure, allergies, screening of shade-intolerant garden or landscape vegetation, etc.

Project Implementation

Whether the sidewalk repair is occurring at a location where the tree is retained or removed, the sidewalk must adhere to ADA requirements and is the responsibility of the adjacent property owner. All matters relating to the removal or remediation of the tree will be conducted by the City unless the responsibility of tree maintenance in public rights-of-way changes. Regarding tree maintenance, mitigation, or removal, the City should involve the public by:

- Providing a public notice prior to the initial tree assessment.
- Share the results of the initial assessment.
- Share the solution decision.

D. Heritage Tree Program

There exist trees of exceptional or special importance in the City of Troy because of their age, size, type, historical association, arboriculture value, and/or ecosystem value. These trees reside in City parks, public rights-of-way, and on private property. At the same time, the City must accommodate growth, redevelopment, construction, and infrastructure repair. Because of this, it is recommended that the City consider establish a voluntary or non-voluntary Heritage Tree Program. These programs are also sometimes called Landmark Tree Protection Programs.

Heritage or landmark tree protection programs and policies acknowledge the scientific consensus that large trees provide substantially more social, public health, and environmental benefits than small trees. Tree growth correlation to tree benefits is an exponential one. Mature

large trees, those greater than 40 feet tall and/or 30 inches in diameter, deliver on average an annual net benefit two to six times greater than mature small trees.[6] The presence and stature of large trees has a measurable human health impact, relieving stress, decreasing respiratory illness by providing particulate matter deposition on leaves, and inspiring the community.[7]

In evaluating existing heritage tree programs across the State of NY, common themes were identified for the City of Troy to consider.

Common Themes of Landmark Tree Programs

- Potential landmark trees can be voluntarily or non-voluntarily designated
  - Voluntary designation by the property owner is generally coupled with title recording on the property mandating the preservation of the tree while the tree remains healthy.
  - Non-voluntary designation applies to trees that meet a certain criterion, most often of size and species, that immediately protects a tree from removal or malpractices while the tree remains healthy.
- Designation committees for voluntary designation of landmark trees can be a City-appointed staff member, a City Arborist, Certified Arborist, City Forester, Street Tree Advisory Board, City Council or Committee.
- Documentation and inventorying of voluntary landmark trees is often facilitated through landmark tree database and tree management software such as the City's TreePlotter program.
  - The list is often associated with historical committees and historical tours.
- Qualifying criteria for landmark trees normally contain subjective and/or objective requirements for historical, cultural, ecological significance, or other important qualifying attributes.
- Variances and relief of landmark tree protection are often provided through the following:
  - High-risk rating through qualified ISA Tree Risk Assessor and/or conspicuously dead trees.
  - Spatial conflict of actively permitted development/redevelopment are exempt.
  - Utility work as necessary to retain utility connectivity are exempt.
  - Other large public land owning organizations with their own urban forest management plan or similar document can be exempt.

Potential Outcomes and Approaches

- A landmark tree protection policy will prevent the removal or requests for removal of trees of importance within parks and the public rights-of-way unless deemed unhealthy or unsafe.
- If the City relinquishes any tree maintenance responsibility, a landmark tree policy in conjunction with the Shade Tree Ordinance would preserve the City's tree canopy.
- Complements the City of Troy's Comprehensive Plan, this Community Forest Management Plan, and other planning documents. Establishment of a landmark tree program achieves goals of these plans.

[6] McPherson, E.G.; et. al. 2003. Northern mountain and prairie community tree guide: benefits, costs and strategic planting. Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service. 92p.
[7] McDonald, R.I., et al, Planting Healthy Air: A global analysis of the role of urban trees in addressing particulate matter pollution and extreme heat. 2016, The Nature Conservancy Arlington, VA.

- Conservation of culturally or historically relevant City landmarks that have importance to the community.
- Ecological inventory of large, important trees and economic quantification of their provided ecosystem services.
- Species diversity improvement.
- It is recommended that the City adopt a landmark tree program as an ordinance and/or amend the Street Tree Ordinance to be adopted.
- Consider partnerships with Capital Roots, Citizen Pruners, the Street Tree Advisory Board, institutions, and civic groups for identifying and promoting the proposed ordinance for adoption and use the groups for community outreach to identify potential landmark trees.

E. Landscape Plans, Zoning, and Other Code Requirements

Proper planning and policy will provide clear direction when tree removal or general tree service requests are received. Developers may be required to prepare a plan as part of the permit process to satisfy tree preservation standards, protection measures, and canopy requirements for site development. The City would continue to develop work processes that promote interdepartmental collaboration and efficiency.

The following provides examples of the proactive approaches:

- Tree removal requests and general tree service requests should consider the Complete Streets Policy where applicable which may impact decisions during the initial assessment or solution options.
- The Street Tree Advisory Board and/or City Certified Arborist (if applicable) should be involved with proposed development landscape plans to ensure tree protection, tree planting, and adherence to the proposed Street Tree Ordinance are followed.
- The Street Tree Advisory Board or appropriate staff should be included in any planned updates or amendments to City Code relating to design standards such as Zoning minimum green space requirements.

2. Implement an Updated Approach to Tree Removal Requests

Currently, the tree service request form is available online and should continue to be available on this platform. The following provides general recommendations for improving the process.

A. Improved Service Request System, Permit System, and Process

The City's online service request system for tree services could be improved by providing more information about the City's community forest programs, benefits of trees, and FAQ's. The City should also consider implementing the service request and work order system available for the TreePlotter software. This would connect information to the 2019 tree inventory data for improved tracking, initial assessments, and response to the resident.

The City should consider creating a permit system for property owners adjacent to a street tree wishing to have the tree pruned, removed, or inspected. The permit would include a reasonable fee that could be applied to the City's tree planting or maintenance program. This permitting system would allow the property owner to hire a licensed and/or Certified Arborist to conduct tree care, inspection, or removal after the City has evaluated the permit and the tree itself or receives a report from the certified/licensed consultant. This would alleviate some of the tree maintenance pressure the City is experiencing. Permitting processes could be administered by the Department of Public Works, Planning Department, City Engineer, or the Street Tree

Advisory Board. Removal of healthy mature trees could be dissuaded through a fee system. Mitigation replantings could be required for tree removals whenever practicable. The City could consider self-issuance below certain thresholds to increase efficiency and accessibility to all.

Examples of tree-related permits in NY include permits for tree planting, tree removal, and tree pruning of limbs greater than two inches in diameter.

Additionally, if not already in progress, a portion of the permit fee for excavating (City Code 251-9) within the public right-of-way should be applied to the City's tree maintenance or planting program.


Source: Frear Park Conservancy

B. Tree Removal Decision Matrix

As stated in the Preparation section, the City should implement the decision matrix for tree removal requests and tree and sidewalk conflict situations.

C. Community Outreach and Education

Any updates to the tree removal requests and general tree service requests program should be communicated with the public. The City should update the appropriate website pages, add a FAQ's section, provide fliers, and utilize partnerships. These efforts will garner additional support from the community and potentially reduce the tree service requests.

D. Strength in Partnerships

Community outreach and engagement efforts about the benefits of trees, the City's tree management program, and the Community Forest Management Plan can be amplified through partnerships with Capital Roots, Neighborhood Associations, Friends groups such as Friends of Prospect Park, Business Improvement Districts, Washington Park Association, Transport Troy, and TAP. institutions, and other civic groups.

3. Tracking, Reporting, Prevention

A. Tracking

As recommended in previous sections, service requests, work orders, tree maintenance, tree removals, and tree pruning should be properly tracked using the City's TreePlotter software or similar program. These efforts will assist City staff with prioritizing requests and work and provide context for future requests. This tracking of public trees will ensure proper tree care and identify conflicts with public infrastructure improvement projects.

B. Monitoring and Inspections

The City should continue to monitor the street (and park trees) to note any changes in condition or maintenance needs and to monitor for pests and diseases. Other concerns such as potential hardscape damage and root issues should be monitored. In addition to monitoring, the City should pursue the routine pruning and young tree training cycles recommended in the Plan. Should the City relinquish any tree maintenance responsibility, proper tracking and detailed records will allow for a more seamless transition.

4. Growth & Preservation of the Community Forest

Implementing the recommendations for response to tree removal requests should also consider the future health and vitality of the community forest. The City should consider the following:

- A tree removal and replacement policy for trees removed within the public rights-of-way. A 1:1 ratio should first be administered with future considerations for a 1:2 ratio of removals to replanting.
- The City should enact or continue to engage a "Citizen Pruners" program for the planting and care of young trees. Proper young tree care will reduce future issues relating to the tree structure and hardscape damage.
- The City should consider implementing tree removal and planting permits with associated fees. The cost and permit process may hinder some residents from making a request for removal of a tree that is still in healthy condition. Additionally, the fee may be applied to the City's tree management program.
- Outside the planning horizon of this Community Forest Management Plan, the City may consider a private tree removal permitting system. The majority of tree canopy exists on private property, particularly on residential land uses. A permitting system would help to preserve existing trees in the City.

Existing & Potential Partnerships

Communication between City departments plays a vital role in establishing community forest sustainability and it is equally important for strong communications and partnerships to exist among organizations and other agencies.

The City's *Realize Troy* Comprehensive Plan provides a catalyst and focus in rallying community partners. The momentum generated from the effort can be leveraged to build support for community forestry. Effective community forest management depends ultimately on the public policy supporting it—financially, administratively, and legally. Tree-related advocacy groups can marshal volunteer support and voices for urban forestry programs to local officials. Tree planting volunteers join professional arborists on the front lines. Citizens can provide the political support to sustain public investment in green infrastructure and the community forest.

The following provides an overview of existing and potential partners to garner community stewardship, provide resources, expand education, and support Plan implementation.

- City Commissions, Committees, and Boards such as the Street Tree Advisory Board and the Environmental Conservation Commission
- Citizen Pruners and Capital Roots
- Cornell Cooperative Extension of Rensselaer County, Rensselaer Polytechnic Institute, Hudson Valley Community College, Russell Sage College, and other institutions
- Neighborhood Associations and the Troy Neighborhoods Action Council
- Friends of Prospect Park and others such as Frear Park Conservancy and the Washington Park Conservancy
- Business Improvement Districts such as Downtown Troy
- Transport Troy
- TAP, non-profit community design center
- NYSDEC, NYS Urban Forestry Council, U.S. Forest Service, The New York State Arborists, ISA Chapter
- Troy, NY Rotary Club, businesses, and other civic groups such as the Van Rensselaer Garden Club
- Rensselaer County Soil and Water Conservation District and the Hudson River Watershed Alliance

Community Engagement Opportunities

1. **Community Meetings.** Discuss the Plan, projects, and issues with residents throughout the City.
2. **Public Surveys.** Conduct surveys to gather rich insights into public perception on the importance of trees.
3. **Non-profit Partnerships.** Utilize the Citizen Pruners to create or improve partnerships.
4. **Social Media.** Post Plan implementation progress, announcements, and opportunities on social media.
5. **Fliers & News Articles.** Distribute to raise awareness and gather support.
6. **Press Releases.** Share projects, events, and studies in The Record.
7. **Canvassing of Homes.** ID street blocks and areas for spreading community forestry awareness.
8. **Email Listserv.** Keep the community up-to-date on Plan implementation and events.

Source: City of Troy

Community Engagement Recommendations

The plan development process included substantial research regarding community outreach and education opportunities. This study provided a broad perspective of the challenges that face Troy's community forest.

For successful implementation of this Plan and strengthened compassion and support for the community forest, community engagement activities should be arranged to provide updates, stewardship opportunities, and a platform for discussing varying opinions on matters pertaining to the care of the community forest. Connections and relationships that will develop among stakeholders during these meetings are valuable outcomes of the outreach process. As community awareness and actions associated with community forestry move forward, it will be the people of Troy that ultimately realize the value of their contributions to their community in the trees that grow around them.

Source: Russell Sage College and Capital Roots (top)
Downtown Troy BID (bottom)

EQUITY OF COMMUNITY FOREST MANAGEMENT

Currently, the maintenance of trees within the public rights-of-way throughout the City are the responsibility of the City. With over 10,000 City-owned trees, this responsibility requires extensive management to prevent trees from becoming a nuisance or a liability. Additionally, trees that are affected by—or at risk to—harmful pests and diseases should be protected, treated, and/or mitigated according to city, state, and federal guidance. Therefore, much of the City's canopy and benefits provided to the community and environment are in the hands of the City.

Unfortunately, the City's current staffing levels and budgets inhibit the City's effectiveness in providing comprehensive community forest management and equitable care across the City within public rights-of-way and public parks. Extensive outreach and education to the community to foster support and encourage stewardship should be conducted to protect and enhance the community forest equitably and efficiently for a healthy, thriving, and sustainable community forest.

For a healthy community forest and public safety, the City should explore options for a shared responsibility of rights-of-way trees with adjacent property owners. In certain areas of the City, tree maintenance may be neglected due to limited budgets and staffing. The City should consider developing priority maintenance corridors so equitable community forest management can be achieved even with limited resources.

The City should use the 2019 comprehensive street tree inventory and overlay the data with U.S. Census Bureau data and/or local socioeconomic data to determine underserved areas and the density/distribution of existing trees and planting spaces as well as the current species and age diversity within these areas. This information should be used in coordination with the classification of roadway, existing neighborhood organizations, and planned construction to identify the type of tree maintenance priority to consider.

Examples on how to apply this include:

- Use of volunteers and Citizen Pruners for young tree maintenance.
- Conducting tree maintenance during planned City construction.
- Use of trained City staff and equipment for routine pruning and removals in highest priority areas.
- Establishment of priority maintenance corridors such as:
    - Downtown: Partner with the Downtown Troy Business Improvement District to establish shared responsibility of tree maintenance and development an approach for contracting certain tree services with a licensed and/or Certified Arborist to relinquish the City of certain maintenance responsibilities.
    - Young Tree Training Pruning. North of Middleburgh Street, River Street (Route 4) contains a high number of trees less than 6 inches in diameter. The City could work with Citizen Pruners and other volunteers to conduct the recommended young tree training pruning.
    - High Priority Maintenance Areas. A large portion of the high priority (Priority 1 and Priority 2) trees exist on 8th Street, West Sunnyside Way, and 10th Street north of Peoples Avenue to Middleburgh Street. The City could work with the local neighborhood association(s) to develop an approach and plan to address these priority trees.

The following maps provide example corridors for shared maintenance responsibility.

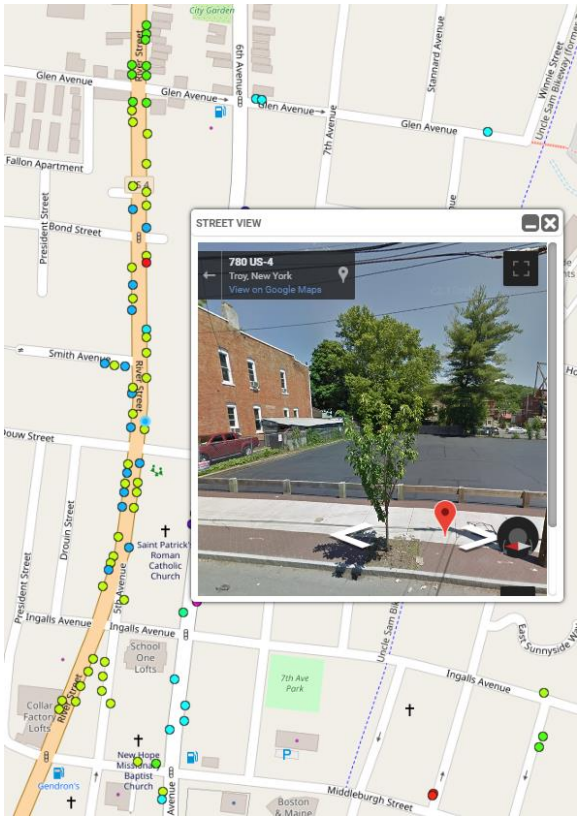


Figure 30. Example priority corridor to address young tree pruning recommendations

The map on the left shows a concentration of trees less than 6 inches in diameter with a Maintenance Priority of Priority 4 (Young). This maintenance priority refers to the pruning of young trees for structural improvements and overall tree health to reduce future maintenance costs.

Figure 31. Example priority corridor to address Priority 1 and Priority 2 maintenance needs

This map shows a concentration of trees requiring Critical (Priority 1) or Immediate (Priority 2) removal or pruning. As recommended on the previous page, the City should work with the local neighborhood associations to develop and approach and funding mechanisms for addressing these high priority trees. Information about the benefits of trees and tree replacement species should be included in the discussion.

Case studies in Appendix F are provided for the City to consider shared responsibility of tree management, prioritizing maintenance corridors, and the relinquishment of certain maintenance responsibilities.

Recommendations & Strategies for Troy's Community Forest

Using the guiding principles, criteria and indicators, and data analysis to establish effective and measurable recommendations for advancing Troy's community forest.

Source: Downtown Troy BID

ACTION STRATEGY ONE:

MAXIMIZE THE EFFICIENCIES IN MAINTAINING TREES

A. Manage Risk Trees

- Address the critical and immediate tree removals and tree pruning needs (476 removals and 938 pruning). Use information in this Plan to acquire more funding and support.
- Use the City's TreePlotter software or similar program to prioritize the maintenance.
- Use the Tree Maintenance Worksheet provided in the Community Forest Management Plan to address these trees in a 3-year period. Use the worksheet to estimate costs.

B. Establish a Routine Street and Park Tree Pruning Cycle

- Establish a 7-year cycle for street and park trees, pruning approximately 750 street trees and 326 park trees per year.
- Use the Tree Maintenance Worksheet to estimate and budget annual and 7-year costs for routine pruning.
- Prioritize, schedule, and track tree maintenance using the City's TreePlotter software.
- Build support for the pruning cycles by using the data summarized in the Community Forest Management Plan.

C. Acquire Maintenance Support & Prioritize Maintenance Corridors

- As routine pruning cycles are being budgeted and established, explore maintenance sharing options with the community, especially for young tree pruning. Consider establishing a large tree maintenance sharing program by working with Business Improvement Districts, Neighborhood Associations, and community groups.
- Establish priority maintenance corridors while maintenance sharing options are pursued. These priority corridors may be based on the street tree density, condition and maintenance needs of the street trees, volume of vehicle and pedestrian traffic, and other variables.

D. Plant and Maintain Young Trees

- Consider a "no net loss" policy by implementing at least a 1:1 ratio in terms of tree removals to replacements. It is recommended to plant at least 68 trees per year to compensate for recommended removals and upwards of 200 trees per year to compensate for natural mortality and to grow the City's tree canopy.
- Use Citizen Pruners and trained volunteer groups for the planting and post-planting care of young trees. Require the use of industry best practices. Continue to partner for grants.

E. Continue to Monitor

- As maintenance, removals, and plantings are conducted, track information in the City's TreePlotter software or similar program.
- Keep the tree inventory data maintained and monitor for any changes or risks to public trees and the community forest such as tree pests and diseases. Consider a Citywide canopy assessment for a better understanding of the community forest.

F. Evaluate Community Forest Demands and Staffing Levels

- Based on the recommended tree maintenance program and the actions described in this Plan, consider establishing a full-time, part-time, or on-call City Arborist position to address the needs of the trees, the people, and long-term community forest planning.

Action Strategy Two:

Use planning, legislation, and enforcement to integrate trees more fully

A. Update and Acquire Approval of the Street Tree Ordinance

- Use the recommendations and resources in the Community Forest Management Plan to finalize the Street Tree Ordinance for adoption.
- Conduct outreach with the community and communications with other City departments to establish awareness and clear understanding of the Street Tree Ordinance. The Street Tree Advisory Board will be advocates and enforcers of this effort.

B. Update the Tree Service Requests and Permit System

- Use the recommended decision matrix provided in the Community Forest Management Plan for implementing consistent evaluation of tree removal and tree service requests.
- Use the recommended decision matrix for tree and infrastructure conflicts, specifically for sidewalks. Use the Street Tree Advisory Board for management of these systems.
- Update the tree service request form to include a permit system that allows property owners adjacent to street trees to hire a licensed and/or ISA Certified Arborist represented company or person to conduct tree maintenance or tree removal within the rights-of-way. The permit system should include the decision matrix and tree assessment protocols recommended in this Plan. Tree service would only be conducted upon approval of the permit by the appropriate City staff. Consider a permitting fee to support community forest management efforts.
- Communicate the established process with community residents and among City departments.

