Street and Park/Public Space Tree Inventory Management Plan

Somerville, Massachusetts

July, 2009

DAVEY RESOURCE GROUP
A Division of The Davey Tree Expert Company

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Somerville, Massachusetts

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Executive Summary

The City of Somerville is a flourishing suburb of Boston, Massachusetts with beautiful neighborhoods, parks, and recreational facilities to create an attractive community and a great place in which to live, work, and play. The economic health of Somerville, as with many communities, is closely related to the ability of the municipal government to supply its citizens with efficient services, safe public spaces, and properly maintained infrastructure. Trees are an integral component of this urban environment. Their shade and beauty contribute to the community's quality of life and soften the hard appearance of concrete structures and streets. They help stabilize the soil by controlling wind and water erosion. Trees also help reduce noise levels; cleanse pollutants from the air; produce oxygen and absorb carbon dioxide; and provide habitat for wildlife.

Trees provide significant economic benefits, including increased real estate values and more attractive settings in which to locate commercial businesses. Trees provide shade and act as windbreaks, helping to decrease residential energy consumption. Unlike other components of the City's infrastructure, the tree population, with proper care, will actually continue to increase in value with each passing year. When properly maintained, trees return overall benefits and value to the community far in excess of the time and money invested in them for planting, pruning, protection, and removal.

A successful urban forestry program requires a combination of organized leadership, comprehensive information about the tree population, dedicated personnel, and effective public relations.

Managing natural resources in urban areas is challenging in the very least. Providing adequate maintenance for public trees within a budget is a common concern among many communities. A successful urban forestry program requires a combination of organized leadership, comprehensive information about the tree population, dedicated personnel, and effective public relations.

The City of Somerville has commissioned a study of its public urban forest to inventory and evaluate the current condition of its street and park/public space trees to establish an effective planning and management program for this valuable resource. This document will explore future management options while reviewing current conditions.

The City of Somerville is located in Middlesex County, Massachusetts. Somerville has a land area of 4.2 square miles and a population of about 77,000 residents. Somerville is the most densely populated municipality in New England, and the 17th such municipality in the United States. There are 41 parks in Somerville and a tree-lined Community Path that stretches nearly halfway across the city.

The Somerville Public Tree Population

In May and June of 2009, Davey Resource Group performed an inventory of 11,372 trees, stumps, and planting sites in Somerville. Tree data were collected and analyzed, providing information concerning the species composition, relative size, health, relative risk, and maintenance recommendations for the urban forest. Along with the analysis, this report also recommends best management practices and provides long-term planning strategies that will improve maintenance efficiency and tree health.

The major findings of Somerville's *Street and Park/Public Space Tree Inventory Management Plan* include the following:

- Davey Resource Group inventoried 11,372 total sites. Of these, 11,062 (97.27%) are trees, 244 (2.15%) are planting sites, and 66 (0.58%) are stumps.
- Of the total inventoried sites, 9,230 (81.16%) are street sites, 2,112 (18.57%) are park/public space sites, and 30 (0.26%) are borderline right-of-way trees. Borderline trees are measured within the street right-of-way; however, further measurements may be needed for greater accuracy.
- The total value of Somerville's inventoried street tree population is estimated to be $15,903,566.21 and the average value per tree is $1,437.68. This value is not intended, nor should it be used, as a substitute for a detailed inspection and appraisal by a qualified arborist. These amounts are based on a generalized application of the trunk formula method found in the Council of Tree and Landscape Appraisers' publication, *Guide for Plant Appraisal (9th Edition).*
- Somerville's tree population is comprised of 101 species representing 52 genera.
- The genus *Acer* (maple) comprises 32.34% of the overall population, followed by *Pyrus* (pear) 14.26%, *Fraxinus* (ash) 9.44%, *Gleditsia* (honeylocust) 8.72%, *Tilia* (linden) 8.35%, *Platanus* (sycamore) 3.87%, *Zelkova* (zelkova) 3.55%, *Quercus* (oak) 3.53%, *Prunus* (cherry/plum) 2.86%, and *Syringa* (lilac) contributing 1.79%.
- The inventoried tree population is dominated by medium-sized (7 to 24 inches in diameter at breast height [DBH]) trees representing 71.11% of the total tree population. Small trees, which are less than 6 inches DBH, represent 25.61% of the total street tree population, and the remaining 3.28% of the trees are large sized (25 inches and greater in DBH).
- Of the inventoried tree population, there are 2,801 (25.32%) rated in Good condition, 6,389 (57.76%) are in Fair condition, and 1,777 (16.06%) are in Poor condition. There are 95 (0.86%) Dead trees.
- Of the 11,062 trees inventoried, 10,194 (92.15 %) are recommended to be maintained and 868 (7.85%) are recommended to be removed. Of the trees to be maintained, 2,376 (21.48%) have a maintenance recommendation of Clean, 4,100 (37.06%) have a recommendation of Raise, and 894 (8.08%) have a recommendation of Reduce. There were 66 (0.59%) stumps collected in the inventory.
- Of the inventoried tree population, 7,307 (66.06%) trees have a low level of risk (Risk Rating of 4 or 5), 3,548 (32.07%) have a moderate level of risk (Risk Rating of 6, 7, or 8), 200 (1.81%) have a high level of risk (Risk Rating of 9 or 10), and 7 (0.06%) have a severe level of risk (Risk Rating of 11 or 12).

Urban Forestry Management Recommendations

Based on the results of this study, Davey Resource Group makes the following recommendations for planning and managing the inventoried trees in Somerville's urban forest:

A *Five-Year Urban Forest Management Program* is explained and outlined in Chapter 3 and includes estimated budgets for each activity. Specific tree management recommendations are detailed and include:

- Perform all recommended tree removals and moderate and high risk level maintenance recommendations as soon as possible beginning in 2009.
- Implement a continual routine maintenance cycle for the tree population to ensure pruning of all trees every five years.
- Beginning in Year 3, implement a *Young Tree Training Pruning Program* for the large number of younger trees.
- Increase the species diversity that currently comprises Somerville's public tree population by establishing a tree planting program to increase species diversity, seasonal interest, and to establish replacements for significant landscape trees.
- Educate all City personnel and/or contractors concerning proper mulching, pruning, general arboricultural treatments and techniques, and about preventing mechanical damage to trees with lawn mowing equipment and string trimmers. It is imperative to emphasize proper arboricultural and horticultural techniques and practices for newly hired personnel and seasonal employees.
- Implement an expanded public relations campaign to gain increased citizen interest and City support for the urban forestry program.
- Present an educational program to highlight the findings of this report and to prepare all personnel and operations budget administrators for inevitable removals, the importance of healthy trees, and the need for continual preventive maintenance and planting.
- Protect valuable mature trees and all young trees from construction damage and unnecessary removal, especially large specimen trees that are in good or better condition. Implement a tree preservation program in conjunction with all building and infrastructure construction and renovation projects. Review and/or revise the City's tree ordinance and issue fines to developers and contractors who continually ignore posted regulations.

Introduction

Importance of the Urban Forest

Trees are a significant component of Somerville's urban environment. The street and park/public space trees are an integral part of the City's infrastructure, no less so than its streets, utilities, buildings, and sidewalks. The actual current legal value of Somerville's street and park/public space tree population is approximately $15.9 million. Unlike other infrastructure components, the tree population, when properly cared for, will actually increase in value as the trees mature over time.

Photograph 1. A diverse and healthy urban forest is a valuable asset.

Trees return overall benefits and value to the community far in excess of the time and money invested in them for planting, pruning, protection, and removal. Their shade and beauty contribute to the community's quality of life and soften the hard appearance of concrete structures and streets, moderating harsh urban conditions. They help stabilize the soil by controlling wind and water erosion. They provide shade and help reduce energy costs. Trees also help reduce noise levels, cleanse air of pollutants, produce oxygen, and absorb carbon dioxide, which is believed to contribute to the "greenhouse effect". Additionally, they provide significant economic value, including increased real estate values and improved settings for business activities.

Residents and officials of Somerville have recognized these benefits and realized the need to protect this investment with a comprehensive, urban forest management program for their public trees. Such a program begins with an inventory of the public trees and their present condition. This inventory will provide important information concerning the public trees.

Statement of Purpose

The purpose of this *Street and Park/Public Space Tree Inventory Management Plan* is to provide a five-year plan of action for the inventoried tree population of Somerville. The City commissioned a study of its street and park/public space tree population to inventory and evaluate the current condition of its trees. The inventory draws attention to immediate problems and provides the basis for designing a long-term Management Plan. The Management Plan, in turn, provides guidelines for the future, allows for more effective use of tree care funds, and allows for more accurate budget projections.

Scope

This document provides a comprehensive action plan for Somerville's inventoried street and park/public space tree population. The Management Plan includes an analysis of the current inventoried tree population, their individual maintenance recommendations, as well as long-range management recommendations for the entire population. It discusses the findings of the complete tree inventory performed by Davey Resource Group. The scope of this discussion includes:

- A summary and analysis of the tree inventory.
- A description of the species composition.
- A discussion of the general condition of the inventoried trees.
- Recommendations for specific maintenance needs for each tree. This concerns pruning or removals to reduce potential safety risks, as well as developing cyclical pruning programs.
- A five-year budget for the street and park/public space tree management program.
- Recommendations for the use of the current tree ordinance (Massachusetts General Law-Chapter 87).

Goals

The City of Somerville Tree Management Program discussed in this Plan is intended to achieve the following goals:

- To gain an overall understanding of the inventoried street tree population in terms of genus and species composition.
- To analyze the individual and overall health (condition) of the inventoried tree population.
- To identify and take remedial action for trees with structural or other defects that could cause them to be or to become potential risks to residents, vehicles, and property.
- To establish a tree safety pruning and removal program that will alleviate all identified potential high-risk conditions by the end of Year 1 of the *Five-Year Urban Forestry Program*.
- To establish a five-year cyclical tree pruning program beginning in Year 3.
- To establish a *Young Tree Training Pruning Program* for all newly planted trees beginning in Year 3.
- To develop a *Street Tree Planting Program* designed to maintain or improve the current stocking level and increase species diversity.
- To build a strong public educational program to achieve urban forest preservation and protection goals.
- To provide for effective use of a well-written tree ordinance.

Evaluating and Updating This Plan

This Management Plan is intended to provide urban forestry guidelines for the next five years. In order to measure the effectiveness of the implementation of the program in achieving the stated goals, a method for evaluation should be followed. Specific accomplishments can be measured in comparison to the Management Plan's goals and recommendations. These include:

- ➢ The completion of all identified high- and severe-risk removals and high- and severe-risk pruning in Year 1 of the program.
- ➢ In Year 2 of the program, evaluate the number of trees pruned annually in the *Routine Pruning Program*.
- ➢ Annually compare the number of trees planted to the desired number of plantings and the number of removals per year.
- ➢ Beginning in Year 3, establish a *Young Tree Training Pruning Program* and evaluate the number of trees pruned annually to match the goal of the five-year program.
- ➢ At the end of each year, compare the City's annual urban forestry budget to that projected in this Management Plan.

Photograph 2. Somerville should maintain its urban forest to reflect a positive image towards its local surroundings.

Chapter 1: Methodology

Summary

This chapter provides a description of the procedures used by Davey Resource Group in conducting the Somerville Street and Park/Public Space Tree Inventory. Definitions and methodology of data collection are provided to give the reader a total understanding of the inventory process.

Definition

A "tree" is defined as a perennial woody plant that may grow more than 20 feet tall. Characteristically, it has one main stem, although many species may grow as multi-stemmed forms. A "street tree" is further defined as a tree growing within the public right-of-way (ROW) planted by the City or its residents. Note that the City did provide Davey Resource Group with ROW information. At times, when the ROW data seemed incorrect or offset, experience reading obvious and subtle ROW indicators was relied upon by Davey Resource Group's urban foresters.

Data Collection

During the inventory of Somerville, all street and park/public space trees were individually examined, identified, measured, and recorded. Data were recorded for the following public tree variables, which are described in further detail below:

- Tree Location
- Tree Genus and Species Identification
- Tree Diameter
- Tree Trunks
- Tree Condition
- Tree Maintenance Requirements
- Additional Consultation Needed
- Risk Rating
- Observations
- Tree Location Type
- Planting Location
- Weak Fork Present
- Cavity Present
- Overhead Utilities
- Percentage of Deadwood
- Additional Comments (Field Notes)

Photograph 3. Establishing a healthy and well-managed public tree population should be a priority for the City of Somerville.

Tree Location

The inventory was conducted using a pen-based Itronix 325 Duo-Touch™ Tablet PC hand-held data collection unit along with a Trimble® GPS (global positioning system) Pathfinder™ ProXH receiver. Geographic information system (GIS) basemap layers, provided by the City, consisted of ROW information, parcels, addresses, and digital orthophotographs. The combination of GPS with GIS facilitated the creation of a seamless map-based data collection system. This system allowed Davey Resource Group to populate a tree layer in the field as each tree's location and attributes were recorded. During the course of the inventory, the tree layers were imported into ArcView® for daily quality control review. Upon completion of all data collection, the files were merged into a final tree layer for delivery as the new City tree inventory.

Photograph 4. A Davey urban forester using a pen-tablet computer with GPS to perform the inventory (stock photo).

Street Tree Location Methodology

To allow for the maximum use of data, individual trees are inventoried by *street* name, *address* number, and by *site* number. Each tree site location is also assigned *lot side* and *block side* information. In order to be consistent in the assignment of tree location information, Davey Resource Group has developed a method for determining addresses, site numbers, and block side definitions. This method is designed so that the urban forester, contractors, or maintenance personnel will be able to identify the correct tree using this location information.

Each **address** includes a *street name* and *address number*. Addresses are determined from the actual address number posted on buildings. In instances where (A) there is no posted street number on a building; (B) trees are located on vacant lots; or (C) trees are located at the rear of a lot which borders two parallel streets, addressing is matched as closely as possible to opposite or adjacent addresses. An '**X**' is entered in the address number *assigned* field for these fictitious addresses.

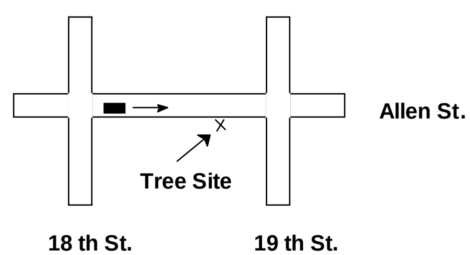
Each tree site at an address is assigned a **side code** depending on whether it is on the front (F), side (S), or rear (R) of the addressed lot. Median or Island tree sites (M) are also identified and assigned a fictitious address closest to an address on an opposite side of the street. Each median segment is collected and numbered with a fictitious (X) address that is interpolated from addresses facing the median/island. The tree sites on the median are collected in the direction of vehicular traffic flow. If there are multiple median areas between two cross streets, each segment is given its own fictitious (X) address.

Multiple tree sites at the same address are distinguished from one another by assigning each tree a separate **site number**. The basis of our location methodology is that the tree sites are collected and assigned site numbers in the direction of vehicular traffic flow. (This is only false in the case of one-way streets; one-way streets are collected and assigned site numbers as if they were two-way streets.) At each address, a separate number sequence is used for each side (front, side, rear, and median/island). This means that the trees at the front may be numbered 1 through 999 and, if trees are located on the side, rear, or median/island of that same address, each side is also numbered consecutively, again beginning with the number 1 and always in the direction of vehicular traffic flow.

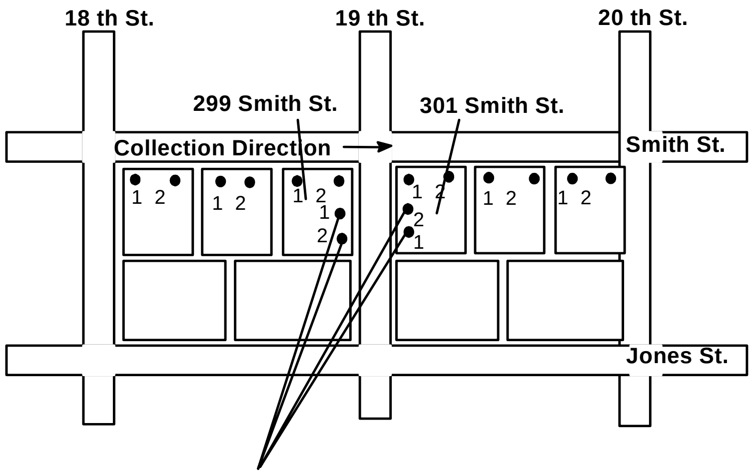
The block side information is composed of an **on** street, a **from** street, and a **to** street:

- The *on* street is the street that the tree site is actually located on. Be aware that some tree sites (*e.g.,* those located on a side street) will be located on a street that is different from the actual addressed street. This means that the *on* street will not necessarily match the address street (Appendix G).
- The *from* street is the cross street the data collector is moving away from when moving in the direction of traffic flow (opposite of traffic flow when moving up the left side of one-way streets).
- The *to* street is the cross street the data collector is moving toward when moving in the direction of traffic flow (opposite of traffic flow when moving up the left side of one-way streets).

The *on* street may not be the same as the address street. For example, a corner house may have trees along the side and those trees may actually be on a side street. The *from* street is the first cross street in the direction from which you would approach the tree site (in order to be on the same side of the street as the tree site). The *to* street is the first cross street that you would cross when leaving the tree site. For example, the trimming crew in the truck shown below would find the tree site *on* Allen St. *from* 18th St. *to* 19th St.



The following diagram provides more detail on how tree site numbering progresses as you move along a street:



These four tree sites are on 19th St., but have Smith St. addresses.

The corner lots have location information similar to the following:

Address:	299		Address:	299	
Street:	Smith St.		Street:	Smith St.	
Side:	F		Side:	F	
Site:	1		Site:	2	
Block:	On:	Smith St.	Block:	On:	Smith St.
	From:	18th St.		From:	18th St.
	To:	19th St.		To:	19th St.
Address:	299		Address:	299	
Street:	Smith St.		Street:	Smith St.	
Side:	S		Side:	S	
Site:	1		Site:	2	
Block:	On:	19th St.	Block:	On:	19th St.
	From:	Smith St.		From:	Smith St.
	To:	Jones St.		To:	Jones St.
Address:	301		Address:	301	
Street:	Smith St.		Street:	Smith St.	
Side:	S		Side:	S	
Site:	1		Site:	2	
Block:	On:	19th St.	Block:	On:	19th St.
	From:	Jones St.		From:	Jones St.
	To:	Smith St.		To:	Smith St.
Address:	301		Address:	301	
Street:	Smith St.		Street:	Smith St.	
Side:	F		Side:	F	
Site:	1		Site:	2	
Block:	On:	Smith St.	Block:	On:	Smith St.
	From:	19th St.		From:	19th St.
	To:	20th St.		To:	20th St.

Tree Genus and Species Identification

The City's trees are identified by genus and species and by cultivars where appropriate (cultivar names are recorded in the Assigned Cultivar section of each tree record, when applicable). However, both botanical and common names are included in this document. Reports with current binomial nomenclature (botanical names) are included in Appendix A. The identification of trees by botanical names ensures the correct scientific identification of each tree species, while the use of common names can provide a readable format for all who may utilize this Management Plan.