C. Establish a Heritage Tree Program

- Preserve large significant trees by establishing a Heritage Tree Program. This program should identify trees within the public rights-of-way and parks of special importance such as size, age, species, location, rarity, ecosystem impact, historic connections, and/or cultural connections.
- Plan for the preservation of these trees through education, careful maintenance, and protection from threats.
- Use the recommended approach provided in this Plan.

D. Integrate Community Forestry with Plans and Policy

- Leverage the urban forest strategies listed in the City's Comprehensive Plan (*Realize Troy*) to achieve goals and recommendations in this Plan. Strategies in the Comprehensive Plan include growing the City's urban tree canopy by expanding tree planting initiatives and incorporating tree planting as part of sidewalk and streetscape improvements (5.1.6) and the protection of existing trees during building construction with the requirement of an inventory and management plan for major capital projects and developments (5.1.7).
- Provide urban and community forest expertise during the design and planning stages of Complete Streets projects to preserve appropriate existing trees, enhance tree plantings, and provide adequate canopy and root growing space.
- Provide urban and community forest expertise when existing policy and ordinances are updated such as design standards and Zoning minimum green space requirements. Reference the adopted Street Tree Ordinance where applicable.

Action Strategy Three:

Implement Best Management Practices for the Health and Benefits of Trees

A. Develop and Implement Tree Planting Plans

- Develop tree planting plans to establish and maintain optimal levels of age and tree species diversity.
- Consider the spatial location of trees for increasing equity of tree canopy and associated benefits.
- Plant street and park trees that maximize benefits, minimize risk, consider site conditions and water restraints, maintenance costs, and potential tree pest and disease risk.
- Establish or update a recommended tree species list that provides recommendations based on mature tree size and the given site conditions.
- Continue to utilize the expertise of the Street Tree Advisory Board.

B. Adhere to Best Management Practices and Standards in Tree Care

- Continue to implement approved best management practices and standards for tree planting, tree pruning, tree nursery selection, and all other community forestry operations.
- Reference these practices and standards in the Street Tree Ordinance and keep it updated.
- Monitor the community forest for potential tree pest and disease risks and use the emerald ash borer plan developed by the Street Tree Advisory Board. Consider a plan for the Asian longhorned beetle due to the abundance of green ash trees and maple trees.
- Require adherence to best practices and standards for any shared maintenance responsibility of young, established, and mature trees.
- Establish or update protocols relating to storm planning, response, and mitigation.
- Consider wood utilization options for any woody debris resulting from tree maintenance and removal operations.

Action Strategy Four:

Foster Support for the Community Forest

A. Educate and Engage the Community

- Continue to implement the Citizen Pruners program and other volunteer tree stewardship programs and events.
- Provide educational materials, workshops, and information on the City's website regarding community forestry and this Plan.
- Maintain and enhance partnerships to implement recommendations in this Plan.
- Promote the community forest ecosystem benefits summarized in this Plan.
- Provide community forestry information specific to developers, businesses, and property owners.
- Lead by example by continuing to implement sound community forest management practices.
- Implement actions in this Plan to acquire and maintain the Arbor Day Foundation's Tree City USA award.
- Use the enhanced community support to acquire more resources and funding for the community forest management program.

The following provides a timeline for implementing the short-term actions (Table 13)

Action Item	Action description	Action Year(s)	Collaborative Partners (DPW = Department of Public Works, STAB = Street Tree Advisory Board)	Notes
1A	Manage risk trees	2019 - 2022	DPW	Continue to monitor and manage risk beyond 2022
1B	Routine pruning Cycles	2022	DPW, Planning	Establish the program and priorities. Identify shared responsibility opportunities
1C	Acquire maintenance support and/or priority corridors	2019	DPW, STAB, Planning	Alleviate the routine and young tree maintenance pressures and demands
1D	Plant and maintain young trees	2019 – 2026	STAB, Planning, DPW, Capital Roots, Citizen Pruners	Minimum of 68 trees per year. Apply for DEC grants
1E	Continue to monitor	2019 – 2016	DPW, Planning, Citizen Pruners	Continue to use TreePlotter and create accounts for other partners to monitor street and park trees
1F	Evaluate staffing levels	2019	Planning, DPW	Consider a City Arborist position
2A	Adopt Street Tree Ordinance	2019 – 2020	STAB, Planning, DPW, Council	Update and undergo City processes for approval
2B	Update tree service request system	2020	DPW, Planning, STAB, Council	Develop a decision matrix for tree removals and infrastructure conflicts
2C	Establish a Heritage Tree Program	2021	STAB, Planning, Council	Explore example programs and provide ordinance language for adoption
2D	Integrate with existing plans and policy	2019 – 2026	Planning, DPW, STAB	*Realize Troy* and Complete Streets example

Action Item	Action description	Action Year(s)	Collaborative Partners (DPW = Department of Public Works, STAB = Street Tree Advisory Board)	Notes
3A	Develop tree planting plans	2022	Planning, DPW, STAB	Tied to capital projects, grants, policy requirements to increase canopy and improve community forest structure and health
3B	Adhere to best management practices and standards	2019 - 2026	DPW, Planning, STAB	Details these in the Street Tree Ordinance
	Implement the EAB plan	2019 – 2026	STAB, Planning, DPW	Update the plan as needed and plan for other pest and disease risks
	Community Forest Storm Response Plan	2023	Planning, DPW, STAB	A plan for preparation, response, and mitigation. This applies to street and park trees
	Wood utilization practices	2025	DPW, Planning, STAB	Use of tree debris for a variety of purposes
4A	Citizen Pruners program	2019 – 2026	STAB, Planning, DPW	Young tree pruning and planting
	Educational material and shared information	2019 – 2026	STAB, Planning, Communications	City website, social media, fliers, events, workshops
	Enhanced partnerships	2019 – 2026	Planning, DPW, STAB	Capital Roots, institutions, BIDs, Friends groups, civic groups, etc.
	Tree City USA Award	2020 – 2026	STAB, DPW, Planning, Communications	Implement this Plan's recommendations for eligibility
	Community support to acquire more community forest management funding	2022	Planning, DPW, STAB	Use data summaries in this Plan and enhanced community engagement to build support for increased funding

Plan Monitoring & Adaptive Management

A management process to promote flexible decision making that can be adjusted in the face of uncertainties.

Source: Frank Treff Photography

Adaptive Management & Monitoring

Adaptive Management is a scientific approach to a community forest management decision process. It promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management does not represent a means to an end, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals; increases scientific knowledge; and reduces tensions among stakeholders. Using an adaptive management approach will require the consistent monitoring of all the City's criteria for community forest sustainability. The City will be able to judge if its new approaches to community forest conservation are being effective, develop relationships between management actions and outcomes, and identify significant trends. This will allow the City to adjust management actions over time as changes occur both in the physical/biological environment and in the expectations of the City's residents.

Few activities suggested by this strategic plan are as important to the success of community forest management as monitoring, but this step is often overlooked, poorly designed, and often underfunded by most cities. Monitoring the City's natural resources is a process very similar to those already developed for business. The basic applications have already been developed, and there is little reason to reinvent the processes. This design for the monitoring program incorporates the principles of sampling design theory and experimental design. Careful consideration has been paid to the selection of indicators.

Types of Monitoring

Monitoring here refers to the periodic and systematic measurement of observations of process or object. The City should institute three forms of monitoring in association with the Community Forest Management Plan: implementation, effectiveness, and validation.

1. "Did we do what we set out to do?" The implementation monitoring will determine if the Plan is being implemented as designed.
2. "Did it work? Effectiveness monitoring determines if the action achieved the stated goal.
3. Validation monitoring determines if assumptions being used are valid and effective.

Implementation Monitoring. Planning Department should review, on a semi-annual basis, the implementation of the Plan's actions. There should be a stakeholder session to discuss accomplishments and recommend strategies for accomplishing the scheduled objectives. Each year these stakeholders should jointly publish a report regarding progress.

Effectiveness Monitoring. Maintaining the street and park tree inventory will serve as the starting point for the effectiveness-monitoring program. Information from the State of the Urban Forest Resource section presented in this Plan describes the present conditions. The use of the criteria and key objectives allow the City to better understand and correlate the effectiveness of its community forest management practices and policies to reaching specific outcomes using the tree inventory analysis. This effectiveness monitoring should be conducted every 5 years. View Appendix D for a list of categories to monitor the community forest program.

Validation Monitoring. The City should maintain and update the tree inventory on a regular basis. This information will be used for the City to conduct a 5-year analysis of the tree structure, maintenance needs, and potential risks, similarly to how it was completed for this Plan.

Conclusion

The community forest is providing many important ecological functions and economic benefits to the City of Troy. Continuous delivery of those services depends on the long-term health and resilience of the tree population. Over 10,000 trees exist along the public streets and parks in Troy providing a multitude of benefits including stormwater reduction, energy savings, increased property values, improved air quality, and enhanced overall community well-being. These benefits have an estimated annual value of over $1.4 million.

Managing trees in urban areas is an arduous and intricate process. Navigating the recommendations of experts, the needs of residents, the pressures of local economics and politics, concerns for public safety and liability, physical components of trees, forces of nature and severe weather events, and the expectation that these issues are resolved all at once is a considerable challenge. The City should begin to implement recommendations in this Plan as soon as possible to ensure a healthy, thriving, and sustainable community forest.

To sustain desired levels of community forest services recommended in this Plan, a multi-faceted approach must be implemented by evaluating tree maintenance responsibilities, increasing staffing and funding levels, enhancing plantings and tree care, encouraging growth and preserving existing trees, monitoring for changes in community forest characteristics, and amplifying community stewardship.

Appendices

Appendix A. The Community Forest Management Plan Approach

Appendix B. UFSMA Categories & Elements for Plan Monitoring

Appendix C. Criteria & Indicators for Urban Forest Management

Appendix D. Monitoring Guidelines for Criteria & Actions

Appendix E. Creating a Tree Policy Manual or Street Tree Ordinance

Appendix F. Case Studies

Appendix G. Funding Opportunities

Appendix H. Tree Maintenance Worksheet

Appendix I. Community Forestry Resources

Appendix J. Tree Maintenance and Planting Best Practices

Appendix K. Example Initial Assessment Checklist for Tree Conflicts

Appendix L. Tree Maintenance Schedule and Budget

Appendix M. Proposed Street Tree Ordinance for Troy, NY

Appendix A. The Community Forest Management Plan Approach

Developing the Community Forest Management Plan was a systematic process where the results of each step informed the next, leading to development of the goals, objectives, actions, and adaptive management measures. Using a combination of information obtained through the project team consultations, augmented by in-depth review of numerous City policies, regulations, initiatives, and related urban forestry efforts, the City's community forest was evaluated and carefully planned.

Information Discovery

The first step in developing the Plan involved an extensive review of existing plans, policies, ordinances, practices, and initiatives to establish a baseline using the U.S. Forest Service's Urban Forest Sustainability & Management Audit (UFSMA, see Appendix B). This audit is an industry-accepted process and region-specific evaluation of 11 categories of urban forest sustainability and management as they relate to the City of Troy. The categories include:

1) Management Policy and Ordinances
2) Professional Capacity and Training
3) Funding and Accounting
4) Decision and Management Authority
5) Inventories
6) Urban Forest Management Plans
7) Risk Management
8) Disaster Planning
9) Practices, Standards, and BMPs
10) Community
11) Green Assets

Data Collection & Analysis

Data pertaining to the City's community forest such as the street and park tree inventory and vacant sites inventory were gathered and analyzed to identify the community forest structure, maintenance needs, potential risks, and opportunities. Results from the analysis were then applied to the UFSMA and ultimately, to the Plan's goals and actions.

Tree Inventory Data

Outputs from the City's tree management software, TreePlotter (www.pg-cloud.com/TroyNY) were used in addition to other data analyses to inform the Plan. The information is provided to guide future maintenance and management and to better plan for the health and longevity of the City's community forest. The summary of the tree analyses begin on page 9.

Plan Targets & Implementation

Criteria and Performance Indicators (C&I) or targets for community forest management and sustainability were established for the City based on the Information Discovery and the Data Collection & Analysis tasks. This process identifies where the City is currently on a management

and sustainability spectrum and a description of indicators representing low to optimal community forest management.

In 2011, Kenney, van Wassenaer, and Satel published a set of 25 Criteria and Indicators (C&I) for the assessment of a community's urban forest resource and its management program. Based on the work of Clark *et al*. (1997), this assessment methodology allows for a comparison of the current status of various criteria related to a community's vegetation resource, community and institutional framework, and resource management approach in relation to key objectives and indicators of success. For Troy's Plan, a total of 31 criteria were developed for a more comprehensive analysis and planning process. An assessment using this framework can identify critical gaps in a community's urban forestry program, establish goals, and help to prioritize management activities and resource allocation. When utilized at the outset of the urban forest planning process, a C&I assessment can also serve as a baseline for future monitoring efforts. This baseline can be referred to at the end of each of the Plan's management periods (e.g. eight year planning, seven year pruning cycle) to track progress towards program goals. The C&I approach, along with specific targets established in the Plan, is a critical component of the active adaptive management process. The U.S. Forest Service's Urban Forest Sustainability & Management Audit (description in Appendix B), research, and applications of industry standards were used to complete the Criteria and Indicators. The complete C&I outcomes are provided in the Criteria & Indicators for Urban Forest Management section and Appendix C.

Figure 32. Example criteria for evaluating Troy's existing community forestry program

Community Forest Goals, Objectives, & Actions

Based on the City's current status, goals and actions were developed to advance the City's urban forest resource and program along the C&I spectrum. Each goal includes an objective and a series of actions along with the responsible entity and roles of the departments, and the implementation timeframe.

Reassess & Adjust

Adaptive Management is a scientific approach to a community forest management decision process. It promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management does not represent an end, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals; increases scientific knowledge; and reduces tensions among stakeholders.

Using an adaptive management approach will require the consistent monitoring of all the City's criteria for community forest sustainability. The City will be able to judge if its new approaches to community forest conservation are being effective, develop relationships between management actions and outcomes, and identify significant trends. This will allow the City to adjust management actions over time as changes occur both in the physical/biological environment and in the expectations of the City's residents.

Summary of the Planning Process

1) Assessment of relevant resource data where it exists
2) Identification of community forest attributes
3) Creation of vision reflecting community values
4) Determination of the current status of various components
5) Identifying gaps between vision and current status
6) Implementation of actions to close the gaps
7) Formulation of operational plan incorporating vision and goals
8) Implementation and monitoring of the plan

APPENDIX B. UFSMA CATEGORIES & ELEMENTS FOR PLAN MONITORING

The following provides the results of the auditing process for the City to effectively monitor Plan implementation. Each component has a rating; 0 points, component doesn't exist or is not practiced; 1 point, component is in development; 2 points, component is routinely practiced; and 3 points, the practice is exceeded. The points can then be totaled for an overall score.

1) Management Policy and Ordinances

Category	Component Evaluated	Description or Criteria for Evaluation	Status
1.00	*Approved Policy Statements*	*Written policy statements approved by a governing body.*	
1.01	Climate Change (Sustainability)	Also referred to as Sustainability. With reference to urban trees. Addresses the long-term health and productivity of the natural resource.	2) Adopted Practice
1.02	No Net Loss	Can refer to trees, basal area, or canopy.	1) In Development
1.03	Risk Management	Should reference: ANSI A300 Part 9, ISA BMP, and prioritization funding mechanisms.	1) In Development
1.04	Tree Canopy Goals	Overall community/campus goal, or by designated "zone".	1) In Development
1.05	Tree Protection	Construction and/or landscape maintenance.	1) In Development
1.06	Utility	Utility pruning, planting, and installation policy (e.g. boring vs. trenching).	1) In Development
1.07	Human Health – Physical & Psychological	Recognizes and addresses the human health benefits of the natural resource (e.g. exercise, air quality, stress management, shade). Could also include Urban Heat Island (UHI) policies.	1) In Development
1.08	Wildlife Diversity/Habitat/Protection	Mammals, birds, or reptiles.	2) Adopted Practice
1.09	Performance Monitoring	Recognizes the annual or biennial calculation of metrics (e.g. some component of ecosystem services) for the purpose of tracking management performance.	1) In Development
1.10	Ordinance (Private) V	Tree protection and management for trees on private property.	1) In Development
1.11	Ordinance (Public)	Tree protection and management for public trees.	1) In Development
1.12	Development Standards	US Green Building Council's LEED® rating systems (or similar internationally) LEED v4 BD+C (Sustainable Sites) LEED 4 ND (Neighborhood Pattern & Design, Green Infrastructure) ASLA's SITES® Rating System	2) Adopted Practice
1.13	High-Conservation Value Forests	Programs or policies for identification, acquisition, and/or protection of groups of trees or forests that provide public benefits.	1) In Development
1.14	Urban Interface (WUI)	Programs or policies that improve management of the urban interface for fire and/or invasive species.	0) Not Practiced

2) Professional Capacity and Training

Category	Component Evaluated	Description or Criteria for Evaluation	Status
2.00	*Professional Management*	*Provision for professional consultation.*	
2.01	Certified Arborist - Staff		1) In Development
2.02	Certified Arborist - Contracted		1) In Development
2.03	Certified Arborist - Other Resource		2) Adopted Practice
2.04	Other Professional - Advising/directing UF management	This could be a professional in an allied field like: LA.	2) Adopted Practice
2.05	Municipal Forestry Institute	Graduate of Society of Municipal Arborist's MFI program.	0) Not Practiced
2.06	Organizational Communications	Process, procedures, and protocol for cross-professional communications within the organization (all departments "touching" trees).	1) In Development

3) Funding and Accounting

Category	Component Evaluated	Description or Criteria for Evaluation	Status
3.00	*Urban Forestry Budget*		
3.01	Budgeted Annually	Budget authorized/required for tree board, tree maintenance, and/or tree planting.	1) In Development
3.02	Contingency Budget Process	A protocol is in place to prioritize urban forestry management activities during budget shortfalls; e.g. during times of limited funding for: 1) risk management, 2) young tree care, 3) mulching.	1) In Development
3.03	Funding Calculated from Community Attribute	Budget in terms of per capita, per tree, or for performance (e.g. per tree weighted by size class or age.	1) In Development
3.04	Funding Based on Performance Monitoring	Budget connected with/based on ecosystem service (ES) monitoring and performance.	0) Not Practiced
3.05	Urban Forestry Line Item	Is the budget specific to urban forest management?	1) In Development
3.06	Green Asset Accounting	Maintain green infrastructure data in the "unaudited supplementary disclosure of an entity's comprehensive annual financial report (CAFR)". GASB 34 implementation for municipalities.	0) Not Practiced

4) Decision and Management Authority

Category	Component Evaluated	Description or Criteria for Evaluation	Status
4.00	*Authority*		
4.01	Urban Forest Manager	Professional urban forester with authority over the program and daily activity. Including designated budget.	1) In Development
4.02	Staff Authority	Designated staff with authority over the program and day-to-day activity. Including designated line item.	2) Adopted Practice
4.03	Communication Protocol	Established protocol and mechanism(s) for communication among all members of the urban forest management "community" in your municipality or organization (e.g. manager, department under control, advisory board, finance, field operations, public, NGOs, business community, developers).	1) In Development
4.04	Tree Board. Commission, or Advisory Council	Establishes a board for public participation (advisory or with authority).	2) Adopted Practice

5) Inventories

Category	Component Evaluated	Description or Criteria for Evaluation	Status
5.00	*Inventories and Assessments*		
5.01	Canopy Inventory (UTC)	Periodic (≤5 year) canopy inventory and assessment. Public & private.	0) Not Practiced
5.02	Ecosystem Services	Is there a recent (≤5 year) ecosystem services (ES) inventory & assessment. Public: 100% or street trees; Public & Private: Sample; or Campus. Or, are ES calculated annually or biennially based on partial re-inventory and projected growth as a monitoring tool.	2) Adopted Practice
5.03	Public Trees V	The publicly controlled urban forest.	
5.04	Street Trees	Is there a recent (5 year) inventory?	2) Adopted Practice
5.05	Parks/Riparian Areas	Is there a recent (5 year) inventory?	2) Adopted Practice
5.06	Other Public Trees	Public landscaped areas, industrial parks, green space.	2) Adopted Practice
5.07	Continuous inventory on a cycle (≤5 years; i.e. panel)	Partial re-inventory to support continuous forest inventory, growth projections, and the calculation of ecosystem services for the purpose of long-term monitoring of urban forest management performance (e.g. carbon or leaf surface).	1) In Development
5.08	Private Trees vvv	vvvv	vvvv
5.09	Campus (Educational)	Is there a recent (5 year) inventory?	0) Not Practiced
5.10	Corporate	Is there a recent (5 year) inventory?	0) Not Practiced
5.11	Other Private Property	Is there a recent (5 year) inventory?	0) Not Practiced
5.12	Continuous inventory on a cycle (≤5 years; i.e. panel)	Partial re-inventory to support continuous forest inventory, growth projections, and the calculation of ecosystem services for the purpose of long-term monitoring of urban forest management performance (e.g. carbon or leaf surface).	0) Not Practiced
5.13	Green Infrastructure (GSI)	BMP stormwater mitigation practices and locations	2) Adopted Practice
5.14	Spatial	GIS inventory data addresses the spatial relationship between the natural resource and people that would help manage the resource for benefits associated with air quality, recreation, stress mitigation, improved educational opportunity.	2) Adopted Practice
5.15	Maintenance and Planting Records Maintained	Planting details (nursery, species, size, cost, contractor, etc.) maintained with inventory or as separate database or recordkeeping system. Also pruning and removal history.	1) In Development

6) Urban Forest Management Plans

Category	Component Evaluated	Description or Criteria for Evaluation	Status
6.00	*Management Planning Activities*		
6.01	Annual Maintenance Calendar	An annual calendar that defines typical activity by season. To support scheduling.	2) Adopted Practice
6.02	Public Trees vvv	The publicly controlled urban forest. vvv	vvv
6.03	Street Tree Management	Is there a recent (5 year) plan for street trees?	2) Adopted Practice
6.04	Parks/Riparian Area Management	Is there a recent (5 year) plan ?	1) In Development
6.05	Other Public Trees	Public facility landscaped areas, Industrial parks, green space.	1) In Development
6.06	Private Trees vvv	vvv	vvv
6.07	Campus (Educational)	Is there a recent (5 year) plan for Campus trees?	0) Not Practiced
6.08	Corporate	Is there a recent (5 year) plan?	1) In Development
6.09	Other Private Property	Is there a recent (5 year) plan?	1) In Development
6.10	Green Infrastructure	Is there a plan for green infrastructure (i.e. nodes & linkages)? Large-scale projects.	2) Adopted Practice
6.11	Other Written Plans	Other natural resource plans (e.g. tree canopy). May be a component of another plan.	1) In Development
6.12	Tree Planting	Is there a recent (3 year) tree planting plan?). May be a component of another plan.	1) In Development
6.13	UF as Part of a Comprehensive Plan	Is any UF management plan referenced in the comprehensive plan (i.e. county or municipality) or master plan (i.e. Campus)?	2) Adopted Practice
6.14	Urban Forest Planning and Management Criteria and Performance Indicators	Criteria and indicators based on *A Model of Urban Forest Sustainability* (Clark, J.R., Matheny, N.P., Cross, G., and Wake, V. 1997 Journal of Arboriculture.) or on work of W.A. Kenney, P.J.E. van Wassenaer, and A.L. Satel in *Criteria and indicators for strategic urban forest planning and management*. (2011)	2) Adopted Practice

7) Risk Management

Category	Component Evaluated	Description or Criteria for Evaluation	Status
7.00	*Risk Management Activities*		
7.01	TRAQ Attained	At least one staff or consultant is TRAQ.	0) Not Practiced
7.02	Annual Level 1 (ANSI A300 Part 9 & ISA BMP)	All trees in high occupancy areas visited annually.	1) In Development
7.03	Mitigation Prioritization	A protocol for prioritizing mitigation following Level 1 and Level 2 assessments. Reflects the controlling agency's threshold for risk.	1) In Development
7.04	Occupancy Areas Mapped	Has TRAQ staff/consultant discussed/mapped occupancy levels with controlling authority?	0) Not Practiced
7.05	Recordkeeping, Reporting, and Communications	A process has been put in place to maintain records on requests, inspections, evaluations, and mitigation of risk; and on the communications among the managers related to those risk assessments.	1) In Development
7.06	Standard of Care Adopted	Controlling authority has adopted a Standard of Care (SOC) or risk management policy.	1) In Development
7.07	Tree Risk Specification	Is there a written specification that meets requirements of ANSI A300 (Part 9)? **And**, has it been discussed with the controlling authority with relevance to the controlling authority's threshold for acceptable risk?	1) In Development
7.08	Urban Tree Risk Management	The community has prepared and follows a comprehensive program for urban tree risk management.	1) In Development
7.09	Invasive Management	Plan to address and manage invasive: plants, insects, and disease.	1) In Development

8) Disaster Planning

Category	Component Evaluated	Description or Criteria for Evaluation	Status
8.00	*Disaster Planning Activities*		
8.01	Response/Recovery Mechanism V	Staff knowledge of the municipality's protocol for requesting disaster resources through the county or state with access to mutual aid and EMAC.	1) In Development
8.02	Urban Forestry as part of the County Disaster Plan V	The UF plan (8.3) is incorporated into the county/municipal disaster plan; specifically in reference to debris management and risk mitigation.	1) In Development
8.03	Urban Forestry Disaster Plan	A separate/specific plan within the urban forestry management program (i.e. who to call, priorities).	1) In Development
8.04	Pre-disaster Contracts	Contracts are in place for critical needs.	2) Adopted Practice
8.05	Mitigation Plan	A mitigation plan has been developed for pre-disaster, recovery, and post-disaster.	1) In Development
8.06	EMAC Mission Ready Packages (MRP) V	Municipality has published disaster resources with state EM and participates in inter-state Mutual Aid to support Urban Forest Strike Teams (UFST).	1) In Development
8.07	Urban Forest Strike Team	Participation in the UFST project.	0) Not Practiced

9) Practices, Standards, and Best Management Practices

Category	Component Evaluated	Description or Criteria for Evaluation	Status
9.00	*ANSI Standard & BMP Activities*		
9.01	ANSI Standards	Reference and adherence to ANSI Standards for arboricultural practices (A300), safety (Z133), or Nursery Stock (ANSI Z60.1) (any or all).	1) In Development
9.02	Ages/Diameter Distribution	Specific management for the development of an age-diverse tree population	1) In Development
9.03	Arborist Standards	Standards of practice for arborists (i.e. Certification).	1) In Development
9.04	Best Management Practices (BMPs)	Establishes or references tree maintenance BMPs (i.e. written comprehensive standards & standards).	1) In Development
9.05	Fertilization and Mulching	Fertilization or mulching standards required for conserved & planted trees.	1) In Development
9.06	Lightning Protection Systems	BMP written to the ANSI A300 Standard.	1) In Development
9.07	Planting	Planting and transplanting standards required/specified.	1) In Development
9.08	Pruning	Pruning standards required for conserved & planted trees.	1) In Development
9.09	Removal	Infrastructure damage, stump grinding, etc.	1) In Development
9.10	Support Systems (Guying and Bracing)	BMP written to the ANSI A300 Standard.	1) In Development
9.11	Tree Risk	Tree risk assessment procedures; ISA BMP or equivalent.	1) In Development
9.12	Construction Management Standards	Written standards for: tree protection, trenching/boring in CRZs, pre-construction mulching, root or limb pruning, watering (any or all).	1) In Development
9.13	Design Standards	Standards for design that specifically require trees; standards for tree placement (i.e. location), soil treatment, and/or drainage.	2) Adopted Practice
9.14	Genus/Species Diversity	Suggests or requires diversity of plant material.	1) In Development
9.15	Green Stormwater Infrastructure (GSI)	BMPs for site level GI practices like rain gardens and swales. Small-scale projects.	2) Adopted Practice

9.16	Inventory Data Collection	Community has adopted or developed applicable (written) standards for local urban tree inventory data collection to support QA/QC. Currently, there is no identified national standard. But, the following have components and elements worth noting.	2) Adopted Practice
9.17	Minimum Planting Volume	Minimum required root zone volume.	1) In Development
9.18	Minimum Tree Size	Minimum caliper for tree replacements, and/or minimum size of existing trees to receive tree density or canopy credit.	2) Adopted Practice
9.19	Root Protection Zone (CRZ)	Defines adequate root protection zone; Critical Root Zone (CRZ).	1) In Development
9.20	Safety		1) In Development
9.21	Topping	Prohibits topping or other internodal cuts (public & private).	1) In Development
9.22	Tree Species List	Identifies and publishes a list of the most desirable, recommended, and/or preferred species (may include native and non-native species); alternatively, a list of species prohibited.	1) In Development
9.23	Tree Quality Standards	Written standards for tree selection at nursery in addition to Z60.1.	1) In Development
9.24	Utility Right-of-Way (ROW) Management	Requirements for planting, pruning, and/or removal of trees within a utility ROW.	1) In Development
9.25	Urban Agriculture	Enabled urban food forestry practices.	1) In Development
9.26	Wood Utilization	Larger diameter material is processed for wood products.	1) In Development
9.27	Third-party forest products certification compliance	Adoption of international standards for production of wood products. Example: Forest Stewardship Council™ (FSC®)	0) Not Practiced
9.28	Energy generation	Local or regional use of chips or other woody debris for co-generation facilities.	0) Not Practiced
9.29	Composting of Leaf and/or Other Woody Debris	Leaves and small woody debris are captured and used on-site or processed by someone by composting for reuse.	2) Adopted Practice

10) Community

Category	Component Evaluated	Description or Criteria for Evaluation	Status
10.00	*Community Building*		
10.01	Education	The urban forest is used as an educational laboratory for class activity; Kids in the Woods, PLT, high school, or college level.	2) Adopted Practice
10.02	NeighborWoods® Program or similar	Does your community sponsor this or similar private tree program locally?	1) In Development
10.03	Public web-mapping inventory software	Public access to the community tree resource via an on-line mapping program	2) Adopted Practice
10.04	Public Perception	Is public management consistent with private property requirements for tree protections and care? Does the Campus/public tree management reflect neighborhood norms?	1) In Development
10.05	Recognition Programs	Programs that raise awareness of trees or that use trees to connect the community to significant events or activities.	1) In Development
10.06	Arbor Day Celebration	Whether or not associated with Tree City USA.	2) Adopted Practice
10.07	Arboretum designation	Internal or third party arboretum designation.	0) Not Practiced
10.08	Significant trees	For example: size, history.	1) In Development
10.9	Memorial/Honorarium	Tree planting or tree care programs that honor individuals, organizations, or events.	1) In Development
10.10	Social Media	Does your community make use of social media for internal or external outreach?	2) Adopted Practice
10.11	Active Communications	Press releases, regular news articles (print), "State of the Urban Forest" reports, periodic analysis of threats and opportunities.	1) In Development
10.12	Tree Care	Are volunteers trained and used for basic tree care (e.g. mulching, pruning, planting).	2) Adopted Practice
10.13	Tree City/Campus USA®	Community/campus meets current qualifications for either of these programs.	2) Adopted Practice
10.14	Volunteer Opportunities	Ad hoc or scheduled. Any/all age groups. Tree Campus USA student activities.	2) Adopted Practice

11) Green Asset Evaluation

Category	Component Evaluated	Description or Criteria for Evaluation	Status
11.00	*Observed Outcomes*		
11.01	Deadwood	Look for evidence of periodic or ad-hoc deadwood removal (i.e. lack of dead limbs ≥ 2" in the trees or on the ground).	2) Adopted Practice
11.02	Genus Diversity	No genera exceed **20%** of population	1) In Development
11.03	Mature Tree Care	Mature trees are retained in the landscape, and are of acceptable risk; i.e. veteran tree management.	1) In Development
11.04	Mulching	Evidence of adequate (i.e. spatial extent, depth, and material) roots zone mulching for all age classes.	1) In Development
11.05	Planting Site Volume Optimization	Are species & sites matched for optimization of above ground canopy; right tree in the right spot concept.	1) In Development
11.06	Rooting Volume Optimization	Are species & sites matched for optimization for below ground rooting volume; right tree in the right spot concept.	1) In Development
11.07	Species Diversity	No species/cultivars exceed **10%** of population; make specific observations for *Acer*, *Quercus*, and *Ulmus* genera. Also evaluate the role of regionally local native species.	1) In Development
11.08	Soil Compaction	Observe evidence of soil compaction during maintenance.	1) In Development
11.09	Tree Health	Rate the overall tree health in all size (age) classes	2) Adopted Practice
11.10	Young Tree Pruning	Look for evidence of periodic structural pruning	1) In Development

APPENDIX C. CRITERIA & INDICATORS FOR URBAN FOREST MANAGEMENT

Based on the auditing results provided in Appendix B, the City can use the following criteria and indicators for adjusting strategies as the Plan is implemented. The indicators provide the monitoring and measurement information for evaluation. These optimal performance indicators are listed in the tables below for the Vegetation Resource (the trees), Resource Management (the staff), Community Framework (the people), and Institutional Framework (the agencies) for Troy's community forest. Using these Performance Indicators that follow and the methods for monitoring (listed in the next section) will guide the City towards preserving and enhancing the community forest for years to come.

Criteria	Vegetation Resource – Performance Indicators				Key Objective
	Low	Moderate	Good	Optimal	
V1 Tree species diversity	Sample survey determines fewer than five species dominate the entire tree population citywide	Sample survey determines no species represents more than 20% of the entire tree population citywide	Complete inventory determines no species represents more than 15% of the entire tree population citywide	Complete inventory determines no species represent more than 10% of the entire tree population citywide	*Establish a diverse and resilient tree population citywide*
V2 Diameter distribution of trees in the City	1 of 6 DBH ranges match the McPherson Ideal Distribution % (+/- 2%)	2 of 6 DBH ranges match the McPherson Ideal Distribution % (+/- 2%)	4 of the 6 DBH ranges match the McPherson Ideal Distribution % (+/- 2%)	6 of the 6 DBH ranges match the McPherson Ideal Distribution % (+/- 2%)	*Provide for uneven aged Distribution citywide*
V3 Street and park tree health (includes pest and disease)	Less than 30% of trees rates as good health condition and/or lack of comprehensive tree inventory	31 - 60% of trees rated as good health condition.	61 - 85% of trees rated as good health condition	Greater than 85% of trees rated as good health condition	*Healthy trees live longer, produce greater no. of benefits and reduce costs associated with maintenance*
V4 Planting and stocking levels	No planting of street trees. Abundant vacant planting sites	10% of inventoried planting sites are planted. No available inventory of planting sites but will use Planting Prioritization data	50-75% of inventoried planting sites are planted	100% of inventoried planting site are planted	*Addition of trees ad value, benefits and improved function. Based on planting sites along, within, or adjacent to street ROW*
V5 Climate change resiliency	Less than 50% of trees are of species considered suitable for the City	50%-75% of trees are of species considered suitable for the City	More than 75% of trees are of species considered suitable for the City	At least 90% of the trees are of species considered suitable for the City	*Establish a tree population suitable for the City's urban environment and resilient to climate change*
Current State Summary					**Total: 5**

Criteria	Resource Management – Performance Indicators				Key Objective
	Low	Moderate	Good	Optimal	
R1 Urban forest management plan	Existing urban forest management plan limited in scope and implementation	Comprehensive plan for publicly owned and managed urban forest resources are accepted and implemented	Strategic multi-tiered plan for public and private urban forest resources is accepted and implemented with adaptive management mechanisms	A comprehensive urban forest management plan for private and public property is accepted and implemented with adaptive management mechanisms	*A comprehensive urban forest management plan for private and public property is integrated into plans for sustainability*
R2 Citywide funding	Funding for reactive management	Consistent funding for minimal proactive management	Consistent funding to provide for net increase in urban forest benefits	Consistent private and public funding to sustain maximum urban forest benefits	*Develop and maintain adequate and consistent funding to implement the urban forest management plan*
R3 City urban forestry staffing	No training for urban forestry staff	Certified arborist on staff with regular professional development	Certified arborist and professional forester on staff with regular professional development and support staff	Multi-disciplinary professional team within the urban forestry unit	*Employ and train adequate Professional staff to implement citywide urban forest management plan*
R4 Management of publicly and privately-owned natural areas	Limited or no information about publicly or privately owned natural areas	Publicly and privately owned natural areas are identified in a generalized "natural area survey" or similar document	Ecosystem structure and function in publicly and privately-owned natural areas is documented	The ecological structure and function of all publicly owned and privately-owned natural areas are documented and used in making management decisions	*Management decisions are based upon a detailed understanding of the ecological structure and function of all publicly and privately-owned natural areas*
R5 Urban forest protection policy development and enforcement	No urban forest protection policy	Policies in place to protect public portion of the urban forest	Policies in place to protect public and private portions of the urban forest with enforcement	Integrated municipal wide policies that ensure the protection of the urban forest on both public and private land and are consistently enforced and supported	*The benefits derived from the urban forest are ensured by the implementation and enforcement of the urban forest management plan*
R6 Urban forest inventory public-private	Sample-based inventory of publicly owned urban forest	Complete inventory of publicly owned trees	Complete inventory of publicly owned trees and sample of privately-owned urban forest	Complete inventory of the urban forest resource	*Complete inventory of the urban forest resource to direct its management, included age distribution, species mix, tree condition, and assessment*

Criteria	Resource Management – Performance Indicators				Key Objective
	Low	Moderate	Good	Optimal	
R7 Tree planting and establishment on public and private land	Tree planting and establishment is *ad hoc*	Tree establishment is directed by needs derived from a tree inventory and/or tree planting prioritization data	Tree establishment is directed by needs derived from a tree inventory and is sufficient to meet canopy cover objectives	Tree planting and establishment program are driven by the UFMP objectives for canopy cover, species diversity, and species distribution objectives to ensure urban forest sustainability	*Tree planting and establishment is directed by objective criteria set in the urban forest management plan*
R8 High risk tree maintenance	Highest priority removals only are addressed within 5 years of notice	All high priority removals and some immediate pruning is addressed within 2 years of notice	All high priority removals and most immediate pruning is addressed within 2 months of notice	Proactive mature tree care (lightning protection, cabling, etc.) is conducted and risk is greatly reduced except after storm events	*Maintain public safety and the longevity of the trees and the reputation of the urban forest program*
R9 Public tree condition assessment and abatement citywide	The condition of the urban forest is unknown	No citywide public tree condition assessment/ remediation program. Request based/reactive system	Complete public tree inventory including tree risk information. Request-based/ reactive risk abatement program system. Use of work order software	Inventory of public trees includes detailed tree risk ratings; risk abatement program is in effect eliminating hazards using a work order software	*All publicly managed trees are free of recognizable hazards*
R10 Routine tree pruning	One-tenth of large trees are pruned on a 5-year rotation	One-eighth of large trees are pruned on a 5-year rotation	One-fifth of large trees are pruned on a 5-year rotation	One-third of large trees are pruned on a 5-year rotation	*Improve tree health, longevity, public safety, and clearance conflicts. Based on trees >6" DBH identified in the inventory*
R11 Young tree maintenance	No young tree training	One-fifth of small trees are training pruned. Newly planted trees are training pruned within 10 years of planting	One-third of small trees are training pruned. Newly planted trees are training pruned at 3-4 years of planting	One-half of small trees are training pruned. Newly planted trees are training pruned at 3 years of planting	*Improve the structure trees at an early age to reduce future maintenance costs and issues. Based on trees <6" DBH*