Tree Diameter

Diameter at breast height (DBH) is a standard forestry measurement taken at 4.5 feet above the ground. Each tree and stump diameter was measured to the nearest inch with a 25-inch reach Biltmore® Cruiser™ stick.

Photograph 5. A Davey Urban Forester shows how to measure a tree with the Biltmore® Cruiser™ stick.

Tree Trunks

During the inventory, each tree was evaluated for the total number of trunks present. For trees with multiple trunks, the largest trunk DBH was measured and recorded. See Appendix B for trunk and DBH frequency reports.

Tree Condition

Condition indicates the current state of a tree's health, structural soundness, overall shape, and growth rate (Appendix C). To some extent, condition class is also a reflection of the life expectancy of the tree. Crown development, trunk condition, major branch structure, twig growth rate, insects/diseases, and root condition, among others, are considered. In general, the condition of each tree is recorded as one of the following categories adapted from MCTI (Mobile Community Tree Inventory) utility of the i-Tree Software Suite.

Photograph 6. This *Acer platanoides* (Norway maple) is recorded in Poor condition. At the time of inspection, the tree was showing signs of stress and crown dieback.

Good
Trees rated Good are healthy and vigorous without signs of insects, disease and mechanical injury, and they require little or no corrective work.

Fair
Trees rated Fair are in average condition or vigor for the area, but may be in need of some corrective pruning or repair. They may show minor insect injury, disease, or other problems.

Poor
Trees rated Poor are in a general state of decline. They may show serious mechanical, insect, or disease damage, but are not dead.

Dead
Trees rated Dead have no signs of life.

Tree Maintenance Requirements

Maintenance requirement information is collected to provide a basis for determining and prioritizing the primary maintenance needs of the City's inventoried tree population (Appendix D). This information is useful for preparing accurate budgets and for developing maintenance schedules, whether the work is performed by in-house crews or contracted out to local tree care companies. The following terms, based on the ANSI A300 Standards for Tree Pruning (2nd edition, 2001), are used to describe the maintenance requirements of each tree:

Clean
This type of maintenance is needed when significant deadwood is found. Significant deadwood refers to branches 2 inches in diameter or greater. This maintenance requirement is also used for trees in need of structural pruning to eliminate codominant leaders, weak branch unions, or structurally weak limbs.

Raise
Crown raising removes lower limbs in order to provide clearance for pedestrian, maintenance, or vehicular traffic, as well as signage visibility. The City of Somerville requires 8 feet of pedestrian clearance over sidewalks and 14 feet of vehicular clearance over roadways.

Reduce
Crown reduction reduces overall tree mass by pruning the top or sides to a sufficiently large lateral. This is often done to prune the tree away from buildings, structures, or overhead utility wires.

Ground-level Maintenance Needed
Trees with this maintenance recommendation will need the removal of secondary stems and/or suckers (sprouts).

Photograph 7. The *Amelanchier arborea* **(downy serviceberry) pictured here was recorded with a maintenance of Ground-level Maintenance. There is a large amount of sprouts at the base of the tree that have become a clearance issue.**

Remove
This type of maintenance is needed on trees that are dead, present a serious amount of risk, or are in poor condition and not contributing to the site. Most removals have serious structural defects that cannot be effectively or practically remedied and present a potential risk to the public. Such defects include, but are not limited to, extensive trunk or root decay and severely decayed or weakened V-crotches where the potential for failure is high. Trees in this category present an immediate, yet unpredictable, potential risk of damage to people or property. These trees should be removed as soon as possible.

Additional Consultation Needed

A tree inventory by its very nature involves only cursory, visual observations of each tree in order to gather basic information. **No trees received detailed examinations or inspections during the tree inventory.** Davey Resource Group's urban foresters recorded certain trees as having pruning, removal, or other maintenance recommendations based on cursory observations.

Photograph 8. This *Acer platanoides* **(Norway maple) has a high concentration of wood boring insect damage. This tree should be inspected to identify the species of insect causing the damage.**

These trees will require further consultation to determine what measures, if any, are needed to abate or mitigate potential risk of personal injury or property damage. These trees are listed in the Trees Recommended for Consultation section of the *Street Tree Inventory Workbook.* Please note that the *Tree Inventory Workbook* has all the City's trees listed in an orderly format by category.

The majority of trees in this category are rated in poor condition. Specifically, this category includes trees that exhibit structural damage or conditions (large cavities, crown dieback, etc.) or the beginning stages of disease or decline that could create the potential for personal injury or property damage within the next five years or so. There were also a few trees recommended for removal that exhibited pest problems that should be inspected for pest identification before removal.

Risk Rating

A Risk Rating was assigned to each tree using an assessment protocol based on the USDA Forest Service Community Tree Risk Rating System. This system analyzes risk in four separate categories and then uses a point system to calculate a *Risk Rating* number.

1. <u>Probability of Failure (1–4 points).</u> Identifies the most likely failure and rates the likelihood that the structural defect(s) will result in failure based on observed, current conditions.

   a) Low: some minor defects present.
      - minor branch/crown dieback
      - minor defects or wounds

   b) Moderate: several moderate defects present
      - stem decay or cavity within safe shell limits: shell thickness >1 inch of sound wood for each 6 inches of stem diameter
      - crack(s) without extensive decay
      - defect(s) affecting 30–40% of the tree’s circumference
      - crown damage/breakage: hardwoods up to 50%; conifers up to 30%
      - weak branch union: major branch or codominant stem has included bark
      - stem girdling roots: <40% tree’s circumference with compressed wood
      - root damage: <40% of roots damaged within the critical root radius

   c) High: multiple of significant defects present:
      - stem decay or cavity at or exceeding shell safety limits: minimum shell thickness = 1 inch of sound wood for each 6 inches of stem diameter
      - cracks, particularly those in contact with the soil or associated with other defects
      - defect(s) affecting >40% of the tree’s circumference
      - crown damage/breakage: hardwoods >50%; pines >30%
      - weak branch union with crack or decay
      - girdling roots with >40% of tree’s circumference with compressed wood
      - root damage: >40% of roots damaged within the critical root radius
      - leaning tree with recent root breakage or soil mounding, crack or extensive decay
      - dead tree: standing dead without other significant defects

   d) Extremely High: multiple and significant defects present; visual obstruction of traffic signs/lights or intersections:
      - stem decay or cavity exceeding shell safety limits and severe crack
      - cracks: when a stem or branch is split in half or has cracks on opposite sides
      - defect(s) affecting >40% of tree’s circumference or critical root radius and extensive decay or crack(s)
      - weak branch union with crack and decay
      - leaning tree with recent root breakage or soil mounding and crack or extensive decay
      - dead branches: broken (hangers) or with a crack
      - dead trees: standing dead with other defects such as cracks, hangers, extensive decay, or major root damage
      - visual obstruction of traffic signs/lights or intersections
      - physical obstruction of pedestrian or vehicle traffic

2. Size of Defective Part (1–3 points). Rates the size of the part most likely to fail. If the trunk is the part most likely to fail, tree will be recommended for removal and the DBH value will be used for the size of the defective part.

   a) Parts less than 4 inches in diameter
   b) Parts from 4 to 20 inches in diameter
   c) Parts greater than 20 inches in diameter

3. Probability of Target Impact (1–3 points). Rates the use and occupancy of the area that would be struck by defective part.

   a) Occasional Use: low-use roads and park trails; parking lots adjacent to low-use areas; natural areas such as woods or riparian zones; transition areas with limited public use; industrial areas.

   b) Intermediate Use: moderated- to low-use school playgrounds, parks, and picnic areas; parking lots adjacent to moderate-use areas; secondary roads (neighborhoods) and park trails within moderate- to high-use areas; and dispersed campgrounds.

   c) Frequent Use: emergency access routes, medical and emergency facilities and shelters, and handicap access areas; high-use school playgrounds, parks, and picnic areas; bus stops; visitor centers, shelters, and park administrative buildings and residences; main thoroughfares and congested intersections in high-use areas; parking lots adjacent to high-use areas; interpretive signs, kiosks; scenic vistas; and campsites (particularly drive-in).

4. Other Risk Factors (0–2 points). This category can be used if professional judgment suggests the need to increase the risk rating. It is especially helpful to use when tree species growth characteristics become a factor in risk rating. For example, some tree species have growth patterns that make them more vulnerable to certain defects such as weak branch unions on *Acer saccharinum* (silver maple) and branching shedding on *Fagus grandifolia* (American beech). This optional subjective Risk Rating is used if professional judgment suggests the need to increase the total Risk Rating and invoke immediate corrective action. For example, trees with a numeric Risk Rating of 9 or 10 would be identified as high-priority trees to receive corrective treatments first. An inspector may wish to increase a tree’s Risk Rating from 8 to 9 as a means of ensuring the tree will receive immediate corrective treatment.

- **Risk Rating.** Generally, trees with the highest numeric risk ratings should receive corrective treatment first. The overall Risk Rating of the tree will be indicated, based on the sum of above risk assessment field values. See the formula below:

Risk Rating (3–12 points) = probability of failure (1–4 points) + size of defective part (1–3 points) + probability of target impact (1–3 points) + optional subjective Risk Rating (0–2 points)

Trees assessed as lower risk may fail before trees assessed as higher risk. There are many uncontrollable conditions, such as weather, pests, and human involvement, that can contribute to tree failure. Davey's assigned risk is meant only to be used as a guideline to make safety-driven maintenance decisions and to direct normal tree maintenance programs efficiently. All risk ratings are based on observable defects at the time of assessment. All observations are made from the ground. The *Risk Rating* assigned to each tree can be interpreted by the following categories:

1. None–Numeric *Risk Rating* equals 0. Used for planting and stump sites only.
2. Low–Numeric *Risk Rating* equals 3, 4, or 5. Trees designated as presenting a Low risk have minor visible structural defects or wounds in areas with moderate to low public access. At the current time, the observable defects—using visual inspection—do not meet the threshold of failure. No corrective action is required.
3. Moderate–Numeric *Risk Rating* equals 6, 7, and 8. Trees designated as presenting a Moderate risk have defects that may be cost-effectively or practically treated. The majority of trees in this category exhibit several moderate defects affecting <40% of a trunk, crown, or critical root zone. This category may also include young or newly planted trees in frequent public use areas such as downtown business districts or popular parks. At the current time, the observable defects—using visual inspection—do not meet the threshold of failure. The defects may or may not result in eventual tree failure. These trees can be recommended for pruning or removal and should be addressed after all *Severe*- and *High*-risk tree maintenance work has been performed.
4. High–Numeric *Risk Rating* equals 9 or 10. Trees designated as presenting a High risk have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category have multiple or significant defects affecting >40% of the trunk, crown, or critical root zone. Defective trees and/or tree parts are most likely between 4–20 inches in diameter and can be found in areas of frequent occupation, such as a main thoroughfare, congested streets, and/or near schools. Currently these defects indicate that the tree is failing, is in immediate danger of failing, or has already partially failed. These trees can be recommended for pruning or removal and should be addressed immediately after all *Severe* risk removals.
5. Severe–Numeric *Risk Rating* equals 11 or 12. Trees designated as presenting a Severe risk have defects that cannot be cost-effectively or practically treated. The majority of the trees in this category have multiple and significant defects present in the trunk, crown, or critical root zone. Defective trees and/or tree parts are most likely larger than 20 inches in diameter and can be found in areas of frequent occupation, such as a main thoroughfare, congested streets, and/or near schools. Currently these defects indicate that the tree is failing, is in immediate danger of failing, or has already partially failed. Large dead and dying trees that are high-liability risks are included in this category. This category is reserved for the highest priority removals only and corrective action should be taken as soon as possible.

Observations

General observations concerning tree health, structure, and location have been recorded for each tree in the inventory, when applicable. Observation types include *Cavity/Decay*, *Grate/Guard*, *Improperly Installed*, *Improperly Mulched*, *Improperly Pruned*, *Mechanical Damage*, *Memorial Tree*, *Nutrient Deficiency*, *Pest Problem*, *Poor Location*, *Poor Root System*, *Poor Structure*, *Remove Hardware*, *Serious Decline*, and *Signs of Stress*. *None* means no observation types were recorded (Appendix E).

Tree Location Type

The physical location of trees in relation to the public ROW and/or public space is recorded. Location types include: *Borderline*, *Off ROW*, *Park/Public Space*, *Street*, and *Unknown* (Appendix F).

Planting Location

Information on the type of planting location is recorded for each tree, stump, or planting site. Planting locations included: *Tree Pit or Planter, Below 4 feet, Above 4 feet,* and *Open or Unrestricted*.

Weak Fork Present

A weak fork refers to a union where two or more stems come together at a narrow angle. This is a significant structural defect which, when not corrected, can lead to major branch failure, property damage, and permanent damage to the structural integrity of a tree. The presence of a weak fork is indicated as *Yes* or *No*.

Photograph 9. This *Pyrus calleryana* (callery pear) was recorded with an observation of Poor Root System. Many poor root systems include the presence of girdling roots, as seen in the picture above. Trees with poorly developed root systems are prone to failure during high wind loading events and typically have a shorter useful lifespan. There are 796 (7.20%) trees in Somerville recorded with a Poor Root System.

Cavity Present

Defined as an opening in the tree, whether visible or not. These openings represent structural decay of the trunk or branches of a tree. The presence of visible cavities is indicated as *Yes* or *No*.

Overhead Utilities

The presence of high and low voltage and cable and telephone overhead utility lines is noted during the inventory. This information is important in planning for pruning projects and for future tree plantings. For the purposes of this inventory, the presence of utility lines is indicated as *Yes* or *No* (Appendix G).

Percentage Deadwood

The percentage class of the crown that contains dead branches over 2 inches in diameter. The percentage of deadwood is recorded in the following ranges: *0–25%, 26–50%, 51–75%,* and *76–100%*.

Additional Comments (Field Notes)

Any additional comments regarding maintenance, cultivars, condition, disease, location, etc. are included for each tree, when applicable.

Chapter 2: The City of Somerville's Tree Population

Summary

The urban forest in Somerville is a complex system of trees, site conditions, and maintenance recommendations. Understanding this system is important for proper decision-making regarding species selection and tree care practices. The *Tree Population Characteristics* section of this report provides insight into the current composition and condition of Somerville's inventoried tree population. This information comes from an analysis of the data collected during the tree inventory phase of the project. Specific information detailed in this chapter includes:

- Species Composition and Diversity
- Size Class Distribution
- General Health and Condition
- Tree Maintenance Recommendations
- Risk-Rating Analysis
- Other Data Fields
- Tree Inventory Concerns

By accumulating and using this information, urban forest managers can forecast trends, anticipate maintenance needs, facilitate budgeting for tree-related expenditures, and develop a basis for long-range planning. This is necessary to ensure a stable and diverse tree population for the coming years and to plan for future tree planting operations.

Tree Population Characteristics

The characteristics of the urban forest include species, DBH, condition, and other related tree and site factors. By identifying the species, DBH, and condition of trees in the urban forest, one can learn much about the forest's composition, relative age, and health. It is important to know the kinds of trees as well as the number of trees present in the City. Species composition data are essential because tree species vary considerably in life expectancy and maintenance needs. The types of trees present in a community greatly affect tree maintenance activities and budgets. Similarly, tree diameter and size class data help to define the general age and size distribution of the total tree population. The following sections only discuss the inventoried street tree population.

Species Composition and Diversity

Table 1. Significant Species Composition of Somerville: Street Trees

Scientific Name	Common Name	Number	Percentage
Acer platanoides	Norway maple	1,922	22.23
Pyrus calleryana	callery pear	1,442	16.09
Acer rubrum	red maple	956	10.67
Gleditsia triacanthos inermis	thornless honeylocust	839	9.36
Fraxinus pennsylvanica	green ash	828	9.24
Tilia cordata	littleleaf linden	743	8.29
Zelkova serrata	Japanese zelkova	319	3.56
Platanus x *acerifolia*	London planetree	294	3.28
Prunus serrulata	Japanese flowering cherry	223	2.49
Syringa reticulata	Japanese tree lilac	187	2.09
Totals		**7,753**	**87.30**

Table 2. Significant Species Composition of Somerville: Park/Public Space Trees

Scientific Name	Common Name	Number	Percentage
Malus spp.	flowering crabapple	173	8.24
Acer platanoides	Norway maple	161	7.76
Pyrus calleryana	callery pear	135	6.43
Tilia cordata	littleleaf linden	129	6.14
Gleditsia triacanthos inermis	thornless honeylocust	126	6.00
Acer rubrum	red maple	123	5.86
Fraxinus pennsylvanica	green ash	96	4.57
Zelkova serrata	Japanese zelkova	74	3.52
Quercus palustris	pin oak	74	3.52
Pinus strobus	eastern white pine	66	3.14
Totals		**1,157**	**55.18**

As can be seen in Appendix A, the inventoried tree population is comprised of 11,062 trees distributed among 52 genera and 101 species. Table 1 illustrates that 10 species account for 81.12% of the street tree population, and Table 2 illustrates that 10 species account for 55.18% of the Park/Public Space trees.

Generally, in urban forestry management, it is recommended that no single species should account for more than 10% of the total population. Furthermore, no single genus (a genus is a group of closely related species) should account for more than 15% of the total population. Table 1 shows that Norway maple and callery pear comprise approximately 22% and 16%, respectively, of the inventoried street tree population, and combined with Park/Public Space trees, they amount to approximately 30% and 23%, respectively, of the entire tree population. Figure 1 shows that the genus *Acer* (maple) accounts for approximately 33% of the City's total inventoried tree population.

The inventory illustrates that past and current tree planting efforts in Somerville have resulted in a species distribution pattern with low diversity. Davey Resource Group recommends the City begin utilizing a wider range of species to reforest the community by including both native and non-native, urban-tolerant species. This would include *Gymnocladus dioica* (Kentucky coffeetree) or *Quercus imbricaria* (shingle oak) for large growing shade trees and *Ulmus parvifolia* (Chinese elm) or *Cercis canadensis* (eastern redbud) as alternatives to callery pear for small-growing trees. (See Appendix H for other suggested species).

Planting a large number of trees of the same species (monoculture) can lead to catastrophic results. A good example of this situation is the dominance of American elm (*Ulmus americana*) in American cities in the 20th century. When Dutch elm disease arrived in the United States in the 1930s, the resulting tree losses were devastating for many Midwestern communities, both economically and environmentally. Similar scenarios are now foreseeable for Asian long-horned beetle (*Anoplophora glabripennis*) and emerald ash borer (*Agrilus planipennis*). Due to the recent introduction of these new exotic tree killers, arborists are researching and scrutinizing the 10% species and 15% genus rule of thumb. Species diversification on this level can protect against specialized tree-eating insects and other major threats to modern urban forests. However, there now needs to be an accelerated effort to find pest-resistant trees at all levels, including genus, species, and cultivar that are currently underrepresented in commonly available nursery stock.