Criteria	Resource Management – Performance Indicators Low	Moderate	Good	Optimal	Key Objective
R12 Tree pest & disease management (ash & EAB)	No ash tree management for EAB is in place	An inventory of ash trees and the locations is current	Ash tree management plan in place	Ash tree management plan is in implementation	*Plan and manage ash trees to reduce sudden widespread mortality*
R13 Tree site suitability	Tree species are considered in planting site selection	Guidelines are in place for the selection of suitable species to meet specific site criteria. Best practices and industry standards are in place	Public trees are planted in sites with adequate soil quality and quantity, and growing space to achieve their growth and form potential. Private owners are provided science-based standards on tree selection and site suitability	All trees are planted in sites that will maximize current and future benefits	*Management of urban forest will become more efficient and effective in producing environmental, social and economic benefits*
R14 Invasive plant species management	Recognition of invasive species	Recognition of invasive species, are actively discouraged and voluntary control on private and public lands	Invasive species are recognized, managed, and their use is prohibited	Invasive plant species management plans are developed and implemented for public and private lands	*Elimination of invasive plant species*
R15 Public tree condition assessment and abatement along emergency and evacuation routes	The condition of trees along emergency evacuation routes is unknown	No tree condition assessment/ remediation program along emergency routes. Request based/reactive system	Sample-based tree inventory including general tree risk information along emergency/ evacuation routes. Risk abatement is not systematic	Complete tree inventory which includes detailed tree failure risk ratings; risk abatement program is in effect eliminating hazards along emergency/ evacuation routes	*Emergency and evacuation routes will be clear during the on-set of storms and will require minimal clearing of woody debris following a storm event*
R16 Canopy assessment and canopy goals	No canopy assessment or a low-resolution canopy assessment (e.g. i-Canopy) is completed but no goals are set	High-resolution canopy assessment is completed but no goals are set	High-resolution canopy assessment and goals are completed and the existing canopy cover equals 25-50% of the goal	High-resolution canopy assessment and goals are completed and the existing canopy cover equals 50-75% of the goal	*Understand canopy cover distribution citywide and set goals to increase canopy*
R17 Tree preservation best practices	No standards or best practices in place	Standards in place but outdated and little adherence and enforcement	Standards and best practices are in place and city forester is contacted to oversee site plan.	City forester is included in the design, placement, and construction or repair of structures and utilities	*Street trees near any excavation, demolition, or construction of any building, structure, or utility are preserved or protected*
Current State Summary					**Total: 17**

Criteria	Community Framework – Performance Indicators				Key Objective
	Low	Moderate	Good	Optimal	
C1 General awareness of the urban forest as a community resource	Urban forest seen as a community problem	Urban forest seen as important to the community	Urban forest acknowledged as providing environmental, social, and economical services	Urban forest recognized as vital to the community's environmental, social and economic well being	*The general public understands the importance of the urban forest to the community*
C2 Neighborhood cooperation	Majority of neighborhoods Are unfamiliar with Urban Forest Management Plan	Isolated or limited number of active neighborhood groups	Majority of neighborhood associations form partnerships with city government to implement the UFMP	All neighborhoods associations form partnerships with city government to implement the UFMP	*At the neighborhood level, citizens understand and cooperate in urban forest management*
C3 Citizen, municipal, business, commuter interaction	No interaction among constituencies	Some interaction among constituencies, with conflicting goals	Informal and/or general cooperation	Formal interaction with staff coordination	*All constituencies in the community interact for the benefit from the urban forest*
C4 Partner organizations, other proponents of the urban forest	No partner entity identified	Community organization exists but does not interact with city urban forestry efforts	Community organization exists and actively works with city to achieve similar goals	A network of community organizations and community leaders exists providing equitable distribution of resources / information and achieving citywide participation	*Community organizations can assist in the implementation of the UFMP, encourage stewardship, educate, and provide resources*
C5 Support by private land holders	Unfamiliar with Issues	Educational materials and advice available to landholders	Clear goals for tree resources by landholders. Incentives for protection and management of private trees	Landholders develop comprehensive tree management plans (including funding)	*Private landholders embrace citywide goals and objectives of the UFMP*
Current State Summary	**0**	**4**	**1**	**0**	**Total: 5**

Criteria	Institutional Framework – Performance Indicators				Key Objective
	Low	Moderate	Good	Optimal	
I1 City public agency cooperation	Conflicting processes among departments and or agencies that are inconsistent with the urban forest management	Urban forest management processes are held in common but improvement in cooperation among departments and/ or agencies is needed	Departments and/ or agencies are functioning and implementing processes consistent with the UFMP on a project specific basis	Municipal standards in place for implementing the UFMP by interdepartmental/ Interagency processes on all municipal projects	*Ensure all city departments cooperate with goals and objectives of the UFMP*
I2 Design and development industry and other government agency cooperation	Unfamiliar with issues	Recognition and acceptance of issues	Implement design and construction objectives consistent with the UFMP	Implement design and construction objectives that exceed UFMP objectives and support citywide green infrastructure	*Design and development industries, and other government agencies embrace citywide UFMP goals and objectives*
I3 Landscape and arboriculture industry cooperation	No cooperation among segments of the green industry. No adherence to professional standards and ethics	General cooperation among nurseries, tree care companies, etc.	Specific cooperative arrangements with City	Shared vision and goals including the use of professional standards and ethics	*The landscape and arboriculture industries operate with high professional standards and ethics, and commits to citywide urban forest management plan goals and objectives*
I4 Cooperation within the geographic region	Government and planning agencies operate independently	Government and planning agencies share similar policy vehicles	Regional planning is in effect	Regional natural resource comprehensive planning is coordinated	*Cooperation and interaction among neighboring regional planning agencies and governments to support forest sustainability throughout the region*
Current State Summary	**1**	**3**	**0**	**0**	**Total: 4**

APPENDIX D. MONITORING GUIDELINES FOR CRITERIA & ACTIONS

Vegetation Resource

V1) Tree species diversity
Measure: Tree inventory data in TreePlotter system and/or MS Excel or Access.

V2) Diameter distribution of trees in the City
Measure: Tree inventory data in TreePlotter system and/or MS Excel or Access.

V3) Street and park tree health (includes pest and disease)
Measure: Tree inventory data in TreePlotter system and/or MS Excel or Access.

V4) Planting and stocking levels
Measure: Tree inventory data in TreePlotter system and/or MS Excel or Access.

V5) Climate change resiliency
Measure: NOAA climate zones and the tree inventory data in TreePlotter system and/or MS Excel or Access. Tree species list is updated accordingly. Trees are evaluated.

Resource Management

R1) Urban forest management plan (acceptance and implementation)
Measure: Review by the Planning Department and Street Tree Advisory Board.

R2) Citywide funding
Measure: Annual review by the Planning Department and Street Tree Advisory Board.

R3) City urban forestry staff funding
Measure: Annual review by the Planning Department and Street Tree Advisory Board.

R4) Management of publicly and privately-owned natural areas
Measure: Annual internal review of public land management to include random sampling of resources and utilize the other plans/studies.

R5) Urban forest protection policy development and enforcement
Measure: Semi-annual review of process by the Planning Department and Street Tree Advisory Board and review of street and park tree inventory data in tree management software relating to tree condition, observations, conflicts, etc.

R6) Urban forest inventory public-private
Measure: Semi-annual review of process by the Planning Department and Street Tree Advisory Board and review the street and park tree inventory data in tree management software and future inventory data.

R7) Tree planting and establishment on public and private land
Measure: Review of the street and park tree inventory data and future tree inventories and analysis. Gather data to determine private property tree plantings.

R8) High risk tree maintenance
Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R9) Public tree condition assessment and abatement citywide

Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R10) Routine tree pruning
Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R11) Young tree maintenance
Measure: Internal review by Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R12) Tree pest and disease management
Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of pest and disease presence, risks, management, and costs.

R13) Tree site suitability
Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R14) Invasive plant species management
Measure: Internal review of public and private lands using random sampling by the Planning Department and Street Tree Advisory Board, and partners.

R15) Public tree condition assessment and abatement along emergency and evacuation routes
Measure: Internal review by the Planning Department and Street Tree Advisory Board by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R16) Canopy assessment and goals
Measure: The Planning Department and Street Tree Advisory Board should conduct a tree canopy assessment and prioritized planting analysis to establish local and Citywide canopy goal based on resources, available planting space, and specific needs. Do a 5 to 10-year follow ups to determine canopy gains and losses.

R17) Tree preservation best practices
Measure: City staff is on site for review of construction/repair of structures and utilities that may impact the trees within the right-of-way. Sample inventory and future inventories to see if in effect.

Community Framework

C1) General awareness of the urban forest as a community resource
Measure: Conduct a 2-year community survey.

C2) Neighborhood cooperation
Measure: Conduct a 2-year community survey.

C3) Citizen, municipal, business, commuter, interaction

Measure: Semi-annual review by the Planning Department and Street Tree Advisory Board.

C4) Support by private land holders
Measure: Semi-annual review by the Planning Department and Street Tree Advisory Board.

Institutional Framework

I1) City public agency cooperation
Measure: Semi-annual review by the Planning Department and Street Tree Advisory Board.

I2) Design and development industry and other government agency cooperation
Measure: Annual random sampling of site specific designs and implementation of future tree inventories.

I3) Landscape and arboriculture industry cooperation
Measure: The green industry use of ANSI standards, state BMP's, state nursery grades and standards.

I4) Cooperation within the geographic region
Measure: Semi-annual review by the Planning Department and Street Tree Advisory Board.

APPENDIX E. CREATING A TREE POLICY MANUAL OR STREET TREE ORDINANCE

Tree Policy Element	Description
ANSI Standards	Reference and adherence to ANSI Standards for arboricultural practices (A300), safety (Z133), or Nursery Stock (ANSI Z60.1) (any or all).
Ages/Diameter Distribution	Specific management for the development of an age-diverse tree population
Arborist Standards	Standards of practice for arborists (i.e. Certification).
Best Management Practices (BMPs)	Establishes or references tree maintenance BMPs (i.e. written comprehensive standards & standards).
No Net Loss	Can refer to trees, basal area, or canopy.
Fertilization and Mulching	Fertilization or mulching standards required for conserved & planted trees.
Lightning Protection Systems	BMP written to the ANSI A300 Standard.
Planting	Planting and transplanting standards required/specified. ANSI A300 Standard.
Pruning	Pruning standards required for conserved & planted trees. ANSI A300 Standard.
Removal	Infrastructure damage, stump grinding, etc.
Utility	Utility pruning, planting, and installation policy (e.g. boring vs. trenching).
Support Systems (Guying and Bracing)	BMP written to the ANSI A300 Standard.
Tree Risk	Tree risk assessment procedures; ISA BMP or equivalent. (ANSI A300 Part 9 & ISA BMP)
Disaster Response/Recovery Mechanism	Staff knowledge of the municipality's protocol for requesting disaster resources through the county or state with access to mutual aid and EMAC.
Urban Forestry as part of the County Disaster Plan	The CFMP is incorporated into the county/municipal disaster plan; specifically in reference to debris management and risk mitigation.
Recordkeeping, Reporting, and Communications	A process has been put in place to maintain records on requests, inspections, evaluations, and mitigation of risk; and on the communications among the managers related to those risk assessments.
Construction Management Standards	Written standards for: tree protection, trenching/boring in CRZs, pre-construction mulching, root or limb pruning, watering (any or all). See ISA BMPs.
Design Standards	Standards for design that specifically require trees; standards for tree placement (i.e. location), soil treatment, and/or drainage.
Genus/Species Diversity	Suggests or requires diversity of plant material.
Green Stormwater Infrastructure (GSI)	BMPs for site level GI practices like rain gardens and swales. Small-scale projects.
Inventory Data Collection	Adopt or develop applicable (written) standards for local urban tree inventory data collection to support QA/QC.
Minimum Planting Volume	Minimum required root zone volume.

Minimum Tree Size	Minimum caliper for tree replacements, and/or minimum size of existing trees to receive tree density or canopy credit.
Root Protection Zone (CRZ)	Defines adequate root protection zone; Critical Root Zone (CRZ).
Safety	Refer to ANSI Z133 Safety Standards.
Topping	Prohibits topping or other internodal cuts (public & private).
Tree Species List	Identifies and publishes a list of the most desirable, recommended, and/or preferred species (may include native and non-native species); alternatively, a list of species prohibited.
Tree Quality Standards	Written standards for tree selection at nursery in addition to Z60.1.
Utility Right-of-Way (ROW) Management	Requirements for planting, pruning, and/or removal of trees within a utility ROW.
Significant Trees	Criteria for designating trees of unique size, history, location, species, etc. and the protection practices of such trees.
Urban Agriculture	Enabled urban food forestry practices.
Wood Utilization	Larger diameter material is processed for wood products.
Third-party forest products certification compliance	Adoption of one of the international standards for production of wood products, for example, Forest Stewardship Council™ (FSC®). Standards can apply to any/all publicly owned and managed trees; parks, street trees, and/or community forests.
Energy generation	Local or regional use of chips or other woody debris for co-generation facilities.
Composting of Leaf and/or Other Woody Debris	Leaves and small woody debris are captured and used on-site or processed by someone by composting for reuse.
Urban Interface (WUI)	Programs or policies that improve management of the urban interface for fire and/or invasive species.
Performance Monitoring	Recognizes the annual or biennial calculation of metrics (e.g. some component of ecosystem services) for the purpose of tracking management performance.
Canopy Goals	Established based on the i-Tree Canopy and Planting Prioritization data. Develop canopy goals at the parcel level, by land use, neighborhood, census boundary, and citywide. Use U.S. Forest Service and i-Tree research to calculate number of trees to achieve canopy percentages.

APPENDIX F. CASE STUDIES

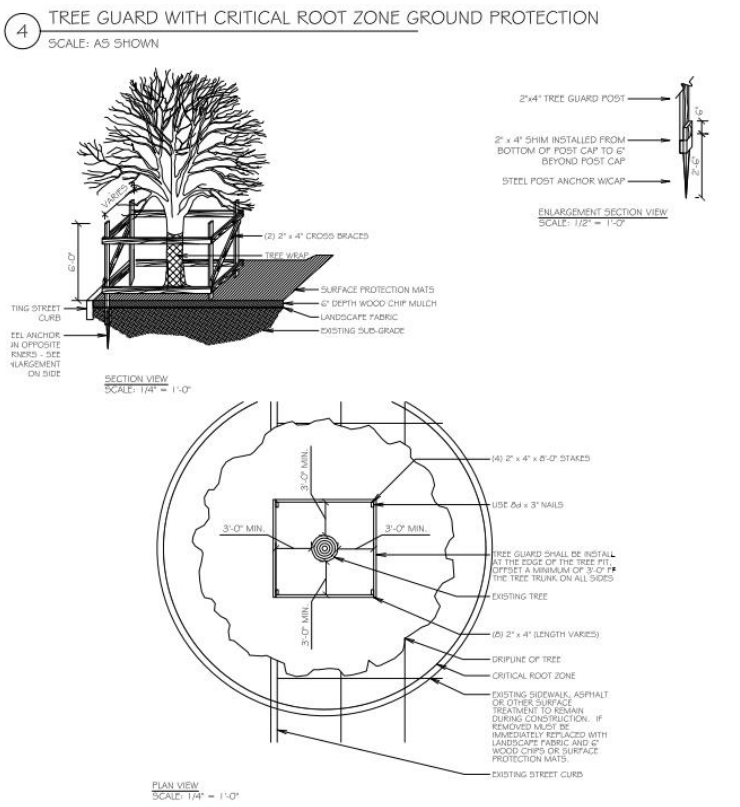
NYC Parks Tree Protection Best Practices & Protocol

nycgovparks.org

Objectives of Case Study: Maximize the efficiencies in maintaining the benefits of trees. Unify and coordinate approved best management practices (BMPs) for all tree care activities.

The City of Troy seeks to improve tree protection during construction projects. The NYC Parks Tree Protection Best Practices & Protocol provides additional information and an approach for the City to consider.

1. Anyone performing any and all work performed within 50 feet of a City tree must possess a permit issued by NYC Parks to avoid unsafe, hazardous and other conditions which may be detrimental or potentially detrimental to any city tree. It is incumbent upon the applicant to ascertain as to whether or not there are any trees or tree roots situated within the city right of way. Any and all trees that fall within NYC Parks jurisdiction are protected by law from any and all damage thereto including but not limited to any incidental damages, damage to the canopy, or damage to the trunk or root zone during and in the course of any and all construction activities, and also the aftermath of any and all construction activities. No cutting or otherwise damaging of tree roots is permitted. Any and all tree work must be permitted. Tree work performed absent a permit can result in civil or criminal sanctions. Violations are punishable by a fine not to exceed $15,000 and/or imprisonment for up to one year. Any and all applications relating to construction activities must be accompanied by the appropriate documentation as requested by the Tree Work Permit or upon Forester request.



2. Applicant shall notify NYC Parks' Forestry division at least 20 business days prior to the commencement of any work requiring a permit.

3. Temporary wooden tree guards and a temporary snow fence boundary shall be installed immediately around each tree impacted by demolition and/or construction and maintained throughout the course of the entire demolition and construction process. Download our Tree Protection Guidelines [PDF] for more.

4. The contractor shall take extreme care to protect the root systems of the existing trees. Bulk material, equipment, scaffold footings, or vehicles shall not be stockpiled or parked within the critical root zone (CRZ) of any tree, or within 10 feet of the trunk (whichever is

greater). This is done to minimize surface and subsurface root and soil compaction. This applies to all CRZs within or outside the project limit line. Every inch of DBH (diameter breast height) of the tree represents one required radial foot of tree protection.

5. If stockpiling occurs within the CRZ, a stop work order shall be issued immediately to the NYC Department of Buildings. Additional violations may be issued and may require remedial work to remain within forestry inspector's prescribed timeframe. Work shall not re-commence until all stockpiled material is removed from the CRZ and tree remediation is satisfied.

6. If any machinery is operating within the CRZ, the affected area shall be covered with mulch to a depth of at least 12 inches and covered with plywood or metal plates to distribute weight in order to protect roots from damage caused by heavy equipment. Such covering shall be maintained during the course of construction and removed by hand or as specified by the contracted certified arborist or forestry inspector with associated photos reported accordingly. Heat sources, flames, ignition sources, and smoking are prohibited within the CRZ and within the above mentioned mulched area.

7. When a deficiency in tree protection is determined by a forestry inspector it must be remedied immediately. Failure to correct the deficiency immediately may result in violations and summons.

8. Any damage to existing trees during construction shall be the contractor's responsibility. The contractor shall perform remedial work to damaged trees at the contractor's expense; this work shall meet all NYC Parks regulations. Contractor is responsible for obtaining all necessary permits to comply with NYC Parks regulations. Visit our Tree Services page for more resources.

9. Contractor will contact NYC Parks if any underground infrastructure (gas, water/electric etc.) affects any proposed/existing trees onsite. Project manager is aware that any work done on or within 50 feet of a city tree requires a permit from NYC parks. This includes utility, sidewalk, pruning, or any other work within the CRZ of a tree (within the city right of way) done by the general contractor or any subcontractors. Contractor will be familiar with, and follow NYC Parks' planting and forestry specifications. In some instances, utilities may not be labeled on proposed site plan. If utilities are unknown, the project manager must amend the plans and request their plans be reapproved by NYC Parks.

10. The construction access route is to be diagrammed and routed to minimally impact any existing trees. Final route shall be established on site and approved by the forestry inspector. Site plans are to be included and amended accordingly when requesting NYC Parks approval.

11. Roots over one inch in diameter shall not be cut without the written permission of the borough director of forestry.

12. To best protect tree roots the contractor shall exercise extreme care in removing concrete or asphalt within the CRZ of existing trees. Pavement should be lifted rather than dragged. Any excavation within the CRZ, or elsewhere on site, as indicated on the tree protection plan, shall be done by hand or pneumatic excavation and in the presence of the forestry inspector or contracted certified arborist with associated photos and

report to be filed with an NYC Parks forestry inspector. A contractor is to schedule appointment with the forestry inspector accordingly.