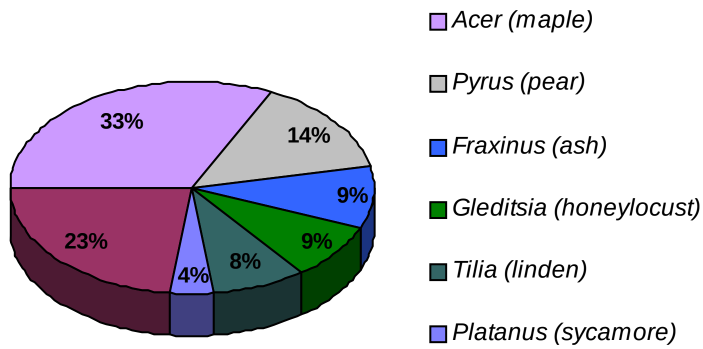


Figure 1. Somerville's Distribution of Trees by Genus

Keep in mind that increased diversity will not happen immediately. It must be made an integral part of a well-planned and executed tree planting program that will lead to the desired results over a period of several years or decades. Long-term planning and thinking is mandatory for any tree planting program to be effective. However, it is an excellent investment in the future of Somerville and one that future residents will appreciate many years from now.

Species diversity alone is insufficient in maintaining a stable urban forest. The extent to which each species is adapted to the site conditions and local climate in Somerville will also determine the general health and longevity of the tree population. Many of the species currently being used in the City represent a satisfactory group for street tree applications. Somerville should expand the number of species represented to improve diversity and emphasize lesser used or uncommon species that are performing well in future tree plantings.

Size Class Distribution

Tree species have different life spans and mature at different diameters, heights, and crown spreads. This means that actual tree ages cannot be assumed from DBH alone. However, general classifications of size, such as small, medium, and large, can be used to describe the general characteristics of Somerville's tree population. This is not a substitute for age classes, which can give the actual age and maturity of trees, but it can provide a general idea of the overall variability in the tree population. The actual breakdown by diameter and size class can be found in Appendix C.

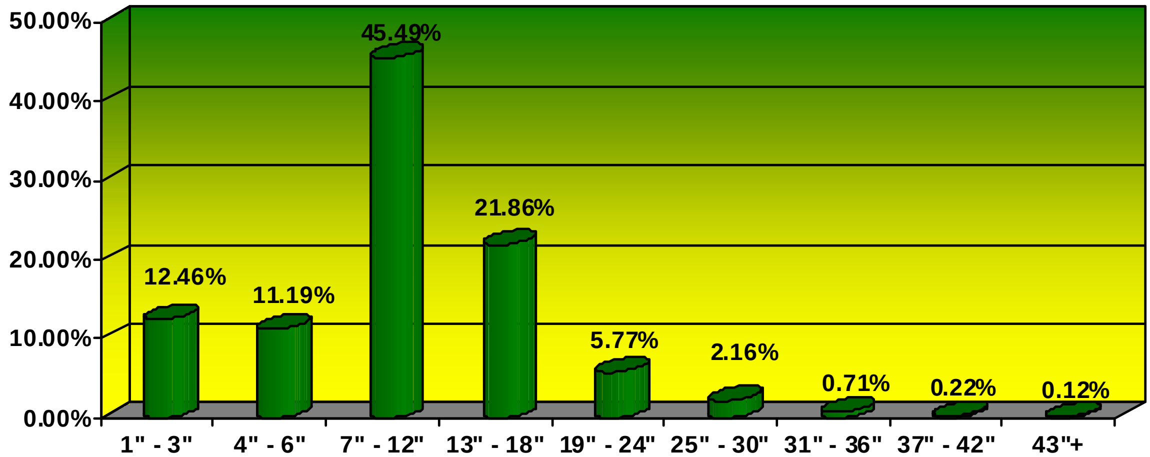


Figure 2. Diameter Size Class Distribution of Somerville's Inventoried Street Tree Population: Street Trees

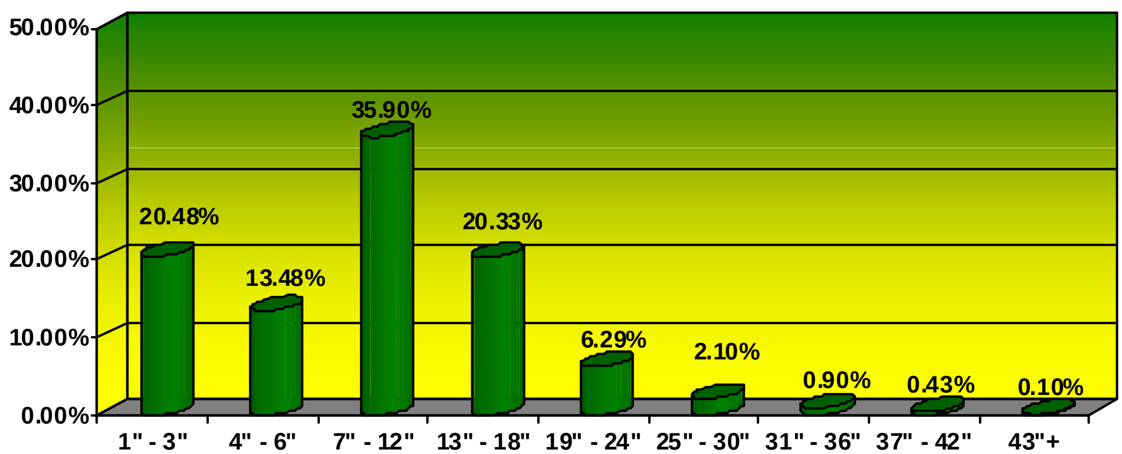


Figure 3. Diameter Size Class Distribution of Somerville's Inventoried Street Tree Population: Park/Public Space Trees

Normal recommendations in urban forestry management call for achieving, over time, an appropriate age mixture by removing and replanting a certain percentage of trees each year. Davey Resource Group believes that the ideal distribution of tree ages should be 40:50:10, reflecting the percentage of trees in each size group and representing a uniform spread of tree ages from young to mature to overmature. By comparison, Somerville's current Street tree population is a 24:73:3 mix, and the Park/Public Space tree population is a 34:63:4 mix of small, medium, and large trees. The entire urban forest tree population has a mix of 26:71:3 small, medium, and large trees. The City should strive to accomplish the acceptable "ideal" distribution of an uneven-aged stand because if this is done, then the forest will be sustainable. A sustainable forest is one that survives or persists, taking severe storms and natural mortality into account.

Somerville's entire inventoried population is primarily comprised of medium-sized trees (71%). This includes trees with a diameter range of 7- to 24-inch DBH. *Acer* (maple), *Pyrus* (pear), and *Fraxinus* (ash) dominate this size class. This percentage of medium-sized trees is a little higher than what may be considered ideal. A problem that could result is the large percentage of the population reaching maturity at the same time. This can group costly maintenance needs, such as high priority pruning or high priority removals, into small periods of time and perhaps overwhelm department budgets. The cyclical spikes and valleys of these maintenance needs will make budget planning hard to predict and gear maintenance toward a reactive, rather than proactive, approach. With a better balance of size class distribution, general maintenance patterns can be more easily predicted and regular maintenance activities can be budgeted for. This is one step in moving a tree care program from a reactive to a proactive approach concerning tree maintenance activities.

The second largest size class represented in Somerville is small-sized trees (6 inches or less DBH). This size-class represents 26% of the entire population and is dominated by maple, pear, ash, and *Syringa* (lilac). This is slightly less than the ideal distribution of 40% small-sized trees. It should be noted that young, deciduous trees must be properly pruned to encourage good growth-habit and to minimize future costly maintenance requirements as the trees mature. Although maintenance requirements can be more intensive in young trees, this care can be performed efficiently by ground crews and without costly equipment (see the *Young Tree Training Pruning Program* section in Chapter 3 for more information). Increasing the percentage and properly maintaining the population of small-sized trees ensures an adequate and healthy urban forest to replace the high number of older, larger trees.

Large trees, which are 25 inches and greater in diameter, comprise approximately 3% of Somerville's inventoried tree population. Maples, *Tilia* (linden), and *Quercus* (oak) dominate this size class.

Planning for tree planting in Somerville will require careful consideration of species selection. The small size class should be composed of both long-lived species and smaller, shorter-lived species, addressing the need for less maintenance and the desire for characteristics such as spring flowers and fall color. Proper tree maintenance should be carried out to ensure the health and longevity of the trees, especially those with good maturity potential. This includes fertilizing, watering, and training pruning when immature.

General Health and Condition

The condition of a tree is evaluated by considering several factors, including, but not limited to, the root characteristics, trunk, branch structure, canopy, foliage, and presence of pests. Based on these factors, each tree is given a condition rating based on those defined by the MCTI Utility of i-Tree.

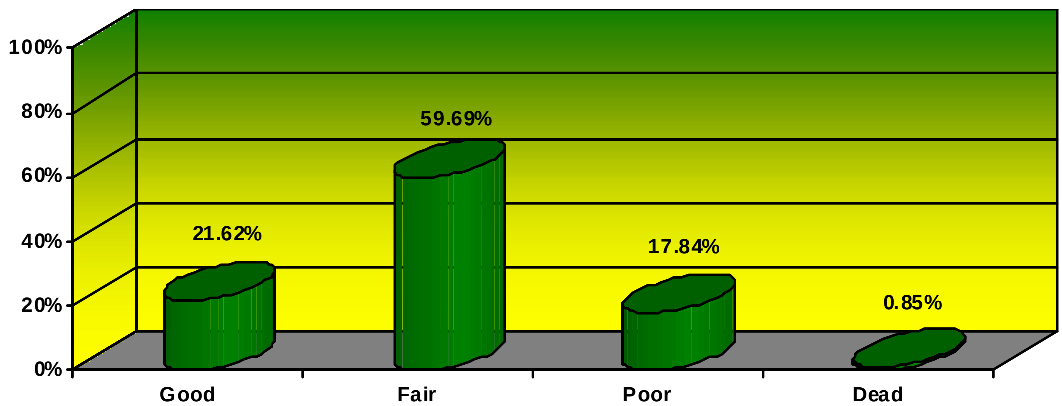


Figure 4. Somerville's Street Tree Conditions: Street Trees

As can be seen in Figures 4 and 5, a significant proportion of Somerville's tree population is in fair to good health. Dead trees and those in poor condition comprise approximately 17% of the total inventoried population. Maples, pears, and lindens have the highest amount of trees listed in poor or dead condition classes.

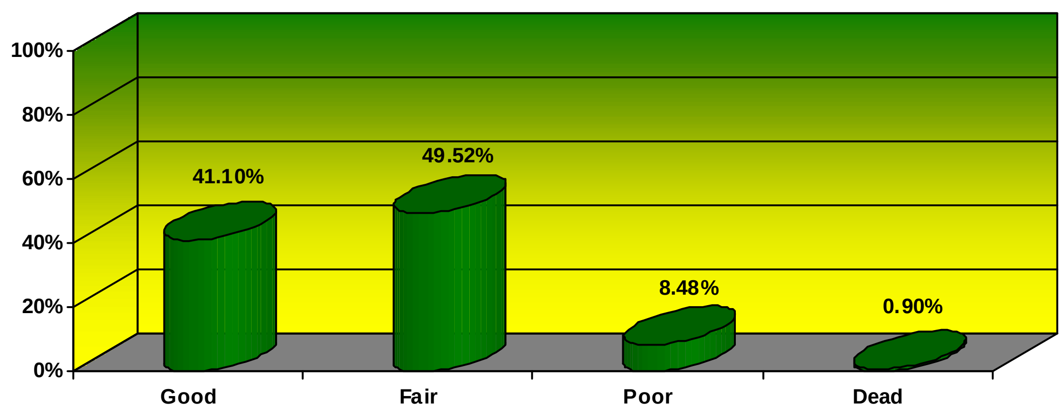


Figure 5. Somerville's Street Tree Conditions: Park/Public Space Trees

Poor condition ratings given to mature trees are generally due to visible signs of decline and stress, including, but not limited to, decay, dead limbs, sparse branching, or poor structure. Where physical damage has occurred, these trees may also become more susceptible to diseases and other problems.

These kinds of stresses can also make trees prone to pest problems by providing access to internal wood tissue. If a tree is already stressed, the additional pest injury can substantially reduce the tree's ability to sustain defense mechanisms and maintain growth. When trees are in good health, most have the ability to withstand pest or disease problems but, with the onset of stress and/or decline, they are less likely to produce sufficient energy for growth and survival and can succumb rapidly.

A poor condition rating given to young or newly planted trees is often due to severe physical damage or to a failure to thrive after planting. Young trees can be seriously impacted by physical damage from vehicles, lawn mowers, string trimmers, and poor pruning and installation practices and are often vandalized because of their small size (which makes them an easy target for destruction).

When maintaining public trees, the potential for loss is an important factor in prioritizing treatments and making effective use of available funds. The loss of trees over time is an inevitable natural process; however, the goal of the management process is to control the decline, removal, and replacement of trees in a timely and cost-effective manner. Monitoring the condition of significant trees and making efforts to maintain their health is essential.

Tree Maintenance Recommendations

One objective of the tree inventory was to determine the current appropriate maintenance recommendations for the tree population. The highest priority maintenance recommendations identified pertain to protecting public safety first. All pruning and removal maintenance recommendations were made by Davey Resource Group urban foresters and ISA *Certified Arborists*, and were based on the existence of potential safety risks to the residents of Somerville and/or their property at the time of the inventory. The maintenance activities associated with reducing the risk of injury or property damage include:

- **High and Moderate Priority Removal**
- **High Priority Pruning**

The other maintenance activities discussed here are:

- **Low Risk Removal**
- **Routine Pruning**
- **Training Prune**
- **Stump Removal**

The latter four categories are not high-priority safety pruning activities, but rather practices directed at improving the overall health, stability, and aesthetics of the urban forest as well as the cost-effectiveness of the management program. It should be noted here that many other maintenance activities could be identified such as insect or disease treatments or fertilization. This information was not collected as part of the inventory because these types of maintenance activities are rarely included in a municipal tree management budget. Davey Resource Group has identified maintenance activities that are of greatest importance to the overall management of the total tree population. The current maintenance recommendations have been determined from visual observations made from the ground. The structure and function of roots, trunk, scaffold branches, and canopy, as well as the tree's location relative to streets, sidewalks, utilities, signs, buildings, and traffic control devices were all taken into consideration during the each tree assessment.

This section analyzes the removal and pruning recommendations noted during the inventory. Recommendations for future maintenance are included as part of the discussion of each category. All maintenance recommendations are identified on a per tree basis in the *Tree Inventory Workbook*. Additionally, Chapter 3 discusses in detail the specific prioritization of maintenance work and provides a detailed five-year estimated budget for the maintenance of Somerville's public tree population.

Maintenance and risk assessment data should be used as a basis for prioritizing activity needs. This information will allow Somerville to develop cost-effective strategies by assisting all relevant City officials with an accurate evaluation of current and future tree-related expenditures.

Table 3. Somerville's Tree Maintenance Requirements: Street Trees*

Maintenance Required	Number of Trees	Percentage of Trees
Removal	757	8.17
Clean	1,915	20.68
Raise	3,439	37.14
Reduce	850	9.18
Ground Level Maintenance	517	5.58
Training Prune**	1,932	20.86
Stump Removal	61	0.66
Planting Sites	237	2.56

*Note for Table 3. Due to the MCTI data specifications used for this inventory, multiple maintenance needs were recommended for trees that required these operations.

**Training Prune data were not collected as apart of the inventory because of the data format. The numbers recorded in the table are discussed below in the Training Prune section.

Table 4. Somerville's Tree Maintenance Requirements: Park/Public Space Trees

Maintenance Required	Number of Trees	Percentage of Trees
Removal	111	5.25
Clean	461	21.83
Raise	661	31.30
Reduce	44	2.08
Ground Level Maintenance	77	3.65
Training Prune	673	31.86
Stump Removal	5	0.24
Planting Sites	7	0.33

*Note for Table 3. Due to the MCTI data specifications used for this inventory, multiple maintenance needs were recommended for trees that required these operations.

** Training Prune data were not collected as apart of the inventory because of the data format. The numbers recorded in the table are discussed below in the Training Prune section.

It is clear from Tables 3 and 4 that a majority of the tree maintenance needs in Somerville involve pruning activities which require a cleaning and/or raising of the crown. Somerville's first priority is the safety of its citizens. Removal and pruning activities that are considered a high priority will be discussed next.

High-Priority Tree Removals

Trees fail from natural causes, such as disease, insects, and weather conditions, and from physical injury due to vehicles, vandalism, poisoning, and root disturbances, among others. There are three main reasons why high-risk public trees should be removed: (1) to reduce risks to persons and/or property; (2) to eliminate breeding sites for insects and diseases; and (3) for aesthetic reasons. In Somerville's inventoried tree population, *High-Priority Tree Removals* are those trees recommended for removal that have a risk rating of 9–10 (High) or 11–12 (Severe Risk).

Of the 9,260 total Street trees inventoried, 151 (1.63%) are recommended for High-Priority Removal. Five of these have a *Severe* risk rating and 146 have a *High* risk rating. Most of these trees are Norway maple and callery pear. Of the 2,112 total Park/Public Space trees inventoried, 13 (0.62%) are recommended for High-Priority Removal. All 13 of these have a *High* risk rating. The prompt removal of these trees is strongly recommended to reduce liability and maintain public safety.

Moderate-Priority Tree Removals

Additionally, there are 550 (5.95%) Street trees, and 78 (3.70%) Park/ Public Space trees marked for removal with a risk rating of 6, 7, or 8 (Moderate). These trees should be removed after all the High-Priority Removals are dealt with. Tree removals in this category still pose some risk to the community; however, smaller defect size and/or less potential for target impact have resulted in a *Moderate* risk only. It is important that these trees be removed after the *Severe* and *High* risk removals because their defects may not be cost-effectively remedied through pruning or other arboricultural techniques. *Moderate* risk removals may have defects that worsen over time or increase in size, thus creating new high-risk situations.

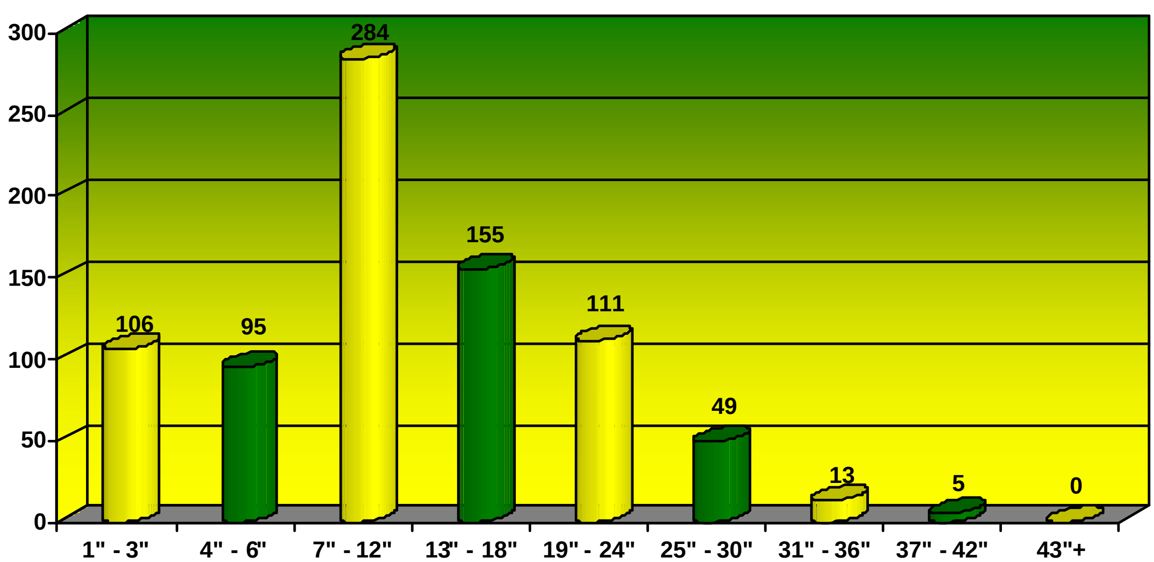


Figure 6. Number of Tree Removals by Diameter Size Class: Street Trees

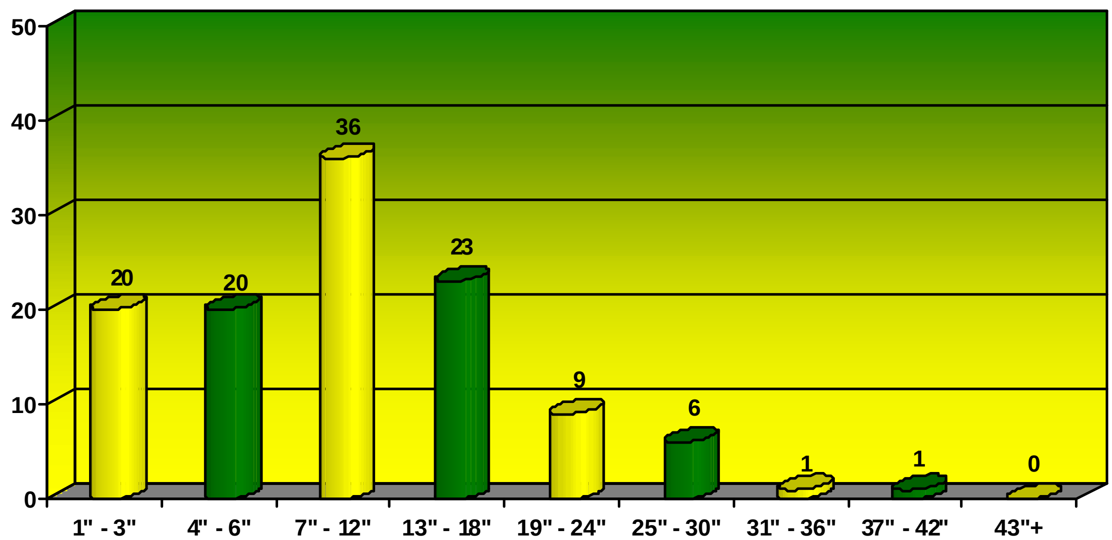


Figure 7. Number of Tree Removals by Diameter Size Class: Park/Public Space Trees

Diameter is a major factor in the removal priority assigned to each tree. Figures 6 and 7 show a breakdown of the removals by diameter class. However, many other factors, such as extent or location of decay, wound wood response, percentage of canopy loss, and species considerations, are analyzed when assigning maintenance priorities.

Low Priority Removals

Low-Priority Removals pose very little risk to the public. They are small, dead, or poorly formed trees that need to be removed. The elimination of these trees will minimize breeding site locations for insects and diseases and increase the aesthetics in the area. Healthy trees growing in a poor location may be included in this category. Undesirable species, such as *Ailanthus altissima* (tree-of-heaven) and *Morus alba* (white mulberry), may also be included. There are 56 (0.60%) Street trees and 20 (0.95%) Park/Public Space trees recommended for Low-Priority Removal. This category consists of trees recommended for removal with a risk rating of 5 or below (*Low*). These trees should be removed only after all *Severe*-, *High*-, and *Moderate*-risk trees have been completed.

High-Priority Pruning

High-Priority pruning is the removal of dead, diseased, or obviously weak, heavy, or high-risk branches, which are greater than four inches in diameter. Trees can also be designated as High-Priority prune if they have an abundance of deadwood two to four inches in diameter in their crowns. As can be seen in Tables 3 and 4, 1,915 (20.68%) Street trees, and 461 (21.83%) Park/Public Space trees in Somerville have a recommended maintenance of Clean. Of the Street trees, 42 (0.45%) have a risk rating of 9-12 (*High* to *Severe*) and 2,348 (25.35%) have a risk rating of 6-8 (*Moderate*). Of the Park/Public Space trees, 1 (0.05%) has a *High* risk rating and 572 (28.76%) have a *Moderate* risk rating. The work performed on these trees should be further prioritized by their specific hazard rating.

All trees in *High*- and *Moderate*-risk categories should be examined closely during pruning operations for severe internal and external decay and/or dieback. If, upon closer inspection, these trees are found to be severely decayed, they should be removed. The trees requiring pruning for high-risk conditions should be attended to as quickly as possible, starting with the greatest risk trees first.

Photograph 10. The *Acer campestre* (hedge maple) pictured here was recommended for a Crown Cleaning. The dead limb over the road should be removed before it fails.

<u>Routine Pruning</u>

Routine Pruning consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches on the main trunks, as well as those within the canopy of trees. In all, 4,009 (43.29%) of the inventoried Street trees, and 791 (37.45%) of the Park/Public Space trees in Somerville have been recommended for Routine Pruning activities, such as crown cleaning, raising, and/or reduction. These are trees that are recommended for one or more of these maintenance needs and have a risk rating of 5 or below (*Low*) and are not designated for Training Prune. A systematic Routine Pruning cycle of all City trees should be implemented to decrease the occurrence of potentially dangerous broken branches and large deadwood and to promote good structure (see Chapter 3 for more details).

Crown Cleaning

Trees in need of structural pruning to eliminate codominant leaders, weak branch unions, or structurally weak limbs fall into the category of Cleaning. These are trees that contain deadwood and are in need of some maintenance to correct problems and ensure healthy and structurally sound growth. There are 1,915 (20.68%) Street trees, and 461 (21.83%) Park/Public Space trees in need of this type of maintenance.

Crown Raising

Crown raising removes lower limbs in order to provide clearance for pedestrian, maintenance, or vehicular traffic, as well as signage visibility. The City of Somerville requires 8 feet of pedestrian clearance on sidewalks and 14 feet of vehicular clearance on roadways. Currently, 3,439 (37.14%) of the Street trees, and 661 (31.30%) of the Park/Public Space trees require crown raising. Trees were recommended for crown raise regardless of their current risk rating, unless they require removal. This is a safety issue, but often times not directly related to tree failure.

Crown Reduction

Crown reduction reduces overall tree mass by pruning the top or sides to a sufficiently large lateral. This is often done to prune the tree away from buildings, structures, or overhead utility wires. Currently, 850 (9.18%) of the Street trees, and 44 (2.08%) of the Park/Public Space trees in Somerville are in need of crown reduction. The need for crown reduction does come into account in the risk rating when determining target impact probability. Trees growing over, or in direct contact with, a target inherently have more risk associated.

Photograph 11. The *Acer platanoides* **(Norway maple) pictured here is in need of crown reduction since its branches are beginning to grow into this house.**

Ground Level Maintenance

Ground level maintenance is designated for trees that have suckers, sprouts, or secondary stems growing at ground level. Suckers and sprouts can become both pedestrian and vehicular maintenance issues if left unmaintained. Of the inventoried tree population, 517 (5.58%) Street trees, and 77 (3.65%) Park/Public Space trees are in need of ground level maintenance.

Due to the nature of MCTI data specifications used in this inventory, the prioritization of work will be based solely on the risk rating assigned to each tree. The maintenance needs of each tree (Clean, Raise, Reduce, and Ground Level Maintenance) can be addressed based on an individual tree basis.

Trees requiring Routine Pruning are not generally regarded as High-risk. This will allow Somerville to budget and schedule most of its tree maintenance projects in a cost-effective and timely manner. Keep in mind that, although many of these recommendations are presently low priority, they can become high-priority liabilities if neglected for an extended period. Pruning guidelines can be found in Appendix I. It should be the City's commitment to keep these specifications up-to-date with the current industry standards. Refer to Chapter 3 for additional discussion of the *Routine Pruning Program*.

<u>Young Tree Training Pruning</u>

Training, or pruning to shape, consists of the removal of dead, dying, diseased, interfering, conflicting, and/or weak branches, as well as selective trimming to direct future branch growth. The objective of training pruning is to increase structural integrity by pruning to one dominant leader and strong branch unions. Of course, this is mostly species-specific since many trees, such as *Malus* spp. (flowering crabapple), often have more than one leader. This maintenance category applies to all trees less than 20 feet in height that are usually immature and newly planted. Trees in this group are of such a size that they can be pruned from the ground with a pole pruner or pruning shears. Training pruning was not collected as a specific maintenance choice during the inventory, but Davey Resource Group feels it is an important part of any urban forestry management program. The number of trees eligible for training pruning was determined by the number of trees with a diameter of 6 inches DBH or less. There are estimated to be 1,932 (20.86%) Street trees, and 673 (31.86%) Park/Public Space trees designated for a training prune (Tables 3 and 4).

Stump Removal

There were 61 (0.66%) stumps that were found along the streets, and 5 (0.24%) stumps found in Parks/Public Spaces during the course of the inventory. These stumps should be removed according to budget allowances. The removal of stumps is important in eliminating breeding sites for insects and diseases, tripping risks, and it is the first step towards preparing each site for the successful planting of a new tree.

Risk Rating Analysis

A major objective of this inventory was to quantify the potential risk of each tree in addition to the overall risk of the street tree population as a whole. Risk rating values were assigned to each tree using an assessment protocol based on the USDA Forest Service Community Tree Risk Rating System. Recall that this system analyzes risk in four separate categories (probability of failure, size of defective part, probability of target impact, and other risk factors) and then uses a point system to calculate a risk rating value from 3–12, with 12 being the most severe. The risk rating number assigned to each tree is an important tool that can be used to prioritize work in Somerville's urban forest. All risk rating determinations were made by Davey Resource Group Urban Foresters and ISA *Certified Arborists*. This section discusses overall risk patterns, the use of the risk rating system as it pertains to tree maintenance is discussed in the *Tree Maintenance Recommendations* section of this Management Plan.

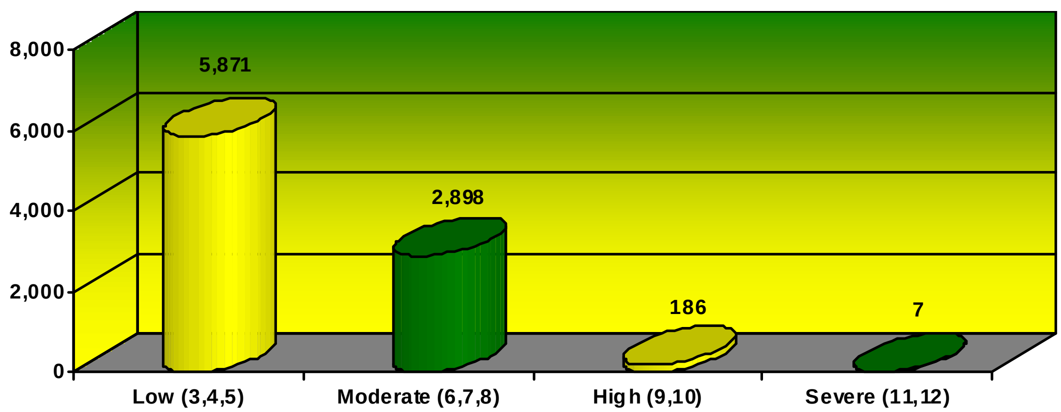


Figure 8. Total Trees by Risk Category: Streets

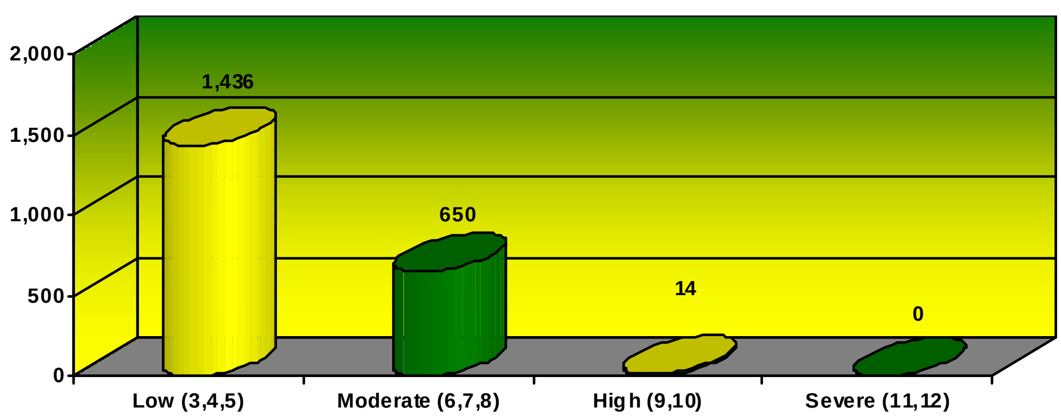


Figure 9. Total Trees by Risk Category: Park/Pubic Space

As seen in Figures 8 and 9, the majority of Somerville's inventoried tree population is in the *Low*- to *Moderate*-risk category. It is impossible to maintain an urban forest free of risk. Trees fail, branches fall, and diseases break out since we still live in a naturally imperfect world. The goal of a risk rating system is to increase public safety by identifying structural defects before a tree fails and causes damage. Trees that present an unacceptable amount of risk should be removed, thus reducing the overall risk of the urban forest and increasing safety community-wide for the municipal staff and citizens of Somerville.

As stated earlier, the first step in maintaining Somerville's urban forest is to remove or mitigate all of the *Severe*- or *High*-risk trees identified during the inventory. Understanding the risk rating system will allow staff to accurately determine and analyze acceptable and unacceptable amounts of risk. Now that Somerville has a risk rating system in place, it can be used to make important budgetary decisions. Making removal and maintenance decisions based on risk enables City managers to more efficiently use available funds. The use of these funds can be focused on the highest priority situations, effectively obtaining the highest gain in overall safety for the citizens of Somerville.

Every city is different in how it manages risk. Budgetary constraints, citizen acceptance, and local weather patterns are just some of the factors that enable city managers to accept certain levels of risk. Furthermore, each specific situation may warrant a different level of risk acceptance. For example, imagine two 20" DBH Norway maples, both with large decayed limbs hanging over a sidewalk. One is located on a street in an industrial area and one is growing along a street in front of a school. Both have a similar probability of failure. They may even have similar target impact ratings. However, city managers would probably consider the tree outside the school a higher priority. This example shows how cultural acceptance may differ in each situation. Somerville's City managers need to come up with their own acceptable levels of risk and manage the urban forest within those levels. Once maintenance of the urban forest is totally driven by this risk rating system, City managers can now demonstrate that they are acting properly to protect public safety. They can show that a widely accepted industry standard approach was used to prioritize the maintenance of all City trees and efficiently use tax-payer money.

Table 5. Species by Risk Category

Common Name	Low	Moderate	High	Severe
Norway maple	1,215	840	96	2
callery pear	942	609	24	2
red maple	841	232	6	0
thornless honeylocust	694	269	2	1
green ash	706	214	4	0
littleleaf linden	403	457	1	0
Japanese zelkova	155	233	5	0
London planetree	292	36	5	0
Japanese flowering cherry	231	35	0	0
Japanese tree lilac	188	10	0	0
Totals	**5,667**	**2,935**	**143**	**5**

Table 5 shows the top ten species in Somerville's inventoried tree population according to risk rating. Norway maple has the most trees in the Severe and High risk categories. Of the total population of Norway maples, 4.55% are considered High risk. This is a result of the many urban stresses that affect Norway maples as they age. Restricted grow space, mechanical damage, poor structural growth, and utility conflicts all contribute to the slow decline and decay of these trees in urban environments. When affected, Norway maples are poor at compartmentalizing decay. As a result, there may be many high-risk situations. However, when the High-risk Norway maples are removed, the levels of risk in the population as a whole are reduced and the result is a healthier, more structurally sound population of trees. This sub-population can then be managed to maintain a more acceptable level of risk. To further avoid these high-risk situations presented by Norway maple, this species should be phased out of City planting plans. Replacing Norway maples with more structurally sound trees, such as pin oak or London planetree, will tend to create less high-risk situations. Keep in mind that any tree planted in the wrong site can create problems. However, phasing out Norway maple will both increase species diversity and decrease overall risk.

Other Data Fields

<u>Additional Consult Needed</u>

There are 114 (1.27%) Street trees, and 9 (0.43%) Park/Public Space trees recommended for additional consult. Eighty-one of these trees are listed as being in fair or poor condition and have been noted as having decay to an undetermined extent. Six of these trees are recommended for removal, but need consulting due to pest problems. A *Certified Arborist* should perform an additional inspection with the assistance of mechanical equipment. If there are any signs of failure upon re-inspection of these trees by a *Certified Arborist*, then they should be removed.

<u>Utilities</u>

Of the 11,062 trees that were collected in the inventory, 5,315 (48.05%) are identified as having utilities above or immediately adjacent to them. Noting the presence of utility lines is necessary when planning pruning activities and can be used to identify which sites are more suitable for small growth-habit species that will not interfere with utility lines when they mature. With a new planting program, the implementation of the concept "right tree, right location" will aid in the reduction of unnecessary maintenance costs. Of the 244 vacant sites noted during the inventory, 53 (21.72%) have utilities above or adjacent to them. Of the 66 stumps inventoried, 6 (9.09%) have utilities above or adjacent to them.

Photograph 12. Approximately 47% of Somerville's trees have utility lines near or directly within their canopies. The concept of "right tree, right location" should be utilized when planting new street trees. Only small growth-habit trees should be planted under power lines (see Appendix H for other suggested small-growing species).

Tree Location Type

Of the 11,372 inventoried sites in Somerville, 9,230 (81.16%) are designated as Street sites, 2,112 (18.57%) are designated as Park/Public Space sites, and 30 (0.26%) are designated as Borderline sites. The majority of the Borderline sites are along the City boundary, where it was difficult to determine where the City boundary is actually located.

Tree Trunks

Of the 8,962 Street trees inventoried, 8,876 (99.04%) had a single, main trunk and 86 (0.96%) had multiple trunks. Of the 2,100 Park/Public Space trees inventoried, 1,873 (89.19%) had a single, main trunk and 227 (10.81%) had multiple trunks. Trees with multiple trunks (or leaders), such as large growth-habit trees or weak-wooded species, can pose high risk to the public. Trunks can fail due to decay, included bark, ice, wind, snow, etc. Large trees with multiple trunks should be monitored and excess trunks should be removed when necessary. However, not all trees with multiple trunks are considered high-risk trees. For example, *Betula nigra* (river birch) and *Magnolia* x *soulangiana* (saucer magnolia), often exist as multi-trunked specimens and may develop no problems throughout their lifespan. Therefore, it is recommended that the City of Somerville develop good pruning techniques to remove structurally weak stems while maintaining the natural form of the tree.

Observations

Photograph 13. This *Pyrus calleryana* (callery pear) was recorded with a Remove Hardware designation. An important part of routine maintenance programs for young or newly planted trees should be the proper and timely removal of hardware or tree staking.