13. The excavation area within the CRZ shall be backfilled immediately and/or roots shall be kept constantly moist with burlap covered with white plastic and checked a minimum of two times a day, once in the morning and once in the afternoon, for a maximum of 48 hours, until backfill is complete as directed by the director of landscape construction and the resident engineer. If directed, soaker hoses shall be installed to facilitate properly moist conditions. No pooling of water or continuous running water shall occur within the drip line of existing trees or within the tree protection zones other than that during the irrigation process.
14. If roots are to be exposed for a period greater than 48 hours, the exposed area shall be covered with at least six inches of mulch and maintained moist during the course of construction until the area can be properly backfilled. Photos are to be taken periodically and reported to the forestry inspector by a landscape contractor or a contracted certified arborist.
15. No runoff or spillage of noxious materials while mixing, placing, or storing construction material shall occur within the tree pit or CRZ. No ponding, eroding, or excessive wetting caused by dewatering operations shall occur within tree pit or critical root zone.
16. All existing trees being protected on the proposed job site are to be watered 20 gallons once weekly between March 1 and October 30 to best preserve existing trees during the demolition and construction processes. Watering shall be done in a manner that there should not be standing water around the tree.
17. Unless otherwise noted it is best to keep existing concrete within tree protection zone as long as possible until removal and reinstallation of new sidewalk. Concrete should be left intact throughout the demolition and construction process to prevent further soil compaction on existing tree roots. Other work may be specified by forestry inspector to be done within a prescribed timeframe. Metal grates are to be removed immediately. Cobblestones are to be removed immediately and the void created is to be amended with soil level to the sidewalk. Pit expansion may be required by forestry inspector.
18. Preparatory pruning work shall be performed only when directed by a forestry inspector. This work shall be performed in accordance with ANSI a300 standards and by a qualified, licensed & insured arborist or tree service company. Contractor is to follow all NYC Parks Forestry permit & work order regulations. Contractor is responsible for scheduling the appointment with forestry inspector.
19. All new indicated tree pits are to be fully excavated to the dimensions labeled and replaced with new quality topsoil to NYC Parks standards.

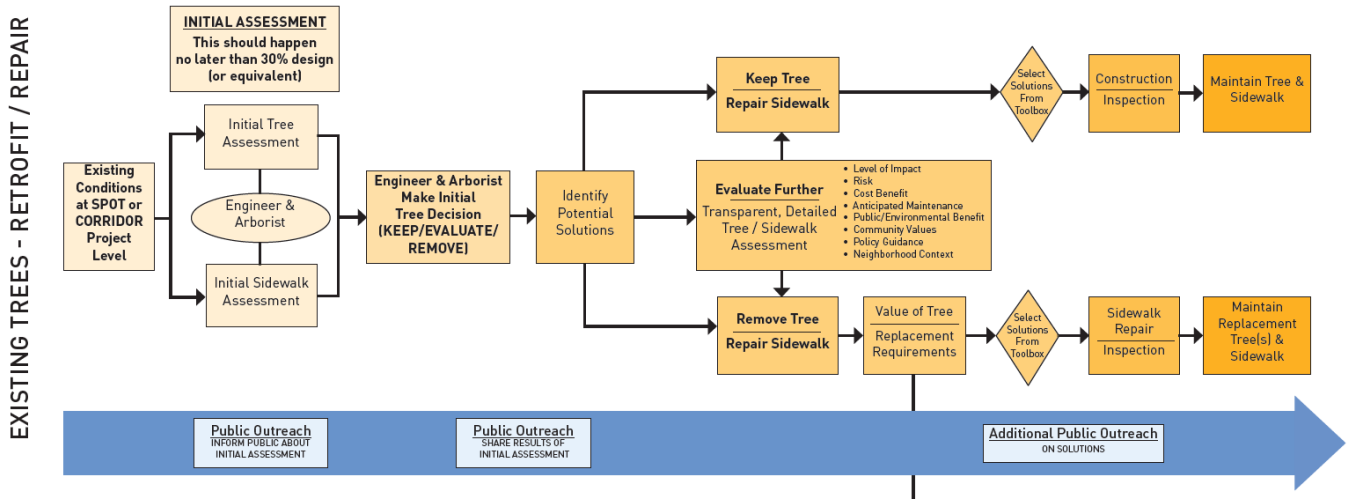
Seattle, WA Trees & Sidewalks Operations Plan

seattle.gov

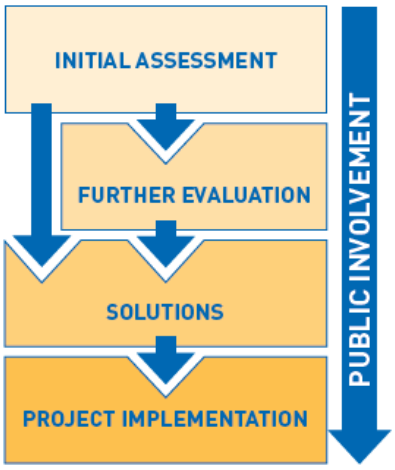
Objectives of Case Study: Maximize the efficiencies in maintaining the benefits of trees. Unify and coordinate approved best management practices (BMPs) for all tree care activities.

The purpose of the Trees and Sidewalks Operations Plan is to clarify responsibilities and work processes and to provide guidance on installation, repair, and maintenance of sidewalks and street trees in public places in Seattle. This tree/sidewalk assessment and work progress will standardize decisions relating to tree protection to achieve goals established in Troy's Plan.

TREE/SIDEWALK ASSESSMENT & WORK PROCESS



TOOLKIT OVERVIEW



CATEGORY	TOOLS	PROACTIVE	RESPONSIVE	COST* ($ $$ $$$ $$$$)	EXPECTED USEFUL LIFE (Month Year Decade Century)
MATERIAL	**PAVING AND OTHER SURFACE MATERIALS**				
	Asphalt	P	R	$-$$$	M Y D C
	Expansion Joints	P	R	$	M Y D C
	Pavers	P	R	$$-$$$	M Y D C
	Pervious Concrete	P	R	$$$-$$$$	M Y D C
	Reinforced or Thicker Slab	P	R	$$-$$$	M Y D C
	Rockery / Wall	P		$$-$$$$	M Y D C
	Beveling		R	$-$$	M Y D C
	Porous Asphalt	P	R	$-$$$	M Y D C
	Shims		R	$	M Y D C
	Tree Guards and Tree Rails	P	R	$$-$$$	M Y D C
	Decomposed Granite	P	R	$-$$	M Y D C
	Mudjacking (Concrete Leveling)		R	$$-$$$$	M Y D C

Financing San Francisco's Urban Forest

healthyplacesindex.org

San Francisco's Cost/Benefits of a Comprehensive Municipal Street Tree Program

Objectives of Case Study: Preserve and increase the City's urban tree canopy and maximize the benefits of trees. Program funding for preserving and growing urban tree canopy cover.

This study explores various options for expanding resources to better maintain, augment and care for San Francisco's street trees. The primary objective of this study is to evaluate the costs and benefits of a comprehensive, municipally-operated street tree program in San Francisco, in which the Department of Public Works (DPW) would be responsible for the planting and maintenance of all trees within the public right-of-way. This study assesses potential financing strategies to generate revenue for the implementation of a municipally-operated street tree program in San Francisco which could be applied to Troy's goal to share some responsibility of tree maintenance in rights-of-way, provide assistance to lower-income residents for tree maintenance, and/or attain additional program funding.

FINANCING OPTIONS	ATTRIBUTES	PROCESS	OPPORTUNITIES	CHALLENGES	PRECEDENTS
Most Feasible Options					
Landscape and Lighting District (LLAD)	Special assessment for landscaping, lighting, open space improvements and acquisition	City agency/property owners initiate via petition, City agency administers; based on benefits calculated in engineer's report; >50% of property owners in proposed assessment district must approve via mail ballot	Citywide LLAD possible for all street trees; individual LLADs more feasible in areas with many trees, high maintenance needs and/or political support	Typically funds more than just street trees	Sacramento citywide LLAD funds 100% of street tree program; Oakland citywide LLAD; San Jose considering $100/tree property-based user fee for street trees
Parcel Tax	Assessment levied independent of property value, can be equal amount per parcel or dependent on lot size	2/3 of voters (not just property owners) must approve via election ballot	Tax can be directly related to program costs; maintenance taxes deductible for property owners	2/3 voter approval; potential competition from other services (e.g., schools); flat tax distributes cost inequitably	Davis Parks Maintenance Tax replaced LLAD in 1998, renewed for 3rd time in June 2012, tax too low ($49/parcel) to be sustainable
General Obligation (GO) Bond	Low-interest loan for capital projects & improvements; repaid by levying tax revenue	2/3 voter approval required	Frequently used tool in San Francisco, with precedent for tree planting	Funding provided for set period; maintenance ineligible for funding	2011 Road Repair and Street Safety Bond; 2009 Safe Streets and Road Repair Bond
Additional Options					
Maintenance Assessment District (MAD)	Special assessment for maintenance of open spaces, parks, playgrounds and other public areas	City agency/property owners initiate via petition, City agency administers; based on benefits provided through engineer's report; >50% of property owners in proposed assessment district must approve via mail ballot	Citywide MAD possible for all street trees; individual MADs more feasible in areas with many trees, high maintenance needs and/or political support	Typically funds more than just street trees	San Jose - 13 small MADs for landscaping, including street trees; San Diego - 52 MADs for various services, including street trees
Community Benefit District (CBD)	Special assessment for revitalization, economic development, streetscape improvements and security	Property owners initiate via petition, non-profit board administers; based on benefits calculated in engineer's report; >50% of property owners in proposed assessment district must approve via mail ballot	Feasible in areas with high pedestrian volumes, business concentrations, maintenance needs and/or political support	11 existing CBDs, most authorized to plant and maintain street trees; citywide CBD not likely feasible; typically funds more than just street trees, commercial area focus	Greater Union Square, Tenderloin North Market, Fisherman's Wharf, Noe Valley, Castro, 2500 Block Mission, Central Market, Yerba Buena, Ocean Avenue, Civic Center, Tourism Improvement District
Parking Benefit District (PBD)	Variant of CBD, revenue stream from parking meters for range of ROW and streetscape improvements and maintenance	Enacted via local ordinance specifying boundaries, rates and use of funds; City agency administers with input from advisory committee	No ballot approval required; visitors bear burden over residents; revenue can be expended beyond district boundaries; Livable City spearheading campaign in SF	Current policy guarantees excess meter revenue to MUNI, amendment required for trees beyond transit-related streetscape; typically funds more than street trees	Pasadena, West Hollywood, Santa Monica PBDS include funding for street and streetscape improvements

Saratoga Springs, NY Recommended Street Tree Planting List

saratoga-springs.org

Objectives of Case Study: Develop an updated tree species list for future tree planting projects based on the 2019 tree inventory and vacant planting site analysis. The City of Troy should develop its own list, but this case study provides an example of information to include.

Use Chart for Recommend Medium and Large Street Trees

Species	Common Name	Form	Height Potential	Soil pH Preference	Moisture Range - See Chart	Sun Shadow	Urban Establishment Notes	Structural Soil Success*	Transplant Notes
Acer rubrum	Red Maple	Varies by cultivar	40'-60'	5.0-7.0	3 to 8	FS-PSd	Sensitive to Stress	not adaptable	Spring
Acer saccharum	Sugar Maple	Varies by cultivar		7.5	4 to 8	FS-PSd	Sensitive to Stress	not adaptable	
Betula nigra	River Birch	oval to arching	50'-80'	5.0-7.0	2 to 8	FS	adaptable	Possible	Spring
Celtis occidentalis	Hackberry	Pyramidal to arching	40'-60'	5.0-8.2	3 to 11	FS	tolerant of urban conditions Terminal bud kill by salt spray	Proven	Spring, Proven bare root
Cladrastis kentukea	Yellow wood	Round	30'-50'	5.0-8.2	4 to 7	FS	Trouble Free - broad and low spreading, limb-up when young	Possible	Spring Only, prune only in the summer
Ginko biloba	Ginko (Male Only)	Pyramidal	60'-100'	5.0-8.2	4 to 12	FS	Male Only	Proven	Spring/ Fall
Gleditsia triancanthos v. inermis	Thornless Honeylocust	Open spreading	40'-100'	5.0-8.2	2 to 12	FS	Male preferred, needs space, most salt tolerante Chicago street tree	Proven	Large pit in lawn area
Gymnocladus dioicus	Kentucky Coffeetree (Male only)	Oval spreading	70'-80'	5.0-8.2	3 to 12	FS	Male preferred, needs space	Proven	Needs space for spreading habit
Liriodendron tulipifera	Tulip Poplar	broad pyramidal	80'-120'	5.0-8.2	3 to 7	FS	Not a tree for constrained locations	Possible	Northern seed source, fast growth
Nyssa sylvatica	Black Tupelo	varied, irregular	40'-70'	5.5-6.8	2 to 10	FS-PSd	prefers deep, acidic soils	not adaptable	transplant small trees B&B - Spring
Ostrya virginiana	hophornbeam	Oval	30'-50'	5.0-8.2	4 to 7	FS-PSd	cool, moist, acidic soils, salt sensitive	Possible	Slow growth
Platanus occidentalis	American Sycamore	Irregular, wide spreading	75'-100'	5.0-8.2	2 to 11	FS-PSd	Very adaptable	Possible	Needs space
Quercus alba	White Oak	Pyramid to wide spreading	50'-80'	5.5-6.5	4 to 11	FS	Trasplant B & B - small tree, not tolerant of compacted soils, iron chlorisis problems in high pH	not adaptable	prefers forested lands with rich mycorrhizal associations
Quercus bicolor	Swamp White Oak	Broad oval	50'-60'	5.0-7.0	1 to 9	FS	Trasplant B & B - small tree, Iron chlorisis problems in high pH	not adaptable	
Quercus coccinea	Scarlet Oak	Rounded	60'-80'	5.0-7.0	4 to 9	FS	Trasplant B & B - small tree, Iron chlorisis problems in high pH	not adaptable	Fast Growing
Quercus palustris	Pin Oak	Strong pyramidal	50'-70'	5.5-6.0	4 to 10	FS	Shallow root system, Iron chlorisis problems in high pH	not adaptable	Easily transplanted
Quercus rubra	Northern Red Oak	Rounded	60'-80'	5.0-7.5	4 to 10	FS	Shallow root system, Iron chlorisis problems in high pH	not adaptable	Fast Growing
Tilia americana	American Basswood	Pyramidal	60'-80'	6.5-8.2	3 to 9	FS-PSd	Adaptable	proven	Transplants readily
Ulmus americana	American Elm (resistant varieties only)	Arching vase	60'-80'	6.5-8.2	2 to 11	FS	Adaptable - disease resitant varieties only	Possible	Transplants readily

* Success with structural soils as documented by Cornell Cooperative Extension (Proven), or assumed to be possible based on pH and drought adaptability (Possible).

Moisture Chart

1	2	3	4	5	6	7	8	9	10	11	12
Occasionally saturated or very wet			Consistently moist, well drained			Occasional periods od dry soil			Prolonged periods of dry soil		

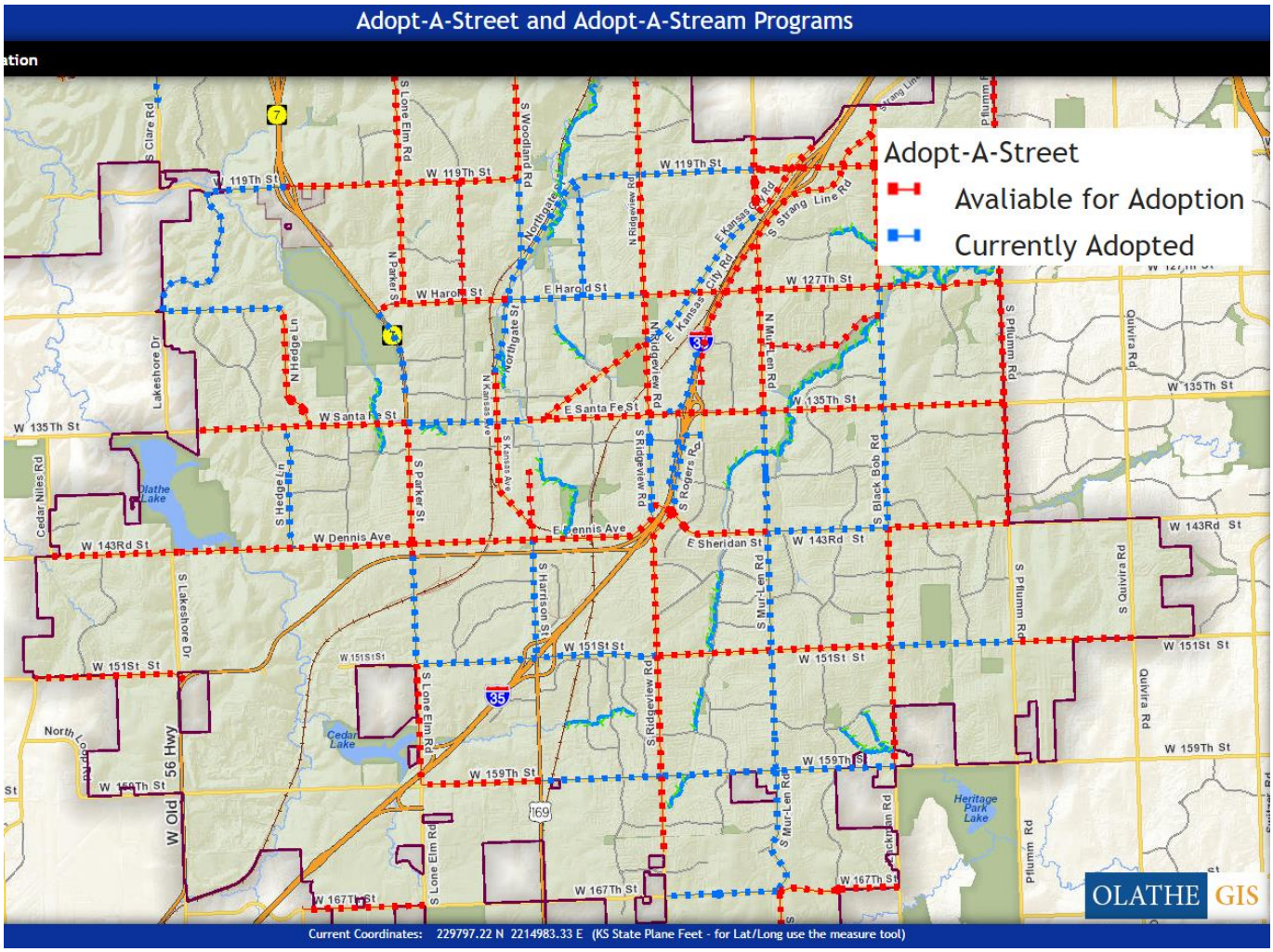
Adopt-A-Street Program

olatheks.org

Objectives of Case Study: Preserve and increase the City's urban tree canopy cover and maximize the benefits of trees. Program funding for preserving and growing urban tree canopy cover.

Kansas City, MO received a $26,000 grant from the U.S. Department of Justice in 2019 to continue its Adopt-A-Street program. Another example is in Olathe, KS.

While these programs focus on litter cleanup, Troy may consider utilizing this program model and funding source to develop a young tree maintenance and public rights-of-way cleanup program for lower-income areas. The City of Troy is devoted to improving lower-income areas by planting trees, but these trees need to be properly cared for and maintained in order to reduce future maintenance costs that would burden the adjacent property owner who may be of lower-income status. Addressing the maintenance needs of mature trees is a challenging issue that should be approached by considering City responsibility of such care. Funding mechanisms for this maintenance structure is provided in the "Financing San Francisco's Urban Forest" case study.



Portland, OR Neighborhood Tree Stewards Program & Urban Forestry Workshops

portlandoregon.gov

Objectives of Case Study: Foster community support for the local urban forestry program. Partnerships and community stewardship.

The Neighborhood Tree Steward (NTS) program trains participants to care for Portland's community trees. The program includes five classes and hands-on workshops where stewards learn tree biology, identification, proper planting and maintenance, tree regulations, and how the benefits of trees are intertwined into the lives of people. Stewards put their skills to use planting and pruning trees, organizing, advocating, and greening their neighborhoods. Stewards commit to volunteering 40 hours in their neighborhood after graduation.

The City of Troy should consider enhancing tree workshop and community engagement events.

Stewardship Opportunity	Description
Interpretive Tree Walks	Hosting a Tree Walk in your neighborhood or in your favorite park to introduce new people to the neighborhood's trees.
Tree Team Projects	Connect with Urban Forestry staff to learn about potential opportunities like tree plantings, tree giveaways, pop-up arboreta, local tree care projects, community outreach, and more.
New Tree Team Development	Connect with Urban Forestry to discuss how to make plans and goals for your new team and learn what resources are available for local tree care projects.
Outreach and Tabling Materials	Get access to Urban Forestry outreach materials to help teach new people about trees.
Portland Pruners Program	Once you have completed the Portland Pruners Program (PPP) orientation training, experienced pruners can organize small pruning workshops in their own neighborhoods.
Volunteer Opportunities	Urban Forestry will have many opportunities to volunteer with us. These opportunities include helping with Yard Tree Giveaways, Arbor Day, tabling at community events, assisting with workshops, more.