Of the 9,260 Street sites included in the inventory, 775 (8.37%) trees have a Poor Root System, 230 (2.48%) trees have Poor Structure, 227 (2.45%) trees have a Remove Hardware designation, 181 (1.95%) trees are Improperly Installed, 170 (1.84%) trees are Improperly Mulched, 168 (1.81%) trees have a Cavity or Decay, 131 (1.41%) trees are showing Signs of Stress, 106 (1.14%) trees have Mechanical Damage, 103 (1.11%) trees are Improperly Pruned, 94 (1.02%) trees are in Serious Decline, 60 (0.65%) trees have a Pest Problem, 28 (0.30%) trees are in a Poor Location, 24 (0.26%) have a Grate or Guard designation, and 8 (0.09%) trees have a Nutrient Deficiency. Of the 2,112 Park/Public Space sites included in the inventory, 75 (3.55%) trees have been Improperly Mulched, 36 (1.70%) trees have a Remove Hardware designation, 33 (1.56%) have a Cavity or Decay, 25 (1.18%) trees are in a Poor Location, 21 (0.99%) trees have a Poor Root System, 18 (0.85%) trees are Improperly Pruned, 15 (0.71%) trees have Mechanical Damage, 12 (0.57%) trees have Poor Structure, 10 (0.47%) trees have a Pest Problem, 10 (0.47%) trees are Improperly Installed, 7 (0.33%) trees are showing Signs of Stress, 4 (0.19%) trees have a Nutrient Deficiency, 3 (0.14%) trees are Memorial Trees, 2 (0.09%) trees are in Serious Decline, and 2 (0.09%) trees have a Grate or Guard designation.

Percentage of Deadwood

Of the 8,962 Street trees included in the inventory, 5,421 (60.49%) trees have None, 2,880 (32.14%) trees have 0–25% deadwood in their canopy, 385 (4.30%) trees have 26–50% deadwood, 102 (1.14%) trees have 51–75% deadwood, and 174 (1.94%) trees have 76–100% deadwood. Of the 2,100 Park/Public Space trees included in the inventory, 1,380 (65.71%) trees have None, 660 (31.43%) trees have 0-25% deadwood in their canopy, 31 (1.48%) trees have 26-50% deadwood, 11 (0.52%) trees have 51-75% deadwood, and 18 (0.86%) trees have 76-100% deadwood. The later two categories represent trees that are very stressed or are dead. Advanced canopy decline beyond 50% is usually a clear sign that a tree will not recover and needs to be removed.

Planting Location

Of the 9,260 inventoried Street sites in Somerville, 8,093 (87.40%) are located in Tree Pits or Planters, 758 (8.19%) are located in areas above 4 feet in width, 251 (2.71%) are located in Open (unrestricted) growing spaces, and 158 (1.71%) are located in areas 4 feet or below in width. Of the 2,112 Park/Public Space sites, 1,109 (52.51%) are located in Open (unrestricted) growing spaces, 754 (35.27%) are located in areas above 4 feet in width, 226 (10.70%) are located in Tree Pits or Planters, and 32 (1.52%) are located in areas 4 feet or below in width. When evaluating future growing spaces and planting locations, the City must carefully select a suitable species for the site's growing conditions. Somerville's high percentage of tree pits or planters should be a major factor when selecting species for planting.

Tree Inventory Concerns

During the inventory and subsequent data analysis, specific observations were made by Davey Resource Group's urban foresters which require mention to Somerville personnel:

Species Diversity**:** As stated earlier in this Management Plan, ten species comprise approximately 77% of the inventoried tree population and Norway maple comprises approximately 19% of the inventoried tree population. The genus *Acer* (maple) accounts for 31% of Somerville's total street tree population. This is well beyond the recommended species distribution of no more than 10% of one species and 15% of one genus. Decreased species diversity can lead to catastrophic results. If any sort of devastating maple pest were to come to Somerville, Massachusetts, the City could lose up to 31% of its public tree stock. There is hope, however, in the form of a sound tree planting program and increased species diversity. Species diversity will provide a more evenly distributed tree population throughout the City, thus reducing the chances for insect and/or disease outbreaks. Additionally, increased diversity on the street or neighborhood level will ensure no single street or part of town will be devastated by a pest or disease outbreak. Keep in mind that increased diversity will not happen immediately. It must be made an integral part of a well-planned and executed tree planting program that will lead to the desired results over a period of several years or decades. Long-term planning and thinking is mandatory for any tree planting program to be effective. It is an excellent investment in the future of Somerville and one that future citizens and municipal staff will appreciate many years from now.

***Asian Longhorned Beetle*:** With the recent discovery of Asian Longhorned Beetle (ALB) in Worcester, it is all the more important to start to think and plan for the devastating effects this insect can have on forest ecosystems in the Northeast. ALB was first found in New York City (August, 1996) infesting numerous Norway maple trees in a specific neighborhood of Brooklyn. Infestations have since been discovered in other areas of New York, Toronto, the suburbs of Chicago, Carteret, New Jersey, and now Worcester. To date, several thousand trees have been removed from these areas in an effort to eradicate this pest. This pest arrived in this country in wood pallets and shipping crates at points of entry for cargo. The beetles then emerge from the discarded wooden shipping material and seek healthy trees to infest. As of the 2008 treatment season in New York City, the host genera are: *Acer* (maple), *Platanus* (sycamore), *Fraxinus* (ash), *Betula* (birch), *Sorbus* (mountain ash), *Ulmus* (elm), *Albizia* (mimosa), *Populus* (poplar), *Aesculus* (horsechestnut), and *Salix* (willow). Currently, 5,254 (46.19%) of the trees in Somerville are potential hosts to the ALB, with the bulk of these in the *Acer* genus. This is cause for concern and immediate action. It is recommended that citizens and municipal staff be educated on the identification of ALB. It is most often on a citizen, non-professional level in which infestations are spotted. Additionally, immediate changes must be made to the variety of species that are planted each spring and fall. There are currently no pest-resistant cultivars of any of the host species. All ALB host genera should be removed from planting lists given to homeowners. With a combined effort, there is a better chance of spotting the pest early in the infestation cycle and eradication efforts can begin.

***Development of a Young Tree Training Pruning Program*:** Currently, 1,932 (21.55%) trees in the inventoried street tree population, and 675 (32.14%) Park/Public Space trees have been recommended for a training prune. Therefore, the City would benefit greatly from the utilization of a small-tree trimming operation. Training Pruning is a relatively inexpensive operation since the trees can be pruned from the ground. Training Pruning will ensure that newly planted and immature trees have a strong, central leader and good form as they mature. Approximately 26% of the City's inventoried street tree population is composed of young trees six inches and less in diameter. Therefore, this is an activity that would be extremely beneficial for the overall health and quality of Somerville's urban forest and will protect its investment in new planting stock.

Chapter 3: Five-Year Urban Forest Management Program

Summary

This chapter details the activities that will constitute the Five-Year Urban Forest Management Program for Somerville. Headings in this chapter include:

- Priority Tree Maintenance Recommendations
- *Routine Pruning Program*
- *Young Tree Training Pruning Program*
- *Public Tree Planting Program*
- *Five-Year Urban Forestry Program* and Budget
- Public Relations and Education
- Sources of Funding
- Tree Ordinance Recommendations
- Management Recommendations for Updating Inventory

In this chapter, a Five-Year Urban Forest Management Program is described including estimated budgets for each activity across the five-year period. Specific tree management recommendations that are detailed include:

Management Recommendations for Street Trees

- Perform all Priority maintenance recommendations. This includes all removals and all priority pruning identified in the inventory. This program is designed to alleviate all potential high-risk trees identified in the tree inventory during Years 1 and 2 of the program.
- Beginning in Year 3 of the Five-Year Program, implement a continuing Routine Pruning maintenance cycle for the entire street tree population to ensure their pruning every five years. This will involve the pruning of approximately 802 Street trees, and 159 Park/Public Space trees annually (Tables 8 and 9).
- Beginning in Year 3, implement a three-year cyclical *Young Tree Training Pruning Program* for the immature street trees. This will involve the pruning of 644 Street trees, and 225 Park/Public Space trees annually (Tables 10 and 11).

Management Recommendations for All Inventoried Trees

- A plan for after-care of new tree plantings should be implemented in order to maximize the cumulative survival rate. This includes pruning, mulching, watering, and fertilizing (when applicable).
- Implement a Public Relations Program designed to educate the residents of Somerville and to generate greater support for the City's urban forestry program.
- Hire enough personnel to implement recommendations within this Management Plan.
- Write and institute a comprehensive tree ordinance specific to the trees of Somerville.

A five-year budget for each of the above activities has been developed and presented in this chapter (Tables 13 and 14). Additional sources of funding and recommendations for budgeting the urban forestry program are presented at the end of this chapter.

Priority Tree Maintenance Recommendations

The following tree maintenance recommendations are based on the analysis of the inventoried portion of Somerville's street tree population in Chapter 2. These recommendations should be followed and used in the development of appropriate and realistic management goals. Implementation of these recommendations will allow Somerville to first address the highest priority maintenance recommendations related to public safety.

Initially, Somerville should concentrate on reducing the potential risks identified in the inventory. This means addressing all trees identified as requiring High-Priority Removal and High-Priority Prune (Tables 6 and 7). All high-risk removals and prunes should be concluded by the end of Year 1 of the Urban Forestry Management Program. Shortly after all priority work is complete, the City should then begin the recommended five-year *Routine Pruning Program* and three-year *Young Tree Training Pruning Program*. These two programs should include preventative pruning that is essential in the development of strong structured trees.

Useful Life

The useful life of a public tree is ended when the cost of maintenance is greater than the value added by the tree to the community. This can be due to either the decline of the tree's condition and increasing maintenance activities or to the costs of repairing damage caused by the tree's presence.

Decline generally starts when the tree has reached a point where it cannot withstand the stresses imposed by its environment. Restrictive growing space, disease, insects, mechanical injury, pollution, and vandalism, among others, can cause stress. Although some species are more resistant to these urban stresses, all trees in urban settings will eventually decline, whether due to overmaturity, stress, or senescence.

The pattern of decline generally begins with persistent limiting site factors that place the tree in a state of chronic stress. This weakens the tree's natural defenses, leaving it more susceptible to injury from pests or unusual weather, such as a single insect-induced defoliation or a late frost. Because the tree is now stressed, it has difficulty withstanding or combating the circumstance or recovering from such stress. As a result, the tree can become even more vulnerable to insects and disease that continue to reduce its vigor. Often, the first signs of a problem appear at this point.

The age at which a tree reaches the end of its useful life differs by genus and also for certain species within a genus. Slow-growing trees, such as pin oak, are most valuable when they attain maturity. Fast-growing species, such as silver maple, are most valuable as juvenile trees because they provide benefits quickly and become expensive to maintain as they reach maturity.

The end of a tree's useful life can also be reached while the tree is still healthy if it is growing in a "limited" site. Useful life, in this instance, is the point at which the cost of related maintenance, such as the repair of hardscape damage, exceeds the value added by the tree. For example, a large, fast-growing tree used in a smaller tree lawn will cause hardscape damage at an early age and periodically throughout its lifetime. The useful life of this tree will be reached before it begins to decline. A smaller tree, on the other hand, would probably not exceed grow space dimensions at any point in its life. The end of its useful life would probably be reached only when it started to decline due to senescence. A smaller tree, as a result, would make better use of this example tree site.

Priority Tree Maintenance Summary

The following priority tree maintenance recommendations are based on the collected tree inventory data. Where numerous priority removal and/or pruning treatment recommendations exist in the same area of Somerville, the work should be performed at the same time in order to reduce travel time and costs.

The City must establish procedures for keeping the tree inventory information current. Keeping accurate records of work completed on specific trees and tracking removals and installations will help accomplish this. Somerville's TreeKeeper® 7.7 system will prove to be an invaluable tool in organizing, scheduling, and routing the needed work to be accomplished.

As mentioned earlier, the overall maintenance priorities are:

- Removals – High and Moderate Priority
- Pruning – High and Moderate Priority

Although large, short-term expenditures are required for trees with these maintenance recommendations, they should be performed within the first year of the Management Plan's implementation.

Based on the tree inventory's results, Tables 6 and 7 provide a summary of Priority Maintenance Recommendations for Somerville's trees. Following completion of these tasks, the Low-Priority Removal and Routine Pruning work should be addressed.

Davey Resource Group strongly encourages the City to schedule all Priority Maintenance Recommendations to occur in as timely a manner as possible in order to advance the reduction of potential risks. By doing so, the City will greatly decrease the potential of injury to residents, damage to property, and possible liability litigation. Although it would be almost impossible to expect the City to perform all needed maintenance activities immediately due to budgetary concerns, an organized and systematic program will achieve the needed results in a timely manner and will demonstrate the City's sincere attempt to keep all streets and park/public spaces safe for its residents.

To reduce all high-risk situations in Somerville, the work in Tables 6 and 7 should be accomplished during Year 1 of the program. In addition to these immediate concerns, a natural mortality rate of 1% of the total tree population per year is usually expected (national averages show an annual mortality rate of about 1% for street tree populations in cities). The mortality rate for Somerville's street trees may represent approximately 90 trees per year, and 21 Park/Public Space trees per year. It is important to keep in mind that as the current tree population increases in size and trees mature, costs for maintaining it will also increase. These anticipated tree removal costs are not factored into the budget projection for the Five-Year Management Program; however, the City should allocate funds in anticipation of these removals.

Table 6. Priority Tree Maintenance Recommendations by Type and Size Class: Street Trees

Tree Diameter Size Class (Inches)	High Priority Removal	Moderate Priority Removal	High Priority Prune	Moderate Priority Prune
1 – 3	0	67	0	0
4 – 6	2	70	0	0
7 – 12	41	204	3	996
13 – 18	40	113	5	845
19 – 24	42	60	13	230
25 – 30	19	27	9	100
31 – 36	5	6	7	36
37 – 42	2	3	5	8
43+	0	0	6	7
Totals	**151**	**550**	**48**	**2,222**

Table 7. Priority Tree Maintenance Recommendations by Type and Size Class: Park/Public Space Trees

Tree Diameter Size Class (Inches)	High Priority Removal	Moderate Priority Removal	High Priority Prune	Moderate Priority Prune
1 – 3	0	10	0	0
4 – 6	0	13	0	0
7 – 12	3	29	0	214
13 – 18	6	16	0	189
19 – 24	2	7	1	71
25 – 30	2	2	0	27
31 – 36	0	1	0	14
37 – 42	0	0	0	7
43+	0	0	0	2
Totals	**13**	**78**	**1**	**524**

Routine Pruning Program

Routine Pruning is an activity that should take place on a cyclical basis for the entire tree population once all priority maintenance removal and pruning activities have been completed. Since the priority maintenance recommendations described above may be accomplished in the first year, it is recommended that the *Routine Pruning Program* described here be implemented beginning in the second year if funds exist for the work. If funds for completing the work in the first year do not exist, the *Routine Pruning Program* can begin after the priority tasks have been completed. This activity is extremely beneficial for the overall health and longevity of street trees. Through Routine Pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles. Proper decisions can be made on declining trees and any trees that are becoming potential high risks can be managed appropriately before any serious incidents occur. Trees included in this program will not include young and newly planted trees. These trees will be included in the *Young Tree Training Pruning Program* explained later. As young trees in this group grow larger, they, too, will eventually become part of the *Routine Pruning Program*.

The five-year budget in this chapter provides average yearly estimates for this pruning program based on diameter classes and the number of trees in each diameter class. Tables 8 and 9 detail the average number of trees in each diameter class that would be pruned annually during the five-year cyclical *Routine Pruning Program* for all inventoried trees. Tables 10 and 11 details the number of trees in each diameter class that would be pruned annually during the three-year cyclical *Young Tree Training Pruning Program* for street and park/public space trees.

Five-Year Cycle

Results from the tree inventory indicate that 4,004 (44.67%) Street trees, and 789 (37.57%) Park/Public Space trees would be included in a cyclical pruning operation. Additionally, 2,270 (25.33%) Street trees, and 525 (25.00%) Park/Public Space trees were recommended for some type of Priority Pruning. Once the priority pruning recommendations of these trees are met, they, too, will fall into the maintenance category of Routine Pruning. This will increase the total number of mature trees requiring Routine Pruning to 6,274 (70.00%) Street Trees, and 1,314 (62.57%) Park/Public Space Trees.

It is suggested that a five-year cycle be implemented so that approximately 802 Street trees, and 159 Park/Public Space trees per year are routinely pruned. A five-year budget has been provided for all inventoried trees. It is intended for these five-year budgets to illustrate estimated costs for each activity and facilitate plans for short-term management recommendations. As happens all too often in many cities, tree pruning consists of trimming by resident request or only if personnel become aware of a high-risk situation. This Management Plan provides the City with exact numbers and locations concerning Routine Pruning and they serve as a guideline for accomplishing such a program.

Routine Pruning includes those trees requiring pruning on a cyclical basis to maintain tree form and health. Centralized pruning should be carried out, meaning that all trees in a City block are trimmed. A certain number of City streets (and blocks along those streets) should be designated for each year's work in order to meet the annual routine pruning goal. In the proposed five-year budget (Tables 13 and 14), it is recommended that *Routine Pruning Program* begin in year three after the High-Priority maintenance tasks are complete and is continued on a five-year cycle.

Table 8. Routine Pruning Program by Size Class: Street Trees

Diameter Size Class (Inches)	Routine Prune (Total Trees)	Routine Prune (Approximate Trees/Year)
1 – 3	0	0
4 – 6	0	0
7 – 12	2,825	565
13 – 18	955	191
19 – 24	170	34
25 – 30	40	8
31 – 36	10	2
37 – 42	3	1
43+	1	1
Totals	**4,004**	**802**

Table 9. Routine Pruning Program by Size Class: Park/Public Space Trees

Diameter Size Class (Inches)	Routine Prune (Total Trees)	Routine Prune (Approximate Trees/Year)
1 – 3	0	0
4 – 6	0	0
7 – 12	505	101
13 – 18	215	43
19 – 24	50	10
25 – 30	15	3
31 – 36	3	1
37 – 42	1	1
43+	0	0
Totals	**789**	**159**

Young Tree Training Pruning Program

As described previously, Training Pruning consists of the removal of dead, dying, diseased, broken, interfering, conflicting, and/or weak branches, as well as selective trimming to direct future branch growth on trees less than 20 feet in height. Although this type of trimming is termed Training Pruning, the word "training" truly pertains to young or recently planted trees. For these trees, Training Pruning is used to develop a strong structural architecture of branches so that future growth will lead to a healthy, structurally sound tree. Many young trees may have branch structure that can lead to potential problems as they grow, such as double leaders, many limbs attaching at the same point on the trunk, or crossing/interfering limbs. When trees are small, these problems can be remedied easily and inexpensively. Training Pruning can be accomplished from the ground with a minimum amount of equipment. If these problems are not corrected while trees are young, they can lead to instances where branches are poorly attached and where decay can develop at the crossing points of interfering limbs. Trees with poor branching can pose risks as they grow larger and could create potential liability for Somerville in the near future.

All newly planted trees should receive their first Training Prune three years following planting. No Training Pruning should be done when a tree is planted because it is already under stress from transplanting and needs as much of its leaf canopy as possible in order to manufacture food and increase root growth for proper establishment in its new site. Only dead or broken branches should be removed at the time of planting.