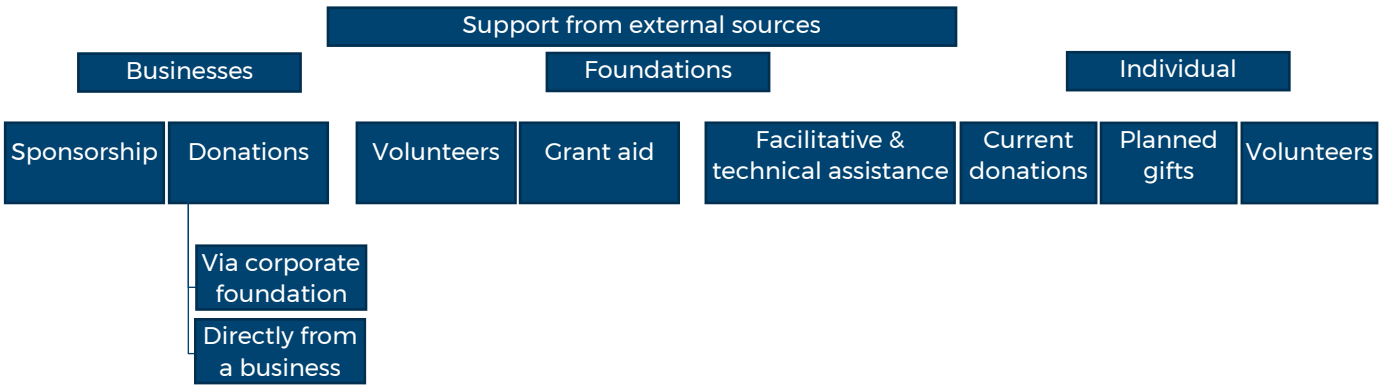
Example Workshops
Learning Landscapes Volunteer Training, Portland Pruners Program, Decode the Tree Code, Tree Walk Leader Training, Heritage Tree Workshop, Local Tree Care Provider Workshop

APPENDIX G. FUNDING OPPORTUNITIES

The City should monitor the NYS DEC Urban and Community Forestry Program for any grant opportunities to plant trees on public lands. The following provides a list of potential local government funding sources.

- **General revenues:** Funded from local property taxes and is the primary source of most tree program funds.
- **Bond revenues:** Bonds sold by a community to raise capital; not commonly used for trees, except in the case of catastrophes, such as storms that destroy many trees.
- **Capital improvement funds:** Project-specific funds from the general revenues; can be used to plant trees and other landscape associated with a construction project.
- **Permits:** A permit fee provides funds for some activity; for instance, funds from tree removal permits might be used for planting trees. The Community Forest Management Plan recommends creating a permitting structure for tree maintenance and removals.
- **Frontage tax:** Private property owners pay an annual tax on their street tree frontage that funds the street tree maintenance program.
- **Assessment district:** A special district formed by local government for property that will receive direct benefit from the construction or maintenance of public improvements. Property owners within the district pay an assessment that is proportional to each owner's share of benefit from the improvement. The tax is subject to majority vote of the property owners.
- **Tax incremental district:** Identify an area(s) as a tax increment district and issue urban redevelopment bonds, which are paid for by property taxes in the district.
- **Building permit assessment:** Building permit fees might be used for tree planting.
- **Compensatory payments:** Compensation for public tree damage by construction activities could be used for the urban forestry program.
- **Subdivision ordinances:** Troy's ordinances require developers to plant trees. Review the cash in lieu of planting and variances to confirm these are at suitable levels and amounts.
- **Development cost charges:** These special fees imposed on developers by cities are intended to offset the impact of growth. For example, if the growth necessitates road widening, some of these funds could be used for tree plantings along boulevards and medians as part of the roads project. Also, some of the revenues received from developmental cost charges may be used for tree planting in parks as part of general park landscaping.

Figure 33. Possible support for community forestry programs from outside sources



APPENDIX H. TREE MAINTENANCE WORKSHEET

Example annual work schedule for community trees (https://extension.psu.edu/annual-work-plans-for-tree-commissions - click "Download PDF")

Annual Work Schedule for Community Trees (Each dot in chart below = one week/month. Circle dot(s) to show when work will be done.)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Example: Work to be done first two weeks of May.	....	....	....	....	◌..	....	....	....	....	....	....	....
1. Planning and administration												
a. prioritize work to be done	....	....	....	....	....	....	....	....	....	....	....	....
b. organize activities	....	....	....	....	....	....	....	....	....	....	....	....
2. Tree planting												
a. survey potential planting sites	....	....	....	....	....	....	....	....	....	....	....	....
b. decide locations, species, and cultivars	....	....	....	....	....	....	....	....	....	....	....	....
c. notify adjacent property owners	....	....	....	....	....	....	....	....	....	....	....	....
d. announce and hold public hearing	....	....	....	....	....	....	....	....	....	....	....	....
e. order trees	....	....	....	....	....	....	....	....	....	....	....	....
f. inspect and tag trees in nursery	....	....	....	....	....	....	....	....	....	....	....	....
g. receive, inspect, and store trees	....	....	....	....	....	....	....	....	....	....	....	....
h. plant trees, prune, stake, and water	....	....	....	....	....	....	....	....	....	....	....	....
i. water trees periodically	....	....	....	....	....	....	....	....	....	....	....	....
3. Tree pruning												
a. survey trees, decide which to prune	....	....	....	....	....	....	....	....	....	....	....	....
b. arrange for crew, equipment, and supplies, or arrange for service contract	....	....	....	....	....	....	....	....	....	....	....	....
c. supervise pruning and disposal of wastes	....	....	....	....	....	....	....	....	....	....	....	....
4. Tree removal												
a. survey trees, decide on removals	....	....	....	....	....	....	....	....	....	....	....	....
b. notify adjacent property owners	....	....	....	....	....	....	....	....	....	....	....	....
c. announce and hold public hearings	....	....	....	....	....	....	....	....	....	....	....	....
d. arrange for crew, equipment, and supplies, or arrange for service contract	....	....	....	....	....	....	....	....	....	....	....	....
e. supervise removals	....	....	....	....	....	....	....	....	....	....	....	....
f. grind stumps, reseed	....	....	....	....	....	....	....	....	....	....	....	....
5. Public relations and funding												
a. report to municipal officials	....	....	....	....	....	....	....	....	....	....	....	....
b. prepare news releases	....	....	....	....	....	....	....	....	....	....	....	....
c. arrange news and TV coverage of events	....	....	....	....	....	....	....	....	....	....	....	....
d. submit Tree City USA application	....	....	....	....	....	....	....	....	....	....	....	....
e. submit grant applications	....	....	....	....	....	....	....	....	....	....	....	....
f. develop education programs	....	....	....	....	....	....	....	....	....	....	....	....
g. hold Arbor Day ceremony	....	....	....	....	....	....	....	....	....	....	....	....
h. conduct youth education	....	....	....	....	....	....	....	....	....	....	....	....
6. Other tasks												
a. water trees during drought	....	....	....	....	....	....	....	....	....	....	....	....
b. fertilize deficient trees	....	....	....	....	....	....	....	....	....	....	....	....
c. control diseases and insects, as needed	....	....	....	....	....	....	....	....	....	....	....	....
d. collect leaves and recycle	....	....	....	....	....	....	....	....	....	....	....	....
e. clean up storm breakage	....	....	....	....	....	....	....	....	....	....	....	....
f. conduct training, professional development	....	....	....	....	....	....	....	....	....	....	....	....
g. train tree workers	....	....	....	....	....	....	....	....	....	....	....	....

Appendix I. Community Forestry Resources

Local Resources

- Troy's TreePlotter app: https://pg-cloud.com/TroyNY/
- NYS Department of Environmental Conservation Urban and Community Forestry: https://www.dec.ny.gov/lands/4957.html
- NY State Urban Forestry Council: https://nysufc.org/
- NYSDEC Emerald Ash Borer: https://www.dec.ny.gov/animals/7253.html
- Cornell Cooperative Extension: http://ccerensselaer.org/environment
- Capital Roots: https://www.capitalroots.org/
- New York City Tree Planting Standards: http://www.nycgovparks.org/permits/trees/standards.pdf
- Cornell University Urban Tree Booklet: http://www.hort.cornell.edu/uhi/outreach/recurbtree/pdfs/~recurbtrees.pdf
- New York State Flora Atlas: http://newyork.plantatlas.usf.edu/
- NYS DEC Invasive Species List: http://www.dec.ny.gov/animals/65408.html

Community Outreach and Education

- The Nature Conservancy "Health Trees, Healthy Cities": https://www.conservationgateway.org/ConservationPractices/cities/hthc/Pages/default.aspx/training-resources
- U.S. Forest Service "Outreach Services Strategies for all Communities": http://actrees.org/files/What_We_Do/OutreachStrategies.pdf
- Project Learning Tree: https://forestry.ces.ncsu.edu/ncplt/

Regional Urban Forestry

- National Urban and Community Forestry Advisory Council: https://www.fs.fed.us/managing-land/urban-forests/ucf/nucfac
- American Forests: http://www.americanforests.org/
- Urban Forestry Index: www.urbanforestryindex.com
- TreeLink: www.treelink.org
- Trees Are Good: www.treesaregood.org
- American Grove: http://thegrove.americangrove.org/
- Society of Municipal Arborists: http://www.urban-forestry.com/
- Arbor Day Foundation: www.arborday.org
- Alliance for Community Trees: https://www.arborday.org/programs/alliance-for-community-trees/
- Tree Care Industry Association: http://www.tcia.org/
- The New York State Arborists, ISA Chapter: https://nysarborists.com/

Tree Ordinances

- Guidelines for Developing and Evaluating Tree Ordinances (automatic download):
- https://ir.library.oregonstate.edu/downloads/pg15bm22x
- Sample Tree Ordinance: https://www.arborday.org/programs/treecityusa/documents/sample-tree-ordinance.pdf
- Example Tree Contracting Specifications: https://www.springfieldmo.gov/DocumentCenter/View/11756
- Trees and Development Guidelines: http://www.a2gov.org/departments/field-operations/forestry/Pages/StreetTreesDevelopment.aspx

- American Public Works Association "Urban Forestry Best Management Practices for Public Works Managers: Ordinances, Regulations, & Public Policies": https://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-3.pdf

Urban Forest Storm Preparedness

- Urban Forest Strike Teams: http://articles.extension.org/pages/71461/urban-forest-strike-teams
- APA "Hazardous Tree Management and Post-Disaster Tree Management": https://www.planning.org/research/treemanagement/

Trees and Stormwater

- Urban Watershed Forestry Management: http://www.forestsforwatersheds.org/
- EPA Green Infrastructure: http://water.epa.gov/polwaste/green/upload/stormwater2streettrees.pdf

Urban Forests and Climate Change

- U.S. Forest Service "Urban Forests and Climate Change": https://www.fs.usda.gov/ccrc/topics/urban-forests-and-climate-change

Tree Management Best Practices

- ANSI A300 Standards: https://tcia.org/TCIA/BUSINESS/ANSI_A300_Standards_/TCIA/BUSINESS/A300_Standards/A300_Standards.aspx?hkey=202ff566-4364-4686-b7c1-2a365af59669
- ANSI A300 Pruning Specification Writing Guide: https://www.tcia.org/TCIAPdfs/Resources/Arboriculture/A300TreeCareStandards/A300Pruning-SpecificationWritingGuide-20170413.pdf
- ANSI Z60.1 Nursery Standards: https://www.americanhort.org/page/standards

Trees and Utilities

- Penn State Extension "Questions about Trees and Utilities": https://extension.psu.edu/questions-about-trees-and-utilities
- Utility Arborist Association "Common Questions about Electric Utility Pruning": https://uaa.wildapricot.org/page-18073
- VA Cooperative Extension "Trees and Shrubs for Problem Landscape Sites: Overhead Utility Easements" (automatic download): https://www.urbanforestrysouth.org/resources/library/ttresources/trees-and-shrubs-for-problem-landscape-sites-overhead-utility-easements/at_download/file
- The eXtension Foundation "Trees for Energy Conservation": http://articles.extension.org/trees_for_energy_conservation
- Arbor Day Foundation "Energy-Saving Trees": http://energysavingtrees.arborday.org/#About

Urban Wood Utilization

- http://ncufc.org/urban_wood_utilization_introduction.php

Planning Resources

- Vibrant Cities Lab's Community Asset & Goal-Setting Tool by American Forests and the U.S. Forest Service: https://www.vibrantcitieslab.com/assessment-tool/

- U.S. Forest Service and Davey Institute "Sustainable Urban Forest Guide": http://www.itreetools.org/resources/content/Sustainable_Urban_Forest_Guide_14Nov2016.pdf
- WI DNR "Technical Guide to Developing Urban Forestry Strategic Plans & Management Plans: http://dnr.wi.gov/topic/UrbanForests/documents/UFPlanningGuide.pdf
- Municipal Urban Forestry Staff American Public Works Association "Urban Forestry Best Management Practices for Public Works Managers: Staffing": https://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-2.pdf
- Tree Boards: http://www.tufc.com/pdfs/treeboard_handbook.pdf

Urban Forestry Funding

- Davey Resource Group "Funding Your Urban Forest Program": http://www.urban-forestry.com/assets/documents/funding-your-uf-program-jenny-gulick.pdf
- Alliance for Community Trees "Funding Sources": http://actrees.org/resources/tools-for-nonprofits/fundraising-tools-for-nonprofits/
- Penn State Extension "Sustaining and Funding an Urban Forestry Program": https://extension.psu.edu/sustaining-and-funding-an-urban-forestry-program
- American Public Works Association "Urban Forestry Best Management Practices for Public Works Managers: Budgeting & Funding": https://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-1.pdf

Tree and Urban Forest Ecosystem Benefits

- U.S. Forest Service i-Tree: www.itreetools.org
- U.S. Forest Northeast Community Tree Guide: Benefits, Costs and Strategic Planting: http://www.itreetools.org/streets/resources/Streets_CTG/PSW_GTR202_Northeast_CTG.pdf
- U.S. Forest Service "The Urban Forest and Ecosystem Services": https://www.fs.fed.us/psw/publications/mcpherson/psw_2016_mcpherson001_livesley.pdf

Tree Assessment Resources

- U.S. Forest Service Urban Tree Canopy Assessments (UTC): www.nrs.fs.fed.us/urban/utc/
- PlanIT Geo Urban Tree Canopy Assessments: https://planitgeo.com/geospatial-mapping-services/
- i-Tree Canopy Assessments: https://canopy.itreetools.org/
- PlanIT Geo Tree Inventory Software: www.treeplotter.com
- Troy, NY's TreePlotter Software: www.pg-cloud.com/TroyNY

Other Resources

- American Forests "Vibrant Cities Lab": http://www.vibrantcitieslab.com/
- ISA International Dictionary Online: https://www.isa-arbor.com/education/onlineresources/dictionary
- PlanIT Geo Reports and Plans: https://issuu.com/planitgeoissuu

Appendix J. Tree Maintenance and Planting Best Practices

The community forest within Troy plays a significant role in maintaining the health and vitality of urban life. The community forest provides a wealth of benefits to neighborhoods and residents through the reduction of energy consumption, the removal of pollutants from the air and water, reduction in stormwater flows, increased valuation of private property, increased worker productivity, reduction in stress and violent crime, as well as providing recreational opportunities and aesthetic diversity. At the same time stresses from the urban environment including air pollution, damage by vehicles, increased impervious surface, soil compaction, and maintenance neglect reduce the diversity and magnitude of these benefits and may lead to tree-related problems.

The inherently close interaction between people and trees in the City requires active and diligent management of the urban and community tree and forest resources to ensure public safety. To enhance tree canopy and associated benefits, trees need to be properly maintained and planted.

The City of Troy can use this information to make any updates to the proposed Street Tree Ordinance.

Tree Maintenance Best Practices

The following provides an overview of tree maintenance best practices. It is not intended to be an extensive or comprehensive summary of best practices. All tree maintenance practices should follow the American National Standards Institute's (ANSI) A300 Standards (Parts 1-10).

Reasons for Tree Pruning

1. *Pruning for Safety*
   Involves removing branches that could fall and cause injury or property damage, trimming branches that interfere with lines of sight on streets or driveways, and removing branches that grow into utility lines. Safety pruning can be largely avoided by carefully choosing species that will not grow beyond the space available to them and have strength and form characteristics that are suited to the site.

2. *Pruning for Health*
   Involves removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce some pest problems, and removing crossing and rubbing branches. Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather. Removing broken or damaged limbs encourages wound closure.

3. *Pruning for Form*
   Improves the structure of trees and removes branches that are more likely to fail. Branches that are poorly attached may be broken off by wind and accumulation of snow and ice. Branches removed by such natural forces often result in large, ragged wounds that rarely seal.

4. *Pruning for Aesthetics*
   Involves enhancing the natural form and character of trees or stimulating flower production.

   To reduce the need for pruning it is best to consider a tree's natural form. It is very difficult to impose an unnatural form on a tree without a commitment to constant.

Common Types of Tree Pruning

1. *Crown Cleaning*
   Consists of the selective removal of dead, dying, diseased, and weak branches from a tree's crown. No more than 25% of the live crown should be removed in any one year, even for young trees.

2. *Crown Thinning*
   Primarily for hardwoods, thinning is the selective removal of branches to increase light penetration and air movement throughout the crown of a tree. The intent is to maintain or develop a tree's structure and form. To avoid unnecessary stress and prevent excessive production of epicormic sprouts, no more than one-quarter of the living crown should be removed at a time. If it is necessary to remove more, it should be done over successive years.

   Branches with strong U-shaped angles of attachment should be retained. Branches with narrow, V-shaped angles of attachment often form included bark and should be removed.

3. *Crown Raising*
   The practice of removing branches from the bottom of the crown of a tree to provide clearance for pedestrians, vehicles, buildings, lines of site, or to develop a clear stem for timber production. After pruning, the ratio of the living crown to total tree height should be at least two-thirds. On young trees temporary branches may be retained along the stem to encourage taper and protect trees from vandalism and sunscald.

4. *Crown Reduction*
   Most often used when a tree has grown too large for its permitted space. This method, sometimes called drop crotch pruning, is preferred to topping because it results in a more natural appearance, increases the time before pruning is needed again, and minimizes stress (see drop crotch cuts in the next section). Crown reduction pruning, a method of last resort, often results in large pruning wounds.

Types of tree pruning:

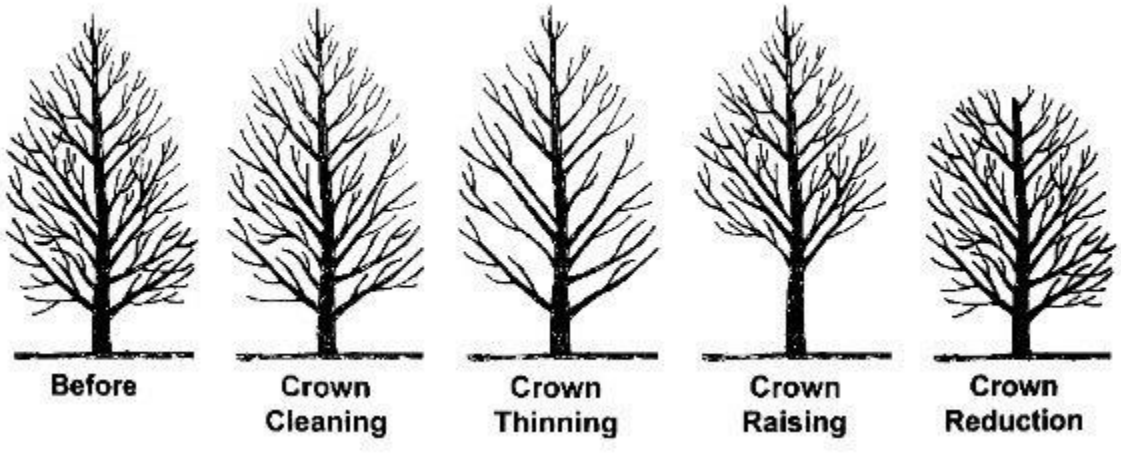
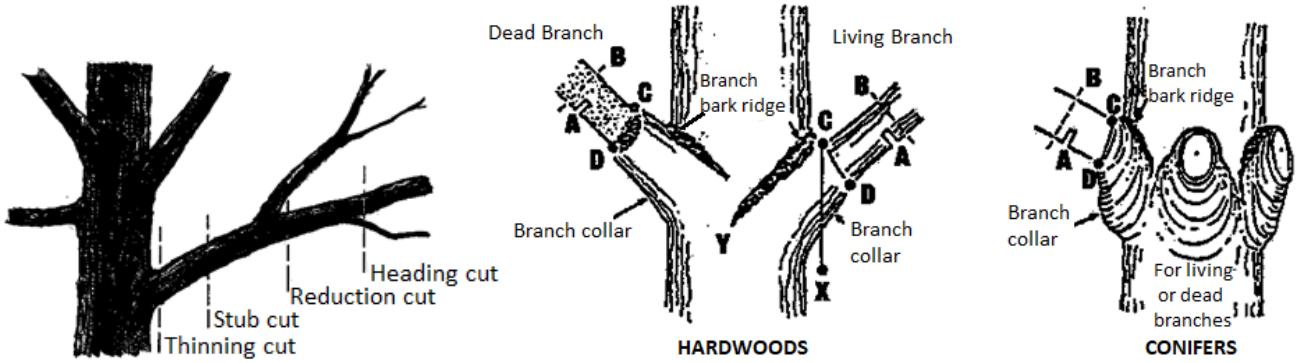


Image source: www.owentree.com

Tree Pruning Cuts

Pruning cuts should be made so that only branch tissue is removed and stem tissue is not damaged. To find the proper place to cut a branch, look for the branch collar that grows from the stem tissue at the underside of the base of the branch. On the upper surface, there is usually a branch bark ridge that runs parallel to the branch angle, along the stem of the tree. A proper pruning cut does not damage either the branch bark ridge or the branch collar. A proper cut begins just outside the branch bark ridge and angles down away from the stem of the tree, avoiding injury to the branch collar.

Types of pruning cuts and the proper branch cutting technique:



Natural target pruning properly removes a branch while protecting the branch collar, which is essential for wounds to heal. First cut A, second cut B, and third cut C-D.

Image source: Pennsylvania State University Urban Forestry Extension

Utility Tree Maintenance Best Practices

Utility Tree Pruning Overview

The City should work with the utility companies to ensure proper pruning practices are followed and that open communication between the company, the city, and the public are maintained. The International Society of Arboriculture provides guidelines for maintaining trees near power lines (*Best Management Practices – Utility Pruning of Trees*, G. Kempter).

Maintaining power lines free of tree growth is based on a consistent, planned trimming cycle of the utility vegetation management company. This approach improves electric service to all the customers who get their power from that line. A sensible approach to trimming trees means having a thorough maintenance plan that improves the safety and reliability of electric service to residents. Residents and the City staff should not attempt to trim any vegetation growing near or on any overhead power lines.

Utility Tree Maintenance Techniques

1. *Directional Pruning*
   Removes entire branches and limbs to the main trunk of the tree and future growth is directed away from the power lines. Reduction cuts are used for removing these branches and limbs and should be pruned properly back to a lateral branch that is at least one-third the diameter of the branch being removed. This allows for good wound closure and protects apical dominance and reduces sprouts.

Avoid topping or rounding over trees. This removes more foliage than directional pruning, increases the number of tree wounds, stresses the tree, causes unstable decay, and increases water sprouts.

2. *Right Tree Right Place*
   Selecting the right tree for the site can reduce potential safety hazards and improve the reliability of the electric service. Smaller trees near power lines do not need to be excessively pruned and do not lose their natural form.

3. *Recommended Trees*
   Trees potentially suitable for planting adjacent to power lines should be shorter and slow growing to prevent clearance issues.

Example of trees directionally pruned for clearance from power lines:

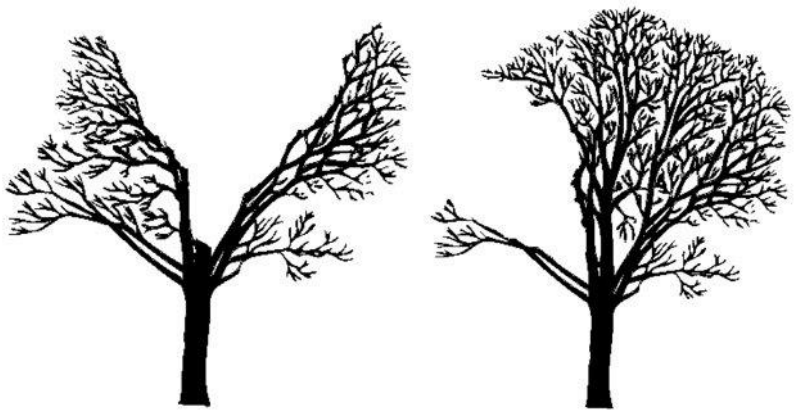


Photo source: Pennsylvania State University Urban Forestry Extension

Young Tree Maintenance Best Practices

Proper pruning is essential in developing a tree with a strong structure and desirable form. Trees that receive the appropriate pruning measures while they are young will require less corrective pruning as they mature.

Young Tree Maintenance Techniques

1. *Consider the Nature Form and Desired Growth*
   Accentuate the natural branching habit of a tree and correct any structural problems over time, if needed, to not stress the tree.

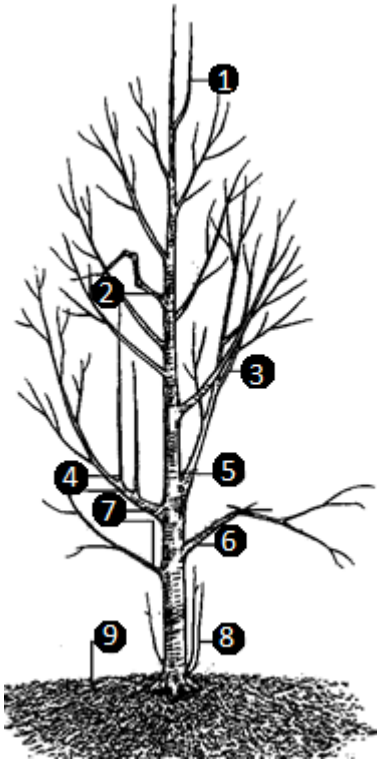
2. *Pruning in 1-2 Years after Planting*
   Prune as little as possible after planting to ensure there are enough temporary branches to produce food for new growth of roots, trunk, and branches. Prune only dead, broken, malformed, or diseased branches. Remove codominant leaders to maintain one dominant trunk. Prune for clearance if absolutely necessary. Keep size of branch removed to less than one inch in diameter.

3. *Pruning 2-3 Years after Planting*
   Prune any dead, broken, malformed, or diseased branches. Remove any suckers from the base of the tree. Next, determine the permanent branch structure by considering:

   - Remove, thin, or cut back any competing leaders

- Remove crossing or rubbing branches, keeping the branch that maintains the natural form
- Thin excessively crowded branches but do not lions-tail
- Remove branches with narrow angles between the branch and trunk (consider species)
- Remove branches to maintain well-spaced branches along and around the trunk. Ideal mature trees will have lateral branches that are 18-24 inches apart (depending on species)
- Avoid pruning near time of bud break
- Prune flowering trees after flowering

Example of branches to be pruned for newly planted trees to promote good structure:



1. Prune competing leader
2. Prune malformed branches
3. Remove crossing branches
4. Remove water sprouts
5. Remove branches with poor angles
6. Prune broken or damaged branches
7. Prune temporary branches over time
8. Remove suckers
9. Apply 2-3" of mulch

Photo source: Pennsylvania State University Urban Forestry Extension

Tree Planting Best Practices

The following provides an overview of best practices that should be considered and followed before during and after planting trees.

- Trees to be planted should be selected from an approved tree planting list developed to maintain and enhance species diversity that are suitable for the Troy, NY Plant Hardiness Zone and changing climates.
- Planting material will conform to the latest version of the American Standard for Nursery Stock (American National Standards Institute [ANSI] Z60.1). Trees to be planted should be of standard quality or better, and should be true to name and type of their species variety.
- Trees should not be planted in tree lawns less than 2 feet in width or in planting pits less than 5 feet long by 5 feet wide.

- Trees should not be planted within 50 feet of any major intersection, or within 20 feet of a fire hydrant, a driveway, or a pole supporting a light.
- The burlap and twine from balled-and-burlap trees should be removed from the tree and the tree pit. Wire tree baskets may remain on the root ball, but the top one-third should be clipped and removed from the planting hole.
- Mulch should be placed around trees in a minimum 3-foot circle and 3-inch depth to protect trees from lawnmower damage and competition from turf; mulch will be kept away from tree trunks.
- Newly planted trees should be irrigated weekly during droughts in the growing season for three years.

APPENDIX K. EXAMPLE INITIAL ASSESSMENT CHECKLIST FOR TREE CONFLICTS

This resource can be adapted for the City of Troy to make decisions regarding tree removals and tree and hardscape (i.e. sidewalks) conflicts.

INITIAL ASSESSMENT CHECKLIST

SDOT Trees and Sidewalks Operations Plan
Initial Street Tree and Sidewalk Assessment Checklist

FEBRUARY, 2015
Prepared by: SvR Design Company, Harrison Design, Tree Solutions, Olaf Ribeiro

The purpose of this document is to outline the INITIAL ASSESSMENT for locations where sidewalk work is located within the dripline of an existing street tree.

Project Location/Address	
Tree Species/Diameter	
Street Classification/Type	
Tree Asset Inventory ID	
Sidewalk Segment #	
Is this assessment along a corridor project?	

An ENGINEER and ARBORIST will look at the site and assess the condition of both the sidewalk and the tree.
If the tree has the following characteristics, it should be removed/replaced pursuant to *SMC 15.43.030 (C): The City's policy is to retain and preserve street trees whenever possible. Accordingly, street tree removal shall not be permitted unless the Director determines that a street tree:*

1. *Is a hazardous tree;*
2. *Poses a public safety hazard;*
3. *Is in such a condition of poor health or poor vigor that removal is justified; or*
4. *Cannot be successfully retained, due to public or private construction or development conflicts.*

Initial Assessment:

1. **Is this tree healthy and worthy of preservation?**
   Yes ☐ *No* - ☐

2. **Poor Health—Is this tree in a condition of poor health or poor vigor that cannot be mitigated by any means other than removal?**
   - Is the tree in poor health or poor vigor or dead?
   - Is there chronic trunk wounding due to inadequate street clearance?

   Yes ☐ *No* - ☐

3. **Hazardous Tree— Defined in 15.02.044.E any tree or tree part that poses a high risk of damage to persons using, or property located in the public place, as determined by the Director according to the tree hazard evaluation standards established by the International Society of Arboriculture.**
   Yes ☐ *No* - ☐

4. **Minimum Standards—Is there enough space for a 6 foot wide sidewalk and a 5 foot wide planting strip?** *Yes* ☐ *No* - ☐

5. **Public Safety Hazard—Does the tree present a public safety hazard that cannot be mitigated by any means other than removal?**
   - Does the tree location obstruct the visibility for pedestrians, cyclists, and/or cars at an intersection?
   - Is the tree impacting a curb ramp such that it no longer meets City of Seattle ADA requirements?
   - Is the tree potentially impacting private property?

Yes ☐ ***No*** -☐ Use this space to draw a sketch of the location. Identify existing clearances from nearby infrastructure.

Recommendation for this tree:

☐ ***–Remove Tree / Replace Sidewalk***
A tree is identified to be removed if it is not healthy or if it is hazardous as identified in the Street Tree Ordinance.

☐ ***–Keep Tree and Maintain Sidewalk***
A tree will be kept and the sidewalk will be maintained if a sidewalk of standard width and a tree pit of standard width (at a minimum) can be installed or retained around a healthy tree.

☐ ***–Evaluate Sidewalk and/or Tree Further***
SDOT views trees and sidewalks as important public infrastructure assets. SDOT intends to keep healthy trees and have accessible sidewalks. If standard widths cannot be met then SDOT will take the time and resources to evaluate if alternative approaches (such as sidewalk width reduction, alternative sidewalk materials, adjustments to the tree pit and/or tree root pruning) can be used to retain a tree and provide an accessible sidewalk at problem locations.

NEXT STEPS

If Tree is REMOVED –Replace the removed tree with the minimum 2:1 replacement ratio. Identify if the replacement trees can be located in the same location or on the same street as the removed tree. If not, replacements should be planted as close to the removal as geographically feasible. Identify the estimated cost to remove the tree(s), repair the sidewalk, and plant replacement trees.

If Tree is KEPT –Estimate the cost of the sidewalk repair that would achieve the desired lifecycle for the repair. Estimate sidewalk and tree maintenance needs/costs and any maintenance to the tree that is being retained (e.g., root pruning, branch pruning, soil amendments).

If EVALUATE Further – Use Tree and Sidewalk Evaluation Form (IN DEVELOPMENT) and/or the tree risk assessment should follow ISA TRAQ guidelines:
http://www.isa-arbor.com/education/onlineresources/basictreeriskassessmentform.aspx

Arborist	**Engineer**
Title	**Title**
Date	**Date**

APPENDIX L. TREE MAINTENANCE SCHEDULE AND BUDGET (TABLE 14)

This maintenance schedule and budget worksheet was developed based on the 2019 street and park tree and vacant site inventory. An interactive version of this worksheet was provided as part of the Community Forest Management Plan project. Plan recommendations regarding tree maintenance are based on this analysis and worksheet.

Estimated Costs for Each Activity			2020		2021		2022		2023		2024		2025		2026		
Activity	Diameter Class	Cost / Tree	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	7-Year Cost
Priority 1 (Critical) Removals* (addressed in first 3 years)	0-3"	$100	1	$100	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$100
	3-6"	$175	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	6-12"	$300	2	$600	7	$2,100	16	$4,800	0	$0	0	$0	0	$0	0	$0	$7,500
	12-18"	$850	3	$2,550	12	$10,200	31	$26,350	0	$0	0	$0	0	$0	0	$0	$39,100
	18-24"	$1,275	1	$1,275	4	$5,100	11	$14,025	0	$0	0	$0	0	$0	0	$0	$20,400
	24-30"	$1,550	1	$1,550	3	$4,650	8	$12,400	0	$0	0	$0	0	$0	0	$0	$18,600
	>30"	$2,100	1	$2,100	4	$8,400	10	$21,000	0	$0	0	$0	0	$0	0	$0	$31,500
Activity Total(s)			**9**	**$8,175**	**30**	**$30,450**	**76**	**$78,575**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$117,200**
Priority 2 (Immediate) Removals* (addressed in first 3 years)	0-3"	$100	1	$100	3	$300	8	$800	0	$0	0	$0	0	$0	0	$0	$1,200
	3-6"	$175	1	$175	4	$700	8	$1,400	0	$0	0	$0	0	$0	0	$0	$2,275
	6-12"	$300	6	$1,800	25	$7,500	62	$18,600	0	$0	0	$0	0	$0	0	$0	$27,900
	12-18"	$850	8	$6,800	33	$28,050	80	$68,000	0	$0	0	$0	0	$0	0	$0	$102,850
	18-24"	$1,275	4	$5,100	18	$22,950	43	$54,825	0	$0	0	$0	0	$0	0	$0	$82,875
	24-30"	$1,550	2	$3,100	7	$10,850	16	$24,800	0	$0	0	$0	0	$0	0	$0	$38,750
	>30"	$2,100	2	$4,200	9	$18,900	21	$44,100	0	$0	0	$0	0	$0	0	$0	$67,200
Activity Total(s)			**24**	**$21,275**	**99**	**$89,250**	**238**	**$212,525**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$323,050**
Stump Removal	0-3"	$18	2	$36	3	$54	8	$144	0	$0	0	$0	0	$0	0	$0	$234
	3-6"	$28	1	$28	4	$112	8	$224	0	$0	0	$0	0	$0	0	$0	$364
	6-12"	$44	8	$352	32	$1,408	78	$3,432	0	$0	0	$0	0	$0	0	$0	$5,192
	12-18"	$72	11	$792	45	$3,240	111	$7,992	0	$0	0	$0	0	$0	0	$0	$12,024
	18-24"	$94	5	$470	22	$2,068	54	$5,076	0	$0	0	$0	0	$0	0	$0	$7,614
	24-30"	$110	3	$330	10	$1,100	24	$2,640	0	$0	0	$0	0	$0	0	$0	$4,070
	>30"	$160	3	$480	13	$2,080	31	$4,960	0	$0	0	$0	0	$0	0	$0	$7,520
Activity Total(s)			**33**	**$2,488**	**129**	**$10,062**	**314**	**$24,468**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$37,018**
Priority 1 (Critical) Pruning* (addressed in first 3 years)	0-3"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	3-6"	$35	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	6-12"	$80	0	$0	2	$160	1	$80	0	$0	0	$0	0	$0	0	$0	$240
	12-18"	$120	1	$120	1	$120	3	$360	0	$0	0	$0	0	$0	0	$0	$600
	18-24"	$200	1	$200	1	$200	3	$600	0	$0	0	$0	0	$0	0	$0	$1,000
	24-30"	$250	1	$250	1	$250	0	$0	0	$0	0	$0	0	$0	0	$0	$500
	>30"	$450	1	$450	3	$1,350	6	$2,700	0	$0	0	$0	0	$0	0	$0	$4,500
Activity Total(s)			**4**	**$1,020**	**8**	**$2,080**	**13**	**$3,740**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$6,840**
Priority 2 (Immediate) Pruning* (addressed in first 3 years)	0-3"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	3-6"	$35	2	$70	8	$280	19	$665	0	$0	0	$0	0	$0	0	$0	$1,015
	6-12"	$80	14	$1,120	52	$4,160	127	$10,160	0	$0	0	$0	0	$0	0	$0	$15,440
	12-18"	$120	23	$2,760	90	$10,800	222	$26,640	0	$0	0	$0	0	$0	0	$0	$40,200
	18-24"	$200	12	$2,400	45	$9,000	109	$21,800	0	$0	0	$0	0	$0	0	$0	$33,200
	24-30"	$250	7	$1,750	26	$6,500	63	$15,750	0	$0	0	$0	0	$0	0	$0	$24,000
	>30"	$450	7	$3,150	25	$11,250	62	$27,900	0	$0	0	$0	0	$0	0	$0	$42,300
Activity Total(s)			**65**	**$11,250**	**246**	**$41,990**	**602**	**$102,915**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$156,155**
Routine Street Tree Cleaning (7-year cycle beginning at year 3)**	0-3"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	3-6"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	6-12"	$75	0	$0	0	$0	238	$17,871	238	$17,871	238	$17,871	238	$17,871	238	$17,871	$89,357
	12-18"	$120	0	$0	0	$0	267	$32,057	267	$32,057	267	$32,057	267	$32,057	267	$32,057	$160,286
	18-24"	$170	0	$0	0	$0	125	$21,323	125	$21,323	125	$21,323	125	$21,323	125	$21,323	$106,614
	24-30"	$225	0	$0	0	$0	64	$14,432	64	$14,432	64	$14,432	64	$14,432	64	$14,432	$72,161
	>30"	$425	0	$0	0	$0	55	$23,496	55	$23,496	55	$23,496	55	$23,496	55	$23,496	$117,482
Activity Total(s)			**0**	**$0**	**0**	**$0**	**750**	**$109,180**	**750**	**$109,180**	**750**	**$109,180**	**750**	**$109,180**	**750**	**$109,180**	**$545,900**
Routine Park Tree Cleaning (7-year cycle beginning at year 3)***	0-3"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	3-6"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	6-12"	$75	0	$0	0	$0	75	$5,625	75	$5,625	75	$5,625	75	$5,625	75	$5,625	$28,125
	12-18"	$120	0	$0	0	$0	95	$11,400	95	$11,400	95	$11,400	95	$11,400	95	$11,400	$57,000
	18-24"	$170	0	$0	0	$0	67	$11,390	67	$11,390	67	$11,390	67	$11,390	67	$11,390	$56,950
	24-30"	$225	0	$0	0	$0	38	$8,550	38	$8,550	38	$8,550	38	$8,550	38	$8,550	$42,750
	>30"	$425	0	$0	0	$0	51	$21,675	51	$21,675	51	$21,675	51	$21,675	51	$21,675	$108,375
Activity Total(s)			**0**	**$0**	**0**	**$0**	**326**	**$58,640**	**326**	**$58,640**	**326**	**$58,640**	**326**	**$58,640**	**326**	**$58,640**	**$293,200**
Training Prune (3-year cycle)*	0-3"	$20	161	$3,220	161	$3,220	161	$3,220	161	$3,220	161	$3,220	161	$3,220	161	$3,220	$22,540
	3-6"	$30	240	$7,210	240	$7,210	240	$7,210	240	$7,210	240	$7,210	240	$7,210	240	$7,210	$50,470
Activity Total(s)			**401**	**$10,430**	**401**	**$10,430**	**401**	**$10,430**	**401**	**$10,430**	**401**	**$10,430**	**401**	**$10,430**	**401**	**$10,430**	**$73,010**