Three-Year Cycle

Similar to the *Routine Pruning Program*, the *Young Tree Training Pruning Program* would also be accomplished on a cyclical basis, but the work would be scheduled during a three-year cycle rather than the five-year cycle for the Routine Pruning of larger established trees due to the faster growth rates of younger trees. As mentioned above, newly planted trees should receive their first Training Pruning three years after planting. This work can be accomplished throughout the year. Particularly, since no bucket truck is required, City employees can perform this work at any time. This type of work is also highly suitable for properly trained summer interns, part-time employees, and/or volunteers.

Work Estimates

A three-year pruning cycle would require the Training Pruning of approximately 644 Street trees, and 225 Park/Public Space trees per year. Tables 10 and 11 provide the total number of trees that can be trained and an annual average breakdown by diameter size class. The proposed five-year budget (Tables 13 and 14) recommends that the *Young Tree Training Pruning Program* be implemented in the final three years of the budget. It has been Davey Resource Group's experience that, based on the generally small size of the trees in this category, a crew of two properly trained personnel would be capable of accomplishing all the work.

Table 10. Young Tree Training Pruning Program by Size Class: Street Trees

Size Class (Inches)	Streets Training Prune (Total Trees)	Streets Training Prune (Trees/Year)
1 – 3	1,014	338
4 – 6	918	306
7 – 12	0	0
Totals	**1,932**	**644**

Table 11. Young Tree Training Pruning Program by Size Class: Park/Public Space Trees

Size Class (Inches)	Park/Public Space Training Prune (Total Trees)	Park/Public Space Training Prune (Trees/Year)
1 – 3	411	137
4 – 6	264	88
7 – 12	0	0
Totals	**675**	**225**

Training of Personnel

Proper training concerning how to perform young tree structural pruning would be required for all tree crew personnel. Additionally, these workers would require an understanding of the growth-habits of the various species being planted, as well as an understanding of basic tree anatomy and physiology. This training can be received through the Massachuets Department of Conservation and/or International Society of Arboriculture *Certified Arborists*. The tremendous aesthetic and financial benefits to be gained in the years to come from proper structural pruning of young trees are a strong incentive for educating tree crew personnel concerning proper pruning techniques. Additionally, the added knowledge gained by the individuals could improve the sense of professionalism in their jobs.

Public Tree Planting Program

Photograph 14. There is ample room around the City to plant medium and small growth-habit trees. There were 244 planting sites inventoried, but there were many areas without tree pits that could benefit from trees.

During this inventory, Somerville only had the existing empty sidewalk tree pits inventoried. Somerville plants about 140–220 trees per year. The following information is important because tree species and planting location designations are significant components of a municipal tree care program due to the long-term impact of these decisions. Considering the removal of 701 street trees in the first year of the maintenance program implementation, Davey Resource Group recommends the City of Somerville work to replace those trees within the same year. This would call for approximately 70 trees per year to be purchased and installed. It is important to develop an overall planting strategy, initially concentrating on streets and blocks with the greatest need for improvement. Tree planting priorities should focus on the developed and developing neighborhoods first. Support from local homeowner associations in funding plantings can be one method of achieving a full stocking of trees along neighborhood streets.

The success of a continuing tree planting program will be judged by the health of the trees post-planting and the amount of money spent on planting and maintaining the new trees. With a small amount of planning, healthy trees with greater life expectancies can be established with minimal up-front investment and minor maintenance costs.

The key elements for a successful tree-planting program are covered in this section and are primarily based on the exceptional reference, *Principles and Practice of Planting Trees and Shrubs* (Watson and Himelick, 1997).

Tree Species Diversity

As stated previously, maples account for 32% of Somerville's total street tree population. The dangers (disease, insects, etc.) of planting monocultures have proven to be devastating throughout the northeastern United States. The goal here should be to increase species diversity throughout the City so that no more than one species represents 10% and that no one genus comprises more than 15% of the total population.

Tree Species Selection

Somerville occurs in Zone 6a of the USDA Hardiness Zone Map, which identifies a climatic region where the average annual *minimum* temperature is between -5^{o} and -10º F. Tree species selected for planting in the City should be appropriate for this zone.

In addition to considering site characteristics, such as availability of space, soil pH, and irrigation, species-specific features must also be scrutinized. A major consideration for street trees is the amount of litter dropped by mature trees. Trees such as *Salix* spp. (willow spp.), have weak wood and typically drop many small branches during a growing season. Others, such as *Liquidambar styraciflua* (American sweetgum), drop high volumes of syncarps (fruits). In certain species, such as *Ginkgo biloba* (ginkgo) and *Maclura pomifera* (osage-orange), female trees produce offensive/large fruit; male trees, however, produce no fruit. Furthermore, a few species of trees, including *Robinia pseudoacacia* (black locust), *Crataegus* spp. (hawthorn spp.), and *Gleditsia triacanthos* (honeylocust), may have substantial thorns. These species should be avoided in high traffic areas.

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

Above all, tree species should be selected for their durability and low-maintenance characteristics. These attributes are highly dependent on site characteristics as well as species characteristics. Matching a species to its favored climatic and soil conditions is the most important task when planning for a low-maintenance landscape. Plants that are well matched to their environmental and site conditions are much more likely to resist pathogens and insect pests and will, therefore, require less maintenance overall. Refer to Appendix H for additional tree species and cultivars suitable for planting in Somerville.

The Tree Planting Process

As trees are purchased through local nurseries, the most important consideration should be species selection. This will aid in increasing species diversity throughout Somerville. Once the appropriate trees have been selected for planting, the most important detail to ensure success is the preparation of the planting sites. Appendix J explains the proper method of excavating a planting hole. In general, the tree-planting holes should be relatively shallow (typically slightly less deep than the height of the root ball) and quite wide (three times the diameter of the root ball). Care should be taken so that the root collars of the new trees are at the same level or slightly higher than the surrounding soil grade. In most situations, it is not recommended to add soil amendments to the planting holes, as this can lead to severe differences between texture and structure of soils inside the planting holes and the surrounding soil. Such differences can lead to either water being wicked away from or accumulating in the planting holes.

Tree staking hardware should only be installed when necessary to keep trees from leaning (windy sites) or to prevent damage from pedestrians and/or vandals. Stakes should only be attached to trees with a loose, flexible material, and all staking material must be removed within one growing season (Appendix J).

Tree Mulching

Mulch should be applied to the soil surface around newly planted trees. Mulch should never be piled up around the root collar (so-called mulch "volcanoes"), but rather should be pulled away from the root collar. Mulch that buries the root collar provides shelter for insects, fungi, and mammals that could damage the tree. Mulch should be applied to an area three times the diameter of the root ball to a depth of two to four inches. Mulch not only suppresses competition from grass and weeds, but also provides a zone where turf maintenance is not needed, thereby keeping lawn mowers and string trimmers safely away and thus preventing mechanical damage. Mulch also helps to hold moisture in the surface of the soil where most of the feeder roots are to be established.

Tree Fertilization

Any fertilization process should not be thought of as "feeding" or "energizing" the trees; instead, arboricultural fertilizers should be understood as essentially replacing soil elements or minerals that are lacking or in short supply for a variety of reasons. Nutrients may be in adequate supply, but be unavailable for uptake by the trees because of extreme pH conditions. Application of fertilizer may not improve the situation until measures are taken to alter pH levels or to replace the trees with a species better suited for the existing soil conditions.

Fertilization may not be necessary for the first growing season unless specific nutrient deficiencies exist. At the beginning of the second growing season, fertilizers can be applied to the root zone. Nitrogen is usually the limiting nutrient for plant growth. Soil analysis, particularly when combined with a foliar analysis, can determine when other elements are in short supply. Slow-release fertilizers applied in autumn will help root growth and will still be available the following spring.

Tree Pruning

If the proper trees have been selected for each site, pruning young trees to improve branch structure is the most effective method of reducing maintenance costs as trees mature. At the time of planting, the only pruning that should be done is the removal of broken or dead branches. In the second growing season, minor pruning can be performed to remove branches with poor attachments, but it is still best to wait until the third growing season to perform the first training prune. In subsequent years, selective pruning should be performed to achieve the proper spacing of branches. See Appendix I for more information on proper pruning techniques.

Tree Purchases

Tree prices, of course, vary based on the species selected, but many nurseries offer trees of 1.5- to 2.5-inch caliper for $100 to $150. As the City works at planting more trees annually, obtaining a good price for quality trees will become more important. Saving money on the cost per tree will allow a greater number of trees to be purchased.

Davey Resource Group believes that a good working relationship with a local nursery is very beneficial, but it is equally important that good prices and wide species availability be considered. It is recommended that Somerville explore local and regional sources for trees and discuss pricing with the current nursery source. Due to the requirement to work towards species diversity, it may be necessary to use several nurseries as sources for trees.

Tree Planting Designs

A prioritization scheme can be developed to begin tree plantings throughout the City. Often, the downtown business district is selected as the highest priority in order to increase the beauty and attractiveness of the area. Tree selection for business and shopping areas must take into consideration the need for shoppers to view storefronts, as well as the need to provide enough shade for shoppers. Tree canopies should be open, as is thornless honeylocust, and the branching habit must be high enough to allow pedestrians to walk comfortably beneath the trees. Other options are tall, narrow growing (fastigiated or columnar) species, such as upright *Carpinus betulus* 'Fastigiata' (European hornbeam) and many others. These trees can provide beauty, a look of uniformity, and a formal appearance to the shopping district.

Tree plantings in residential areas can be selected to match the existing types of trees growing on each street (such as large growth-habit trees or flowering tree species) or can be selected to begin to develop a uniform look for a given street. To create unity, balance, and beauty on a street, it is advantageous to plant the same species or species of similar form and size on both sides of the street, if possible. Often, in older neighborhoods, one side of the street has utility lines, which precludes the use of large trees. The primary aesthetic role that street tree plantings can play in a residential neighborhood is to visually link individual homes into a unified scene. It is this unified quality that makes older neighborhoods with large mature trees so attractive in many communities. Either formal or informal planting schemes are appropriate for neighborhood streets. In most instances, medium or large trees, spaced so that their canopies overlap, are desirable. As always, a street tree planting program must have the objective of species diversity in mind at all times.

Tree Planting Program Assistance

In any tree planting program, funding and participation can often be achieved by soliciting certain sectors of the community. Businesses, institutions, and corporations in the City are often willing to donate funds for tree plantings in exchange for recognition in some way (either through the media or during Arbor Day ceremonies).

It is fully understood that a citywide program will require maximum effort in the form of public relations to gain the support of the community. Somerville can become more involved in its urban forestry program using solid public relations techniques. A select group of citizens can be responsible for organizing and implementing a campaign of public relations, education, and community financial support. Additionally, they can recruit volunteer groups to aid in tree planting activities on a designated weekend in the spring or fall. Volunteer organizations, such as a garden club, service organization, or Boy/Girl Scout troop, can be recruited to do the actual planting and after-care watering and maintenance activities.

Five-Year Urban Forestry Program and Budget

Somerville's Tree Warden is responsible for a variety of administrative and advisory duties, including guiding the City's tree planting and maintenance programs. The following section consists of a five-year program projection for all pertinent urban forestry activities and is intended to provide an example of the relative costs that could be incurred by the recommended activities. In presenting this budget, Davey Resource Group's consultant is aware that the portion of Somerville's budget allocated to street and public space tree related functions might be stretched beyond its limits. However, Somerville must understand that the budgeting recommendations below are only estimates and are based on the application of sound urban forestry management principles to municipal forestry operations.

The five-year program is designed to address the highest priority removal and maintenance recommendations first. This is intended to reduce potential high-risk situations for the public and all associated liabilities. The City may find it in its best interest to begin this work in Year 1 of the management program or change the recommended pruning cycle to distribute the annual budget funds more evenly. **As stated previously, Davey Resource Group strongly encourages the City to schedule these activities to occur in as timely a manner as possible in order to address the reduction of all potential high-risk situations.** By doing so, the City will greatly lessen the potential of injury to residents, damage to property, and possible liability litigation.

Tree pruning and removal costs for trees in this Management Plan are based on quotes from a large number of reputable North American tree care companies and are averages extracted from bids received by communities in the Eastern United States during the past few years. The figures are equivalent to average costs for the same activities by municipal in-house crews. These costs are an average and are used to estimate the Priority Maintenance Recommendations, *Routine Pruning Program*, and *Young Tree Training Pruning Program* budget projections in this Management Plan. Table 12 lists the estimated costs for tree removals, pruning, stump removals, fertilization, and mulching.

Table 12. Cost Estimates Per Tree for Removals, Pruning, Stump Removals, Fertilization, and Mulching

Diameter Size Class (Inches)	Estimated Removal Cost/Tree	Estimated Pruning Cost/Tree	Estimated Stump Removal Cost/Stump	Estimated Fertilization Cost/Tree	Estimated Mulching Cost/Tree
1 – 3	$25	$20	$25	$5	$11
4 – 6	$105	$30	$25	$18	$11
7 – 12	$220	$75	$25	$22	$14
13 – 18	$355	$120	$40	$30	$14
19 – 24	$525	$170	$60	$50	$20
25 – 30	$845	$225	$85	$60	$20
31 – 36	$1,140	$305	$110	$90	$28
37 – 42	$1,470	$380	$130	$120	$28
43+	$1,850	$590	$160	$150	$28

Tables 13 and 14 have been provided as an estimated budget for the Five-Year Urban Forest Management Program for Somerville. These tables should be used as general guideline for implementation of the five-year program, planning future tree care operations, and reviewing on-going City forestry operations. Specific accomplishments should be measured in comparison to the Management Plan's goals and recommendations. **In short, the management program discussed in this Management Plan aims to abate or mitigate all identified potential high-risk conditions within the first year, establish a three-year *Young Tree Training Pruning Program* for all young and newly planted trees, and establish a five-year *Routine Pruning Program*.**

Table 13. Estimated Costs for Somerville's Five-Year Urban Forestry Management Program: Street Trees

Estimated Costs for Each Activity			YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Five-Year Cost
Activity	**Diameter Class**	**Cost/Tree (dollars)**	**# of Trees**	**Total Cost**	**# of Trees**	**Total Cost**	**# of Trees**	**Total Cost**	**# of Trees**	**Total Cost**	**# of Trees**	**Total Cost**	
High-Priority Removal	1-3"	$25	0	$0									$0
	4-6"	$105	2	$210									$210
	7-12"	$220	41	$9,020									$9,020
	13-18"	$355	40	$14,200									$14,200
	19-24"	$525	42	$22,050									$22,050
	25-30"	$845	19	$16,055									$16,055
	31-36"	$1,140	5	$5,700									$5,700
	37-42"	$1,470	2	$2,940									$2,940
	43"+	$1,850	0	$0									$0
Activity Total(s)			**151**	**$70,175**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$70,175**
Moderate-Priority Removal	1-3"	$25	67	$1,675									$1,675
	4-6"	$105	70	$7,350									$7,350
	7-12"	$220	204	$44,880									$44,880
	13-18"	$355	113	$40,115									$40,115
	19-24"	$525	60	$31,500									$31,500
	25-30"	$845	27	$22,815									$22,815
	31-36"	$1,140	6	$6,840									$6,840
	37-42"	$1,470	3	$4,410									$4,410
	43"+	$1,850	0	$0									$0
Activity Total(s)			**550**	**$159,585**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$159,585**
Low-Priority Removal	1-3"	$25					36	$900					$900
	4-6"	$105					13	$1,365					$1,365
	7-12"	$220					7	$1,540					$1,540
	13-18"	$355					0	$0					$0
	19-24"	$525					0	$0					$0
	25-30"	$845					0	$0					$0
	31-36"	$1,140					0	$0					$0
	37-42"	$1,470					0	$0					$0
	43"+	$1,850					0	$0					$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**56**	**$3,805**	**0**	**$0**	**0**	**$0**	**$3,805**
High-Priority Prune	1-3"	$20	0	$0									$0
	4-6"	$30	0	$0									$0
	7-12"	$75	3	$225									$225
	13-18"	$120	5	$600									$600
	19-24"	$170	13	$2,210									$2,210
	25-30"	$225	9	$2,025									$2,025
	31-36"	$305	7	$2,135									$2,135
	37-42"	$380	5	$1,900									$1,900
	43"+	$590	6	$3,540									$3,540
Activity Total(s)			**48**	**$12,635**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$12,635**
Moderate-Priority Prune	1-3"	$20			0	$0	0	$0					$0
	4-6"	$30			0	$0	0	$0					$0
	7-12"	$75			498	$37,350	498	$37,350					$74,700
	13-18"	$120			845	$101,400	0	$0					$101,400
	19-24"	$170			230	$39,100	0	$0					$39,100
	25-30"	$225			100	$22,500	0	$0					$22,500
	31-36"	$305			36	$10,980	0	$0					$10,980
	37-42"	$380			8	$3,040	0	$0					$3,040
	43"+	$590			7	$4,130	0	$0					$4,130
Activity Total(s)			**0**	**$0**	**1,724**	**$218,500**	**498**	**$37,350**	**0**	**$0**	**0**	**$0**	**$255,850**
Routine Pruning Program	1-3"	$20					0	$0	0	$0	0	$0	$0
	4-6"	$30					0	$0	0	$0	0	$0	$0
	7-12"	$75					565	$42,375	565	$42,375	565	$42,375	$127,125
	13-18"	$120					191	$22,920	191	$22,920	191	$22,920	$68,760
	19-24"	$170					34	$5,780	34	$5,780	34	$5,780	$17,340
	25-30"	$225					8	$1,800	8	$1,800	8	$1,800	$5,400
	31-36"	$305					2	$610	2	$610	2	$610	$1,830
	37-42"	$380					1	$380	1	$380	1	$380	$1,140
	43"+	$590					1	$590	1	$590	1	$590	$1,770
Activity Total(s)			**0**	**$0**	**0**	**$0**	**802**	**$74,455**	**802**	**$74,455**	**802**	**$74,455**	**$223,365**
Stump Removal	1-3"	$6					3	$18					$18
	4-6"	$15					10	$150					$150
	7-12"	$29					32	$928					$928
	13-18"	$47					2	$94					$94
	19-24"	$65					9	$585					$585
	25-30"	$83					3	$249					$249
	31-36"	$101					2	$202					$202
	37-42"	$119					0	$0					$0
	43"+	$160					0	$0					$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**61**	**$2,226**	**0**	**$0**	**0**	**$0**	**$2,226**
Training Pruning Program	1-3"	$20	0	$0	0	$0	338	$6,760	338	$6,760	338	$6,760	$20,280
	4-6"	$30	0	$0	0	$0	306	$9,180	306	$9,180	306	$9,180	$27,540
	7-12"	$75	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**644**	**$15,940**	**644**	**$15,940**	**644**	**$15,940**	**$47,820**
Tree Planting	Purchasing	$110	49	$5,390	49	$5,390	49	$5,390	49	$5,390	49	$5,390	$26,950
	Planting	$110	49	$5,390	49	$5,390	49	$5,390	49	$5,390	49	$5,390	$26,950
Activity Total(s)			**98**	**$10,780**	**98**	**$10,780**	**98**	**$10,780**	**98**	**$10,780**	**98**	**$10,780**	**$53,900**
Activity Grand Total			**1,548**		**1,822**		**2,098**		**1,544**		**1,544**		**8,556**
Cost Grand Total				**$253,175**		**$229,280**		**$144,556**		**$101,175**		**$101,175**	**$829,361**