(Tree Maintenance Schedule and Budget Worksheet continued)

			2020		2021		2022		2023		2024		2025		2026		
Activity	Item	Cost / Tree	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	7-Year Cost
Replacement Tree (total of 476 priority removals over 7 years. Does not include vacant sites at this time)	Purchasing	$200	68	$13,600	68	$13,600	68	$13,600	68	$13,600	68	$13,600	68	$13,600	68	$13,600	$95,200
	Planting	$110	68	$7,480	68	$7,480	68	$7,480	68	$7,480	68	$7,480	68	$7,480	68	$7,480	$52,360
Activity Total(s)			**68**	**$21,080**	**68**	**$21,080**	**68**	**$21,080**	**68**	**$21,080**	**68**	**$21,080**	**68**	**$21,080**	**68**	**$21,080**	**$147,560**
Replacement Tree - Young Tree Maintenance (beginning at year 3)	Mulching	$100	0	$0	0	$0	0	$0	68	$6,800	68	$6,800	68	$6,800	68	$6,800	$27,200
	Watering	$100	0	$0	0	$0	0	$0	68	$6,800	68	$6,800	68	$6,800	68	$6,800	$27,200
Activity Total(s)			**0**	**$0**	**0**	**$0**	**0**	**$0**	**68**	**$13,600**	**68**	**$13,600**	**68**	**$13,600**	**68**	**$13,600**	**$54,400**
Annual Mortality (1% of 10,021 total trees) Removals (includes stump removal)	Based on 14.3" average DBH	$922	100	$92,200	100	$92,200	100	$92,200	100	$92,200	100	$92,200	100	$92,200	100	$92,200	$645,400
Annual Planting Mortality (1% of 476 tree plantings)	Average Tree	$200	5	$1,000	5	$1,000	5	$1,000	5	$1,000	5	$1,000	5	$1,000	5	$1,000	$7,000
Activity Total(s)			**105**	**$93,200**	**105**	**$93,200**	**105**	**$93,200**	**105**	**$93,200**	**105**	**$93,200**	**105**	**$93,200**	**105**	**$93,200**	**$652,400**
Activity Grand Total			**709**		**1,086**		**2,894**		**1,719**		**1,719**		**1,719**		**1,719**		**11,564**
Cost Grand Total				**$168,918**		**$298,542**		**$714,753**		**$306,130**		**$306,130**		**$306,130**		**$306,130**	**$2,406,733**

APPENDIX M. PROPOSED STREET TREE ORDINANCE FOR TROY, NY

CITY OF TROY STREET TREE ORDINANCE

Preliminary -3/23/16

Article I. General Regulations

§ 99-1. Findings and intent.

The City Council hereby finds and declares that the planting, preservation and maintenance of trees is necessary to protect the health, safety and general welfare of the City of Troy because trees provide necessary shade, green space and aesthetic appeal, impede soil erosion and aid water absorption, provide other environmental benefits and generally enhance the quality of life. It is the intent of the City Council, by the adoption of this chapter, to provide for:

A. The planting, protection and preservation of as many trees as possible, particularly those trees which are specimen trees and/or trees of select or rare species.

B. The reforestation and replacement of those trees which are removed due to **storms, accidents**, development, disease or **other environmental conditions.**

C. The preservation of **a high** level of green foliage and **canopy cover in most** areas of the City.

D. **The creation and maintenance of** suitable wildlife habitats throughout the City.

E. The establishment and maintenance a maximum diversity of tree species.

§ 99-2. Definitions.

As used in this chapter; the following terms shall have the following meanings:

ALTER

To remove more than 25% of a tree's live growth, to prune in such a manner as to change the natural shape of a tree's crown **or for street trees, to limb up more than 8' above the sidewalk and 14' above the roadbed.**

ANSAI A300 – American National Standard for Tree Care Operations including all its parts.

ARBORIST – Someone holding a current arborist certification from the International Society of Arboriculture (ISA).

BROW -

CARE - that which is required to maintain the maximum possible health and vigor, **structural stability and long-term health** of a tree or shrub.

CONTRACTOR - a person, company or organization employed to supply necessary skills and services in **planting, maintaining** or removing trees and shrubs.

CROWN - All portions of a tree, excluding the trunk and roots, such as branches, leaves, and flowers.

FERTILIZE - the application of **plant nutrients** to the plant or the surrounding soil **in order to stimulate or improve** the growth and health of the tree or shrub.

INJURE A TREE - To weaken or severely alter a tree, whether to its branches, trunk or roots. Injury to a tree shall include, but not be limited to:

A. Improper use of machinery on the tree.
B. Storage of materials in or around the tree **root zone.**
C. Soil compaction in or around the tree **root zone**.
D. **Severing roots**, altering the natural grade **by adding more than three inches of soil or by adding more than one inch soil.**
E. Large excavations within **the root zone** of the tree.
F. Removing **any** bark **from** the tree.
G. Excessive **or** harmful pruning **which deviates from the American National Standard for Tree Care Operations (ANSI A300).**
H. Paving with concrete, asphalt or other impervious surface within such proximity as to be harmful to the tree.
I. **Affixing signs or other objects to a tree trunk with fasteners such as nails,**

screws, staples or other objects that injure the live tissue or restricts growth of the tree.

J. Application of herbicides, defoliants or **harmful chemicals** to any tree.

K. Causing or permitting any brine, oil, gas, gasoline, liquid dye or other substance deleterious to tree life to lie, leak, pour, flow or drip on or into the soil about the base of the tree at a point where such substance may in any manner cause harm to the tree.

PRUNE - to remove dead or living parts from a tree or shrub so as to increase health, vigor, **environmental benefits, structural stability** or form.

PUBLIC PLACE - Any land owned by the City of Troy or any other governmental entity, including the right-of-way of any street.

RAIN GARDEN - A planted depression that collects stormwater from impervious urban areas allowing it soak into the ground. The purpose is to reduce runoff and erosion, recharge groundwater and improve water quality in nearby bodies of water. They are to be designed for specific soils using plant materials suited to the conditions. Native plants are encouraged.

See: *Installing a Rain Garden* prepared by Cornell Cooperative Extension – Albany County (RENS CTY website)

RECOMMEND URBAN TREES – reference the current editions of the following documents:

***Recommended Urban Trees: Site Assessment and Tree Selection for Stress Tolerance* by Cornell University-Urban Horticulture Institute:**
www.hort.cornell.edu/uhi/outreach/recurbtree/pdfs/~recurbtrees.pdf

***Recommended Small Trees For Planting Under Low Overhead Utility Lines or Confined Spaces* by National Grid: _____**

SHRUB - woody plant with one or more main stems emerging from the ground **that attains a maximum height of 20'.**

SITE PLAN - a site development plan approved pursuant to § 110-45 of this Code.

SPECIMEN TREE(S)

A. Trees which have a minimum trunk circumference of 36 inches at a point **4.5** feet above the **average** natural grade and/or a minimum crown spread of **75** feet;

B. Any tree that is defined as rare, endangered or protected according to Village, County, State or Federal law, rule or regulation

C. One which:
1. is a tree species of record size **for the species** including but not limited to Landmark Trees;
2. **is a very unusual species or cultivar for Troy;**
3. has non-invasive **quality;**
4. is associated with historical event or person;
5. has significant old age.

D. Any other tree or grouping of trees deemed significant by the **STREET TREE ADVISORY BOARD.**

SPRAY - the liquid application of any pesticide, fertilizer or other substance to **any surface of** a tree or shrub.

STREET TREE - any tree or shrub planted or growing within the right-of-way of a street. **New street trees shall be selected RECOMMENDED URBAN TREES.**

Structural Soil - CU-Structural Soil™ (U.S. Patent # 5,849,069) or equivalent: a two-part system comprised of a rigid stone "lattice" to meet engineering requirements for a load-bearing soil, and a quantity of soil, to meet tree requirements for root growth.

See: ***Using CU-Structural Soil™ in the Urban Environment*** **by Cornell University: http://www.hort.cornell.edu/uhi/outreach/pdfs/custructuralsoilwebpdf.pdf**

TREE - Any woody plant at maturity having at least one well-defined trunk with at least four inches in diameter measured at a height of **4.5** feet above the natural grade, having a clearly defined crown and acquiring a minimum height of ten (10) feet.

Small Tree - a tree that attains a maximum height of less than 30 feet at maturity.
Medium Tree - a tree that attains a maximum height of 45 feet at maturity.
Large Tree - a tree that attains a height of **more than** 45 feet or more at maturity.
Private Tree - a tree or shrub not in a **PUBLIC PLACE**. A tree or shrub on privately-owned property.
Public Tree - a tree or shrub in a **PUBLIC PLACE.**

STREET TREE ADVISORY BOARD - The Street Tree Advisory Board appointed by the Mayor of the City of Troy in accordance with this chapter and City Ordinances.

TREE LAWN/**PLANTING STRIP** or TREE PIT - that part of a street or highway right-of-way**, including islands**, not covered by sidewalk or other paving, lying between the private property line and that portion of the street or highway usually used for vehicular traffic differing only in size.

TREE REMOVAL PERMIT – authorization, written or **otherwise documented**, pursuant to this chapter to remove or **ALTER** a tree.

XERISCAPING - Landscaping to reduce or eliminates the need for supplemental water from irrigation with emphasis on plants whose natural requirements are appropriate to the local climate and on care taken to avoid losing water to evaporation and run-off.

See: *Drought Tolerant Plants for the Landscape* by the UMass Amherst Agriculture & Landscape Program; www. extension.umass\landscape\fact-sheet\drought-tolerant-plant-landscape

§ 99-3. Policies

A. Solar Panel Policy – While solar installations may provide cost saving and environmental benefits these benefits do not substantiate the removal of mature, healthy trees which not only reduce energy costs through passive cooling, but also provide significant air infiltration, stormwater attenuation and aesthetic and wildlife value. Applications for removal of alteration to trees in public places to optimize solar panel installations will be reviewed on a case by case basis.

§ 99-4. Planting in public places.

No person shall plant any tree or shrub within the limits of any street, park or other public place without first securing a written permit from the City Engineer and complying with the following requirements. Such a permit shall be granted only upon a determination by the City Engineer that such planting will not create a traffic safety hazard, will not interfere with the use of such street, park or other public place by the public and will enhance the beauty and appearance of the **PUBLIC PLACE** and the surrounding area. The City Engineer will consult with the Police Department in evaluating whether the proposed planting may create a traffic hazard and **with the Street Tree Advisory Board on the appropriateness of the proposed tree species for the proposed site.**

A. Trees planted in a **PUBLIC PLACE** shall be of a quality **and spacing as recommended for that species *and location*** unless otherwise authorized by the City Engineer. Each such tree shall measure not less than two inches nursery caliper.

B. Should any tree or shrub planted **in a PUBLIC PLACE** pursuant to any such permit, in the opinion of the City Engineer, interfere at any time with the use of such **PUBLIC PLACE** or the surrounding area, the City Engineer shall mail a notice, in writing, to the permittee or, if the tree or shrub is planted within the right-of-way of any street, to the permittee's successor in ownership of the abutting premises to remove such tree or shrub and to restore such **PUBLIC PLACE** to its original condition within 30 days of the mailing of the notice, and such permittee or owner shall comply with such notice within 30 days. If such permittee or owner shall fail to comply with such notice, the City Engineer may cause the tree or shrub to be removed and the **PUBLIC PLACE** to be restored to its original condition at the expense of such permittee or owner.

C. *Any tree or shrub or plant planted within the right-of-way of any street pursuant to such a permit **may** be maintained by the owner of the abutting premises and, notwithstanding anything set forth elsewhere in this Article, may hire an **ARBORIST** to **PRUNE** such tree or shrub to the extent necessary to maintain it through the permitting process.*

§ 99-5. Removal or alteration of trees restricted.

A. No person shall, without first obtaining a tree removal or alteration permit remove, cut, break, trim or destroy or injure any tree or shrub planted or growing in or on any street or in any public place.

B. Application for a tree removal or alteration permit shall be made, in writing, to the City Engineer, who, after consultation with the Street Tree Advisory Board, shall issue or deny the permit. The application shall be accompanied by the fee as set forth in Chapter A112, Fees, and shall include the following information **to the extent applicable**:

(1) The name and address of the applicant.
(2) The address and tax map designation of the property on which the subject tree is or trees are located.
(3) The total land area involved in cutting operations.
(4) The number of trees to be removed, altered, cut or otherwise destroyed or injured.
(5) The purpose for removing, altering, cutting or otherwise destroying or injuring the tree.
(6) A survey of that section to be disturbed, showing the location of all trees regulated herein to an accuracy of one foot, indicating those trees to be removed and those trees to be preserved, their species and diameter, except that where the total land area involved in cutting operations is less than 100 square feet, a sketch plan drawn by the applicant may be substituted for the survey.
(7) The method by which it is proposed that the trees be removed, altered, cut or otherwise destroyed or injured.
(8) **The name of the certified arborist or certified Tree Care Industry individual or entity that will be removing, altering, cutting or otherwise destroying or injuring the tree.**
(9) Provide evidence of insurance meeting minimum levels applicable in the City.

C. The City Engineer, in consultation with the Street Tree Advisory Board, shall issue a tree removal permit when it is established to their satisfaction that:

1. There is a need for the action proposed to be taken, in that:

(a) The presence of the tree would endanger the public or the person or the property of the owner or of an adjoining owner;

(b) The tree threatens the health of other trees; or
(c) The tree or trees substantially interferes with a permitted use of the property.

2. The need outweighs the environmental and aesthetic advantages to be derived from maintaining the tree; and

3. The means by which such action is proposed to be taken is consistent with accepted industry practice, the preservation of neighboring trees and the public safety.

4. If, in the judgment of the City Engineer after consultation with the Street Tree Advisory Board, it is necessary to retain an arborist to review an application, the application shall not be granted or denied until the applicant has paid to the City Treasurer the cost incurred by the City for such services.

D. No permit shall be required to remove, alter, cut, break or trim any tree when:

1. Necessary to control a fire.
2. Necessary for the immediate protection of health, safety or property, **such as storm damage caused by ice, wind, snow or other natural disasters where all other viable practices to save the tree have been exhausted.** In the event a tree regulated by this chapter is removed, altered, cut or trimmed pursuant to this subsection, within three days after such act, the individual or entity that removed, altered, cut or trimmed the tree shall submit to the City Engineer a letter or other documentation explaining and confirming the nature and extent of the imminent hazard. The City Engineer in his/her discretion, may require documentation from a certified arborist.
3. **Accomplished by the Citizen Pruners when in accordance with their tasks pursuant to § 99-7. Citizen Pruners of this chapter.**

§ 99-6. Additional regulations.

A. No person shall **be permitted to injure a tree in any street or public place.**

B. **Tree protection during construction shall be provided in accordance with this Ordinance and ANSI A300 Standards. See the Appendix for tree protection details.**

§ 99-7. Street Tree Advisory Board.

A. There shall be a Street Tree Advisory Board consisting of between five and twelve persons appointed by the Mayor, each of whom shall serve without compensation. The Mayor shall have the power to remove members for cause.

B. The general charge of the Street Tree Advisory Board is to:

1. **Oversee the development of plans and the planting of City street trees and open spaces, the purpose of which will be to strengthen existing streetscape images, create identifiable images for particular types of streets (such as city entranceways, major thoroughfares and commercial strips) and to create a more pleasant urban environment.**

2. **Oversee the preparation of a plan that identifies areas to be inventoried and planted on an annual basis.**
3. **Oversee the preparation of an inventory of existing trees in selected areas of the city and make tree planting recommendations for the selected areas.**
4. **Prepare and update a list of trees suitable for street tree planting in the City of Troy.**
5. **Make recommendations to:**
   a. **the Planning Commission relating to all landscape issues involved in the cases coming before them.**
   b. **the City Engineer relating to the planting, maintenance including pruning, and removal of city shade trees as deemed necessary.**
6. **Form subcommittees that may include interested citizens to address identified issues with the city's urban forest.**
7. **Help to create greater community awareness regarding the value and care of the city's trees.**

§ 99-8. Citizen Pruners

A. **There shall be a group of volunteers meeting during the spring, summer and fall seasons to prune small statured city tress. The program is a joint partnership between the Street Tree Advisory Board and Cornell Cooperative Extension of Rensselaer County. Organization, support, training and recruitment are to be provided by the same.**

B. **Volunteers receive training about Troy's street and park trees, correct planting and maintenance procedures and the pruning and training of trees and shrubs. The** Citizen Pruner's work augments that of the Department of Public Works and encourages citizens to respect and enjoy the trees and shrubs of our City.

C. **The main task of Citizen Pruners are to remove suckers, damaged, dead or poorly formed branches, to train young trees and to prune overgrown shrubs.**

§ 99-9. Penalties for offense.

A. Any person who violates any provision of this chapter shall be punishable as provided in § 1-17A of this Code. Where the offense consists of removing, cutting, altering or otherwise destroying or injuring a tree, the removal, cutting, alteration, destruction or injury of each individual tree shall constitute a separate offense.

B. **In addition, any (specimen) tree as defined in this chapter, which is removed, injured or otherwise destroyed shall be replaced with a specimen tree of an**

equal caliper and quality. Where replacement of a (specimen) tree is not practicable as determined by the City Engineer in consultation with Street Tree Advisory Board, then an in-kind contribution equal to the replacement cost of the (specimen) tree shall be required.

C. There shall be established a Tree Planting Fund for contributions, fines, insurance claims and other forms of enforcement generating revenue for the purpose of funding new or replacement plantings. Funds are to be expended under City expenditure policy.

§ 99-10. Appeals

Any person who receives a written notice from the City at the request of the Street Tree Advisory Board and objects to all or a part thereof, may, within ten (10) days of receipt thereof, notify the City, in writing, of the specific nature and reason(s) of the objection and request a hearing thereon. The hearing shall be held within thirty (30) days of notice from the appellant. Within ten (10) days after such hearing, the Mayor, in consultation with the City Corporation Counsel and the Street Tree Advisory Board, shall render a decision and notify the appellant of the decision.

§ 99-11. Interference with Planting, Maintenance and Removal

No person, firm, organization or corporation shall prevent, delay, or interfere with the Street Tree Advisory Board, City Engineer or contractors in the execution of enforcement of this law including the planting, mulching, pruning or removal of any tree, shrub or plant in any right-of-way or public place within the City.

§ 99-12. Local Government Liability Disclaimer

Nothing contained in this law shall be deemed to impose liability upon the City, the Street Tree Advisory Board or individuals, companies or corporations hired by the City, nor to relieve the owner of any private property from the duty to keep any tree, shrub or plant that he/she planted in the right-of-way of a public street or that is on his/her property from constituting a hazard or an impediment to travel or vision upon any street, sidewalk, park or other public place within the City.

§ 99-13. Effective Date

This law shall take effect upon filing with the Office of the NYS Secretary of State.

Troy's Community Forest Management Plan was developed to provide the road map for the City to maintain a healthy and sustainable community forest that is properly managed and cared for, benefiting the City and its citizens with improved economic and environmental well-being, increasing public safety, cost effective maintenance, and informed tree planting decisions.

Source: Rensselaer County

NEW YORK STATE OF OPPORTUNITY Department of Environmental Conservation

CITY OF TROY, NY

PLANIT GEO™ mapping a greener future