Table 14. Estimated Costs for Somerville's Five-Year Urban Forestry Management Program: Park/Public Space Trees

Estimated Costs for Each Activity			YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		Five-Year Cost
Activity	Diameter Class	Cost/Tree (dollars)	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	
High-Priority Removal	1-3"	$25	0	$0									$0
	4-6"	$105	0	$0									$0
	7-12"	$220	3	$660									$660
	13-18"	$355	6	$2,130									$2,130
	19-24"	$525	2	$1,050									$1,050
	25-30"	$845	2	$1,690									$1,690
	31-36"	$1,140	0	$0									$0
	37-42"	$1,470	0	$0									$0
	43"+	$1,850	0	$0									$0
Activity Total(s)			**13**	**$5,530**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$5,530**
Moderate-Priority Removal	1-3"	$25	10	$250									$250
	4-6"	$105	13	$1,365									$1,365
	7-12"	$220	29	$6,380									$6,380
	13-18"	$355	16	$5,680									$5,680
	19-24"	$525	7	$3,675									$3,675
	25-30"	$845	2	$1,690									$1,690
	31-36"	$1,140	1	$1,140									$1,140
	37-42"	$1,470	0	$0									$0
	43"+	$1,850	0	$0									$0
Activity Total(s)			**78**	**$20,180**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$20,180**
Low-Priority Removal	1-3"	$25					10	$250					$250
	4-6"	$105					7	$735					$735
	7-12"	$220					2	$440					$440
	13-18"	$355					1	$355					$355
	19-24"	$525					0	$0					$0
	25-30"	$845					0	$0					$0
	31-36"	$1,140					0	$0					$0
	37-42"	$1,470					0	$0					$0
	43"+	$1,850					0	$0					$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**20**	**$1,780**	**0**	**$0**	**0**	**$0**	**$1,780**
High-Priority Prune	1-3"	$20	0	$0									$0
	4-6"	$30	0	$0									$0
	7-12"	$75	0	$0									$0
	13-18"	$120	0	$0									$0
	19-24"	$170	1	$170									$170
	25-30"	$225	0	$0									$0
	31-36"	$305	0	$0									$0
	37-42"	$380	0	$0									$0
	43"+	$590	0	$0									$0
Activity Total(s)			**1**	**$170**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$170**
Moderate-Priority Prune	1-3"	$20	0	$0	0	$0							$0
	4-6"	$30	0	$0	0	$0							$0
	7-12"	$75	107	$8,025	107	$8,025							$16,050
	13-18"	$120	94	$11,280	95	$11,400							$22,680
	19-24"	$170	35	$5,950	36	$6,120							$12,070
	25-30"	$225	13	$2,925	14	$3,150							$6,075
	31-36"	$305	7	$2,135	7	$2,135							$4,270
	37-42"	$380	3	$1,140	4	$1,520							$2,660
	43"+	$590	1	$590	1	$590							$1,180
Activity Total(s)			**260**	**$32,045**	**264**	**$32,940**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$64,985**
Routine Pruning Program	1-3"	$20					0	$0	0	$0	0	$0	$0
	4-6"	$30					0	$0	0	$0	0	$0	$0
	7-12"	$75					101	$7,575	101	$7,575	101	$7,575	$22,725
	13-18"	$120					43	$5,160	43	$5,160	43	$5,160	$15,480
	19-24"	$170					10	$1,700	10	$1,700	10	$1,700	$5,100
	25-30"	$225					3	$675	3	$675	3	$675	$2,025
	31-36"	$305					1	$305	1	$305	1	$305	$915
	37-42"	$380					1	$380	1	$380	1	$380	$1,140
	43"+	$590					0	$0	0	$0	0	$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**159**	**$15,795**	**159**	**$15,795**	**159**	**$15,795**	**$47,385**
Stump Removal	1-3"	$6					0	$0					$0
	4-6"	$15					0	$0					$0
	7-12"	$29					2	$58					$58
	13-18"	$47					0	$0					$0
	19-24"	$65					0	$0					$0
	25-30"	$83					2	$166					$166
	31-36"	$101					0	$0					$0
	37-42"	$119					1	$119					$119
	43"+	$160					0	$0					$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**5**	**$343**	**0**	**$0**	**0**	**$0**	**$343**
Training Pruning Program	1-3"	$20					137	$2,740	137	$2,740	137	$2,740	$8,220
	4-6"	$30					88	$2,640	88	$2,640	88	$2,640	$7,920
	7-12"	$75					0	$0	0	$0	0	$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**225**	**$5,380**	**225**	**$5,380**	**225**	**$5,380**	**$16,140**
Tree Planting	Purchasing	$110	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	Planting	$110	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$0**
Activity Grand Total			**443**		**264**		**404**		**384**		**384**		**1,879**
Cost Grand Total				**$57,925**		**$32,940**		**$23,298**		**$21,175**		**$21,175**	**$156,513**

Table 15. Arboricultural Planning Chart for Tree Management

ACTIVITY/ TREATMENT	YR*	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
REMOVALS													
Severe and High Risk (Inventory)	1	X	X	X							X	X	X
Moderate Risk (Inventory)	1	X	X	X							X	X	X
Removals (Anticipated)	2A	X	X	X							X	X	X
Stump Removal	1A	X	X	X							X	X	X
PRUNING													
High Risk	1	X	X	X							X	X	X
Moderate Risk	1	X	X	X							X	X	X
Routine Pruning (Five-Year Rotation)	2A	X	X	X							X	X	X
Training Pruning (Three-Year Rotation)	2A	X	X	X							X	X	X
FERTILIZATION													
Macronutrient (N-P-K; Fair and Poor Condition Trees)	1A			X	X						X	X	
Macronutrient (N-P-K; Excellent and Good Condition Trees)	2			X	X						X	X	
Micronutrient (Fe/Mn Trunk Injection)	N					X	X	X	X				
Micronutrient (Fe/Mn Soil Treatment)	N												
PEST MANAGEMENT													
Scouting	1A				X	X	X	X	X	X			
Pesticide Treatments	N				X	X	X	X	X	X			
Pest Pruning	N												
TREE PLANTING													
Site Assessment	1A												
Ball and Burlap Container	1A			X	X	X				X	X	X	
Bare Root	1A			X	X	X							
Watering (New Trees)	1A			X	X	X	X	X	X	X	X	X	
Cabling and Bracing	N	X	X	X								X	X
Mulching	1A												
Weed Control	1A			X	X	X							
Watering (Older Trees)	1A							X	X	X	X		
INVENTORY													
Update Field Inventory	5	X	X								X	X	X
Update Computer Database	1A												

Notes:
Shaded areas indicate months where tasks can be completed operationally
*** = Year task is recommended to be initiated/completed**
A = Continue on an annual basis after task is initiated
N = Implement on an as-needed basis
X = Optimal biological time (or for cost-efficiency)

Table 15 has been provided in order to help Somerville better organize the tree maintenance program that has been described in this chapter. The success of most tree maintenance tasks, such as planting, pruning, or fertilizing, is dependent upon seasonal temperature and weather conditions. The maintenance tasks described in this Management Plan should be scheduled for and performed during optimal biological periods to sustain vigorous health and to ensure the best chance for survival of the City's street trees.

Public Relations and Education

Through years of experience and research, Davey Resource Group has found that public education is the true key to reaching the goals of an urban forestry program in a community. Only by educating citizens, City officials, developers, and all contractors working within the City will it be able to achieve urban forest preservation and protection goals. Ordinances and guidelines alone will not guarantee success since builders, contractors, and others often have their own priorities and trees and ordinances often are no more than a nuisance to them.

In working with communities to help implement and enforce a new tree preservation ordinance for new developments, Davey personnel have consistently found resistance from builders and developers who implemented many ingenious means to circumvent ordinances. Only when a tree preservation educational seminar was developed (with attendance required by all contractors working within City limits) did communities begin to see greater cooperation from contractors.

By requiring various community stakeholders to attend educational sessions to learn about the community's urban forest, urban forest preservation, and the importance of it all to the future of the community, Somerville will begin to see much greater cooperation from all concerned parties.

It is recommended that various public outreach campaigns, aimed at educating the residents of Somerville and gaining their support for the urban forestry program, be implemented. Based on public relations efforts by urban foresters in other communities, the following types of activities are suggested for the City to undertake:

- Hold a seminar or public meeting to discuss the tree inventory project, its results, and its importance for the City.
- Develop monthly evening or weekend seminars directed at residents related to tree care and landscaping. Bring in guest experts from various disciplines in the green industry.
- Host monthly *Tree Talks*.
- Write a monthly *Tree Talk* article for local newspapers.
- Send letters to residents in areas of the City where Routine Pruning will be conducted each year and describe the pruning program.
- Develop a *Tree Care* door hanger brochure to go to each residence where new trees are planted; this could help eliminate trunk damage and improper mulching and pruning of new trees by educating residents about proper tree care.
- Expand the annual Arbor Day celebration. The celebration could be developed as an all-day Saturday event, preferably held in a popular public space setting in the City. Short programs on planting and pruning trees, as well as children’s programs about trees, are some good ideas for increasing public interest in the City’s tree programs. Additionally, the City could invite contractors to conduct demonstrations on tree planting, trimming, landscaping, species selection, etc. Organizers could also set up booths with tree information as helpful supplements for the general public. Refer to the National Arbor Day Foundation (visit http://www.arborday.org or call 402-474-5655) for publications that provide great Arbor Day ideas to assist in planning of this event.

Sources of Funding

Funding sources for tree care range from the City's general funds to joint programs with local companies. Davey Resource Group encourages Watertown to explore the following sources of support for tree care operations:

Federal Government Grants: Federal programs, such as *America the Beautiful* (www.america-the-beautiful.org), appropriate funds for tree planting and maintenance programs in cities throughout the United States. Another federal program, the *Intermodal Surface Transportation Efficiency Act of 1991* (ISTEA), established funding for transportation enhancement activities, including roadside beautification.

State Government Grants: State programs will support a variety of urban forestry program development projects, including training and education. Further information can be obtained by visiting the Massachusetts Department of Conservation and Recreation website at www.mass.gov/dcr.

Other Grants: *The Conservation Fund* provides grants to non-profit organizations and public agencies. Monetary allocations range from $500–$2,500 through the *American Greenways DuPont Awards Program* sponsored by *The Conservation Fund*, *The DuPont Corporation*, and *The National Geographic Society*. Grant applications are due by March 31 of each year:

- The Conservation Fund
  1655 North Fort Myer Drive, Suite 1300
  Arlington, Virginia 22209
  703-525-6300
  www.conservationfund.org

Global ReLeaf dollars should be used to help cover the expenses associated with conservation- or restoration-oriented tree plantings. There is no specific guideline for grant amounts. Project proposals need to reach your *Global ReLeaf Forest Technical Committee* representative:

- American Forests
  Attn: Margo Dawley
  P.O. Box 2000
  Washington, D.C. 20013
  202-737-1944 ext. 224
  www.americanforests.org/global_releaf/

This U.S. EPA grant program provides financial assistance to eligible community groups that are working on, or plan to carry out, projects to address environmental justice issues. Funds can be used to develop a new activity or substantially improve the quality of existing programs:

- U.S. EPA/Office of Environmental Justice
  1200 Pennsylvania Avenue NW, Room 2232E
  Washington, D.C. 20004
  202-564-5396
  http://www.epa.gov/compliance/environmentaljustice/grants/index.html

For the NUCFAC grant program, all funds must be matched at least equally (dollar for dollar) with non-federal source funds. This match may include in-kind donations, volunteer assistance, and private and public (non-federal) monetary contributions. All matching funds must be specifically related to the proposed projects:

- The National Urban and Community Forestry Advisory Council
  Nancy Stremple, RLA
  U.S. Forest Service
  Executive Staff to NUCFAC/U&CF Program Specialist
  1400 Independence Avenue SW
  Yates Building (1 Central)
  Washington, DC 20250
  202-309-9873
  nstremple@fs.fed.us

The National Arbor Day Foundation's (NADF) goal is to positively influence organizations and institutions in the planting and proper care of trees. Through conferences and seminars, positive recognition programs, conservation models, and how-to materials, the NADF educates and motivates cities, utility companies, schools, and other organizations to plant and care for trees, and to support related environmental stewardship activities. Whenever possible, the NADF works through existing structures of organizations and individuals who care about trees to achieve their objectives. The NADF has created programs and educational tools that can be effectively utilized by existing agencies. The NADF is most notably known for its Tree City USA and TreeLine USA accreditation programs.

- The National Arbor Day Foundation
  100 Arbor Avenue
  Nebraska City, Nebraska 68410
  1-888-448-7337
  www.arborday.org

Foundation Grants: Many companies and estates operate foundation programs that contribute funds to worthy programs. Comprehensive listings of foundations in the United States are available at many public libraries. *The Foundation Directory*, *National Data Book of Foundations,* and *The Foundation Grants Index,* all published by the *Foundation Center*, are good references.

Private Donations: Area corporations and organizations may donate funds to special tree planting and maintenance programs. Urban foresters can generate public support of tree care through programs involving "memorial trees" or special tree improvement projects.

Volunteer Groups: Urban foresters can encourage community organizations to donate funds or organize fund-raising activities or other support for community tree planting and maintenance programs.

Cooperative Tree Planting Programs: In such programs, homeowners are offered a selected choice of street trees at a reduced price. In effect, a cooperative tree-planting program allows the homeowner to assume some of the cost of street tree planting while the City can limit the species choices. Again, the key to the success of such a program is a detailed plan for implementing and publicizing the project.

<u>Automobile Tree Damage Reimbursement</u>: The City should be reimbursed for any tree damage or loss caused by automobile accidents, if the provision is in the City's tree ordinance(s).

<u>Establish a Tree Donation or Memorial Tree Program</u>: Use Arbor Day as a focal point for promoting citizen interest in contributing to the community. For example, first establish where and when memorial trees will be planted. Decide the form of memorial, such as a plaque at the tree or a listing in a community register. Set a donation price per tree that includes the cost of purchasing and planting the tree, as well as any recognition given to the donor. Determine how donations will be collected and set a timeframe for the project. Take the same steps for publicizing the project: determine how, when, and where it should be announced, and how application forms will be distributed. Consider a kick-off ceremony, brochures, public service announcements, press releases, and other avenues of communication with the general public.

Tree Ordinance Recommendations

The City of Somerville's Tree Warden currently works under the authority of Massachusetts General Law-Chapter 87. Shade Trees. This is a very basic set of guidelines which gives authority to the Tree Warden and states some general rules pertaining to street trees. However, this is not a Tree Ordinance specifically designed for the issues and concerns of Somerville. Only through a strong, properly enforced ordinance will the City gain effective control to manage and expand its street tree resource. It is recommended that the City write and institute its own tree ordinance.

Appendix O of this Plan shows an example of a street tree ordinance. This is a good place to start when writing the ordinance for Somerville's street trees. This sample can be customized to the specific needs of the City. It outlines the proper definitions needed for the language of the ordinance. It has the wording to continue and expand the legal authority of the tree warden. The sample goes into detail regarding the needed regulatory guidelines to properly manage and protect the street trees of Somerville.

The City should fully understand its stated responsibilities in the new ordinance and provide adequate staff to ensure adequate enforcement. A strong ordinance will become ineffective without good technical knowledge and an understanding of the ordinance and the responsibilities it creates. For example, Section 6 of the sample ordinance requires a permit for any planting, maintenance, or removal of public trees. If the City were to adopt this ordinance, the individual responsible for issuing the permit will need to have knowledge of appropriate tree species, good arboricultural practices, etc. No matter how well the new tree ordinance for Somerville is written, it will only be effective when properly enforced.

Management Recommendations for Updating the Inventory

Somerville's new Tree Keeper® 7.7 system should be updated on a regular basis to reflect new plantings, removals, and performed maintenances. An up-to-date inventory is the best way for the City to monitor the progress of its tree care operations. The major benefit of an accurate tree inventory is that the community can budget, plan, and anticipate tree-related problems and situations in the most cost-effective manner possible. Somerville's TreeKeeper® 7.7 system will now enable the City to keep track of every aspect of its newly acquired data and help City personnel manage the existing tree stock in a more efficient and effective manner throughout the coming years. The new system is designed for easy updating and reporting. The system should be incorporated into all departments of City government which deal with the care and maintenance of trees.

Summary and Conclusions

Somerville has a low diversity tree population in relatively fair condition that adds to the beauty and livability of the City. Although the urban forest is in relatively fair condition at the present time, the City should strive for an overall good condition. As trees get older, they become increasingly inefficient in withstanding the inherent stresses of an urban environment and are subject to decline without professional and regular management. With that in mind, the City of Somerville should strive to achieve the goals of this Management Plan.

Generally stated, Somerville's goals include:

1. **Understand the inventoried public tree population in terms of species and genus.** Currently, the genus *Acer* (maple) comprises 32% of the total tree population. The City must begin planting different species to increase its overall diversity in the future. Species diversity will help avoid potential catastrophic tree losses due to disease outbreaks and/or insect infestations. Additionally, different tree species can add to the City's aesthetic appeal. Every effort must be made to budget enough money each year for new tree plantings, and these new plantings should include many different species of trees suited to the local climate.

2. **Evaluate the condition of the inventoried tree population.** Site conditions and local climate will influence the general health and longevity of the tree population. Stresses due to improper species selection make trees more prone to pest and disease problems. Although the public tree population is in relatively fair condition, approximately 17% of the inventoried trees are in poor condition or dead. The City of Somerville needs to expand the current use of species. Many of the species presently being used are trees that do moderately well for street applications. Trees in good health and proper site location generally can withstand the onset of pest and disease problems. Controlling the decline, removal, and replacement of trees in a timely and cost-effective manner is the ultimate goal of the management process.

3. **Identify trees with potential high risk**. A high-risk tree is defined through the presence of three factors: (1) There must exist a defective tree, or tree part, that poses a high risk of failure or fracture; (2) there must be a target that would be struck by the tree or tree part, such as people or property; and (3) a potential high risk exists when the environment increases the likelihood of tree failure. Such environmental factors could include severe storms, strong winds, shallow or wet soil conditions, or growing spaces that restrict tree root or crown development.

4. **Establish and initiate a tree safety pruning and removal program that abates and mitigates potential high-risk conditions without delay.** Situations where injury or property damage has occurred from falling trees are not isolated and are well documented in the media on a regular basis. Along with the potential for personal injury or property damage comes the probability of the responsible parties being held liable for any injuries or damages. Such lawsuits can and have resulted in costly judgments against the defendants. One of the primary concerns in Somerville must be public safety. Tree removals and pruning are a vital part of risk mitigation. The tree population on the streets and in park/public spaces is mostly in fair condition; however, there are large trees with varying degrees of decay existing in the scaffold limbs, trunks, and roots. The five-year plan discussed previously is designed to address the highest risk conditions first. Consideration must always be made of

area usage and the threat of falling limbs or trees to persons and property when putting a pruning and removal plan into action. This inventory has provided a prioritization scheme for risk abatement, and it is strongly recommended that the five-year plan be followed accordingly.

5. **Establish a *Routine Pruning Program* for all established trees.** The City should begin and continue a five-year pruning cycle. This cycle will allow for maintenance of all trees in the urban forest, thus decreasing the occurrence of structural problems and potential risks in the City's tree population.

6. **Establish a *Young Tree Training Pruning Program* for all newly planted trees.** Many young trees may have branch structure that can lead to potential problems as they grow, but these problems can be remedied easily and inexpensively through training pruning. The training of all immature trees would be accomplished on a three-year cyclical basis. Newly planted trees should receive their first training prune three years after planting. Based on the generally small size of the trees in this category, a crew of two properly trained personnel would be capable of accomplishing the work throughout the year. Training young trees would decrease the occurrence of structural problems and potential risks in the City's total tree population.

7. **Start planning and preparing for any invasive species, such as ALB infestations, within the City.** Although ALB or any other invasive pests have not been discovered in Somerville, the City should be prepared if an infestation is ever found. Regular inspections for ALB should be conducted since this exotic pest has been discovered within the region.

8. **Create a strong public educational program that promotes the value of quality trees and quality tree care.** Arbor Day ceremonies, articles in city newsletters and local newspapers, and training seminars are a few examples.

9. **Write and institute a Tree Ordinance for the tree population.** A new tree ordinance specific to Somerville will be an important step for the enhancement and protection of the street tree resource. Be sure the City has adequate staff to understand and enforce the new ordinance. The individual responsible for the new ordinance should be an ISA *Certified Arborist.*

The management of trees in a municipality is challenging, to say the least. Balancing the recommendations of experts; the wishes of council members and other elected officials; the needs of residents; the pressures of local economics; the concerns for liability issues; the physical aspects of trees; the forces of nature and severe weather events; and the desires for all of these factors to be met simultaneously is quite a daunting task. **The City of Somerville's Tree Warden must carefully consider each specific issue and balance these pressures with a knowledgeable understanding of trees and their needs**. If balance is achieved, the City's beauty will flourish and the health and safety of its trees and citizens will be maintained.

Appendix A
Genus and Species Composition Frequency Reports

Somerville, MA

Quantity Report: Botanical

Botanical	Total	Percentage of Entire Population
Acer platanoides	2153	18.93%
Pyrus calleryana	1577	13.87%
Acer rubrum	1079	9.49%
Gleditsia triacanthos inermis	965	8.49%
Fraxinus pennsylvanica	924	8.13%
Tilia cordata	872	7.67%
Zelkova serrata	393	3.46%
Platanus x acerifolia	333	2.93%
Prunus serrulata	266	2.34%
Syringa reticulata	198	1.74%
Malus spp.	193	1.70%
Quercus palustris	181	1.59%
Quercus rubra	150	1.32%
vacant site small	149	1.31%
Fraxinus americana	117	1.03%
Acer saccharinum	108	0.95%
Acer saccharum	103	0.91%
Platanus occidentalis	95	0.84%
Liquidambar styraciflua	93	0.82%
Pinus strobus	71	0.62%
stump	66	0.58%
Robinia pseudoacacia	65	0.57%
Styphnolobium japonicum	62	0.55%
vacant site large	58	0.51%
Carpinus betulus	54	0.47%
Pinus nigra	53	0.47%
Acer campestre	53	0.47%
Amelanchier arborea	48	0.42%
Populus spp.	44	0.39%
Ulmus x	43	0.38%
Tilia americana	43	0.38%
Ailanthus altissima	43	0.38%
vacant site medium	37	0.33%
Tsuga candensis	37	0.33%
Acer tataricum ginnala	36	0.32%

Botanical	***Total***	***Percentage of Entire Population***
Thuja occidentalis	35	0.31%
Ulmus americana	32	0.28%
Cornus kousa	29	0.26%
Fagus sylvatica	27	0.24%
Betula nigra	27	0.24%
Ginkgo biloba	24	0.21%
Pinus resinosa	23	0.20%
Prunus subhirtella	20	0.18%
Acer pseudoplatanus	18	0.16%
Prunus serotina	17	0.15%
Morus alba	17	0.15%
Quercus shumardii	16	0.14%
Ulmus pumila	15	0.13%
Acer negundo	15	0.13%
Quercus imbricaria	14	0.12%
Catalpa speciosa	14	0.12%
Magnolia x soulangiana	13	0.11%
Juniperus virginiana	13	0.11%
Betula papyrifera	13	0.11%
unknown	12	0.11%
Quercus alba	11	0.10%
Liriodendron tulipifera	11	0.10%
Crataegus spp.	11	0.10%
Cornus florida	11	0.10%
Quercus robur	10	0.09%
Prunus spp.	10	0.09%
Picea pungens	10	0.09%
Tilia tomentosa	9	0.08%
Cercidiphyllum japonicum	9	0.08%
Larix decidua	8	0.07%
Betula pendula	8	0.07%
Abies concolor	8	0.07%
Pseudotsuga menziesii	7	0.06%
Picea abies	7	0.06%
Acer nigrum	6	0.05%
Quercus bicolor	5	0.04%
Metasequoia glyptostroboides	5	0.04%
Aesculus hippocastanum	5	0.04%

Botanical	Total	Percentage of Entire Population
Ulmus rubra	4	0.04%
Ulmus parvifolia	4	0.04%
Acer palmatum	4	0.04%
Sorbus aucuparia	3	0.03%
Quercus macrocarpa	3	0.03%
Populus deltoides	3	0.03%
Phellodendron amurense	3	0.03%
Magnolia spp.	3	0.03%
Fraxinus excelsior	3	0.03%
Cornus mas	3	0.03%
Prunus cerasifera	2	0.02%
Juniperus spp.	2	0.02%
Gymnocladus dioica	2	0.02%
Cladrastis kentukea	2	0.02%
Chamaecyparis obtusa	2	0.02%
Cedrus atlantica	2	0.02%
Carpinus caroliniana	2	0.02%
Ulmus thomasi	1	0.01%
Ulmus glabra	1	0.01%
Salix discolor	1	0.01%
Prunus pensylvanica	1	0.01%
Pinus parviflora	1	0.01%
Picea spp.	1	0.01%
Picea glauca	1	0.01%
Magnolia stellata	1	0.01%
Koelreuteria paniculata	1	0.01%
Juglans nigra	1	0.01%
Hibiscus syriacus	1	0.01%
Crataegus phaenopyrum	1	0.01%
Cotinus obovatus	1	0.01%
Corylus colurna	1	0.01%
Cercis canadensis	1	0.01%
Acer spp.	1	0.01%
Acer pensylvanicum	1	0.01%
Acer buergerianum	1	0.01%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Botanical

Botanical	Total	Percentage of Entire Population
Abies concolor	8	0.07%
Acer buergerianum	1	0.01%
Acer campestre	53	0.47%
Acer negundo	15	0.13%
Acer nigrum	6	0.05%
Acer palmatum	4	0.04%
Acer pensylvanicum	1	0.01%
Acer platanoides	2153	18.93%
Acer pseudoplatanus	18	0.16%
Acer rubrum	1079	9.49%
Acer saccharinum	108	0.95%
Acer saccharum	103	0.91%
Acer spp.	1	0.01%
Acer tataricum ginnala	36	0.32%
Aesculus hippocastanum	5	0.04%
Ailanthus altissima	43	0.38%
Amelanchier arborea	48	0.42%
Betula nigra	27	0.24%
Betula papyrifera	13	0.11%
Betula pendula	8	0.07%
Carpinus betulus	54	0.47%
Carpinus caroliniana	2	0.02%
Catalpa speciosa	14	0.12%
Cedrus atlantica	2	0.02%
Cercidiphyllum japonicum	9	0.08%
Cercis canadensis	1	0.01%
Chamaecyparis obtusa	2	0.02%
Cladrastis kentukea	2	0.02%
Cornus florida	11	0.10%
Cornus kousa	29	0.26%
Cornus mas	3	0.03%
Corylus colurna	1	0.01%
Cotinus obovatus	1	0.01%
Crataegus phaenopyrum	1	0.01%
Crataegus spp.	11	0.10%

Botanical	Total	Percentage of Entire Population
Fagus sylvatica	27	0.24%
Fraxinus americana	117	1.03%
Fraxinus excelsior	3	0.03%
Fraxinus pennsylvanica	924	8.13%
Ginkgo biloba	24	0.21%
Gleditsia triacanthos inermis	965	8.49%
Gymnocladus dioica	2	0.02%
Hibiscus syriacus	1	0.01%
Juglans nigra	1	0.01%
Juniperus spp.	2	0.02%
Juniperus virginiana	13	0.11%
Koelreuteria paniculata	1	0.01%
Larix decidua	8	0.07%
Liquidambar styraciflua	93	0.82%
Liriodendron tulipifera	11	0.10%
Magnolia spp.	3	0.03%
Magnolia stellata	1	0.01%
Magnolia x soulangiana	13	0.11%
Malus spp.	193	1.70%
Metasequoia glyptostroboides	5	0.04%
Morus alba	17	0.15%
Phellodendron amurense	3	0.03%
Picea abies	7	0.06%
Picea glauca	1	0.01%
Picea pungens	10	0.09%
Picea spp.	1	0.01%
Pinus nigra	53	0.47%
Pinus parviflora	1	0.01%
Pinus resinosa	23	0.20%
Pinus strobus	71	0.62%
Platanus occidentalis	95	0.84%
Platanus x acerifolia	333	2.93%
Populus deltoides	3	0.03%
Populus spp.	44	0.39%
Prunus cerasifera	2	0.02%
Prunus pensylvanica	1	0.01%
Prunus serotina	17	0.15%
Prunus serrulata	266	2.34%

Botanical	***Total***	***Percentage of Entire Population***
Prunus spp.	10	0.09%
Prunus subhirtella	20	0.18%
Pseudotsuga menziesii	7	0.06%
Pyrus calleryana	1577	13.87%
Quercus alba	11	0.10%
Quercus bicolor	5	0.04%
Quercus imbricaria	14	0.12%
Quercus macrocarpa	3	0.03%
Quercus palustris	181	1.59%
Quercus robur	10	0.09%
Quercus rubra	150	1.32%
Quercus shumardii	16	0.14%
Robinia pseudoacacia	65	0.57%
Salix discolor	1	0.01%
Sorbus aucuparia	3	0.03%
stump	66	0.58%
Styphnolobium japonicum	62	0.55%
Syringa reticulata	198	1.74%
Thuja occidentalis	35	0.31%
Tilia americana	43	0.38%
Tilia cordata	872	7.67%
Tilia tomentosa	9	0.08%
Tsuga candensis	37	0.33%
Ulmus americana	32	0.28%
Ulmus glabra	1	0.01%
Ulmus parvifolia	4	0.04%
Ulmus pumila	15	0.13%
Ulmus rubra	4	0.04%
Ulmus thomasi	1	0.01%
Ulmus x	43	0.38%
unknown	12	0.11%
vacant site large	58	0.51%
vacant site medium	37	0.33%
vacant site small	149	1.31%
Zelkova serrata	393	3.46%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Botanical (Non-Street Sites)

Botanical	Total	Percentage of Entire Population
Malus spp.	173	8.19%
Acer platanoides	161	7.62%
Pyrus calleryana	135	6.39%
Tilia cordata	129	6.11%
Gleditsia triacanthos inermis	126	5.97%
Acer rubrum	123	5.82%
Fraxinus pennsylvanica	96	4.55%
Zelkova serrata	74	3.50%
Quercus palustris	74	3.50%
Pinus strobus	66	3.13%
Acer saccharum	64	3.03%
Robinia pseudoacacia	62	2.94%
Quercus rubra	62	2.94%
Pinus nigra	48	2.27%
Populus spp.	44	2.08%
Prunus serrulata	43	2.04%
Platanus x acerifolia	39	1.85%
Tsuga candensis	37	1.75%
Acer saccharinum	37	1.75%
Carpinus betulus	30	1.42%
Cornus kousa	28	1.33%
Betula nigra	26	1.23%
Fagus sylvatica	25	1.18%
Pinus resinosa	23	1.09%
Styphnolobium japonicum	19	0.90%
Ailanthus altissima	19	0.90%
Fraxinus americana	18	0.85%
Prunus subhirtella	16	0.76%
Ulmus americana	15	0.71%
Thuja occidentalis	12	0.57%
Prunus serotina	12	0.57%
Amelanchier arborea	12	0.57%
Syringa reticulata	11	0.52%
Juniperus virginiana	11	0.52%
Ginkgo biloba	11	0.52%

Botanical	Total	Percentage of Entire Population
Acer pseudoplatanus	11	0.52%
Quercus alba	10	0.47%
Magnolia x soulangiana	10	0.47%
Catalpa speciosa	10	0.47%
Morus alba	9	0.43%
Liquidambar styraciflua	9	0.43%
Cornus florida	9	0.43%
Ulmus pumila	8	0.38%
Larix decidua	8	0.38%
Betula pendula	8	0.38%
Betula papyrifera	8	0.38%
Abies concolor	8	0.38%
vacant site medium	7	0.33%
Pseudotsuga menziesii	7	0.33%
Liriodendron tulipifera	7	0.33%
Crataegus spp.	7	0.33%
Ulmus x	6	0.28%
Cercidiphyllum japonicum	6	0.28%
unknown	5	0.24%
stump	5	0.24%
Picea pungens	5	0.24%
Metasequoia glyptostroboides	5	0.24%
Acer negundo	5	0.24%
Tilia americana	4	0.19%
Quercus shumardii	4	0.19%
Acer campestre	4	0.19%
Populus deltoides	3	0.14%
Picea abies	3	0.14%
Cornus mas	3	0.14%
Ulmus rubra	2	0.09%
Quercus robur	2	0.09%
Quercus bicolor	2	0.09%
Prunus spp.	2	0.09%
Platanus occidentalis	2	0.09%
Phellodendron amurense	2	0.09%
Magnolia spp.	2	0.09%
Juniperus spp.	2	0.09%
Cladrastis kentukea	2	0.09%

Botanical	Total	Percentage of Entire Population
Chamaecyparis obtusa	2	0.09%
Cedrus atlantica	2	0.09%
Acer nigrum	2	0.09%
Ulmus glabra	1	0.05%
Tilia tomentosa	1	0.05%
Sorbus aucuparia	1	0.05%
Quercus macrocarpa	1	0.05%
Prunus pensylvanica	1	0.05%
Picea spp.	1	0.05%
Picea glauca	1	0.05%
Koelreuteria paniculata	1	0.05%
Gymnocladus dioica	1	0.05%
Cotinus obovatus	1	0.05%
Cercis canadensis	1	0.05%
Aesculus hippocastanum	1	0.05%
Acer palmatum	1	0.05%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Botanical (Street Sites)

Botanical	*Total*	*Percentage of Entire Population*
Acer platanoides	1992	21.51%
Pyrus calleryana	1442	15.57%
Acer rubrum	956	10.32%
Gleditsia triacanthos inermis	839	9.06%
Fraxinus pennsylvanica	828	8.94%
Tilia cordata	743	8.02%
Zelkova serrata	319	3.44%
Platanus x acerifolia	294	3.17%
Prunus serrulata	223	2.41%
Syringa reticulata	187	2.02%
vacant site small	149	1.61%
Quercus palustris	107	1.16%
Fraxinus americana	99	1.07%
Platanus occidentalis	93	1.00%
Quercus rubra	88	0.95%
Liquidambar styraciflua	84	0.91%
Acer saccharinum	71	0.77%
stump	61	0.66%
vacant site large	58	0.63%
Acer campestre	49	0.53%
Styphnolobium japonicum	43	0.46%
Tilia americana	39	0.42%
Acer saccharum	39	0.42%
Ulmus x	37	0.40%
Amelanchier arborea	36	0.39%
Acer tataricum ginnala	36	0.39%
vacant site medium	30	0.32%
Carpinus betulus	24	0.26%
Ailanthus altissima	24	0.26%
Thuja occidentalis	23	0.25%
Malus spp.	20	0.22%
Ulmus americana	17	0.18%
Quercus imbricaria	14	0.15%
Ginkgo biloba	13	0.14%
Quercus shumardii	12	0.13%

Botanical	Total	Percentage of Entire Population
Acer negundo	10	0.11%
Tilia tomentosa	8	0.09%
Quercus robur	8	0.09%
Prunus spp.	8	0.09%
Morus alba	8	0.09%
unknown	7	0.08%
Ulmus pumila	7	0.08%
Acer pseudoplatanus	7	0.08%
Prunus serotina	5	0.05%
Pinus strobus	5	0.05%
Pinus nigra	5	0.05%
Picea pungens	5	0.05%
Betula papyrifera	5	0.05%
Ulmus parvifolia	4	0.04%
Prunus subhirtella	4	0.04%
Picea abies	4	0.04%
Liriodendron tulipifera	4	0.04%
Crataegus spp.	4	0.04%
Catalpa speciosa	4	0.04%
Aesculus hippocastanum	4	0.04%
Acer nigrum	4	0.04%
Robinia pseudoacacia	3	0.03%
Quercus bicolor	3	0.03%
Magnolia x soulangiana	3	0.03%
Fraxinus excelsior	3	0.03%
Cercidiphyllum japonicum	3	0.03%
Acer palmatum	3	0.03%
Ulmus rubra	2	0.02%
Sorbus aucuparia	2	0.02%
Quercus macrocarpa	2	0.02%
Prunus cerasifera	2	0.02%
Juniperus virginiana	2	0.02%
Fagus sylvatica	2	0.02%
Cornus florida	2	0.02%
Carpinus caroliniana	2	0.02%
Ulmus thomasi	1	0.01%
Salix discolor	1	0.01%
Quercus alba	1	0.01%

Botanical	Total	Percentage of Entire Population
Pinus parviflora	1	0.01%
Phellodendron amurense	1	0.01%
Magnolia stellata	1	0.01%
Magnolia spp.	1	0.01%
Juglans nigra	1	0.01%
Hibiscus syriacus	1	0.01%
Gymnocladus dioica	1	0.01%
Crataegus phaenopyrum	1	0.01%
Corylus colurna	1	0.01%
Cornus kousa	1	0.01%
Betula nigra	1	0.01%
Acer spp.	1	0.01%
Acer pensylvanicum	1	0.01%
Acer buergerianum	1	0.01%
Grand Total	*9260*	*100%*

Common	*Total*	*Percentage of Entire Population*
maple, Norway	2153	18.93%
pear, callery	1577	13.87%
maple, red	1079	9.49%
honeylocust, thornless	965	8.49%
ash, green	924	8.13%
linden, littleleaf	872	7.67%
zelkova, Japanese	393	3.46%
planetree, London	333	2.93%
cherry, Japanese flowering	266	2.34%
lilac, Japanese tree	198	1.74%
crabapple, flowering	193	1.70%
oak, pin	181	1.59%
oak, northern red	150	1.32%
vacant site, small	149	1.31%
ash, white	117	1.03%
maple, silver	108	0.95%
maple, sugar	103	0.91%
sycamore, American	95	0.84%
sweetgum, American	93	0.82%
pine, eastern white	71	0.62%
stump	66	0.58%
locust, black	65	0.57%
Japanese pagodatree	62	0.55%
vacant site, large	58	0.51%
hornbeam, European	54	0.47%
pine, Austrian	53	0.47%
maple, hedge	53	0.47%
serviceberry, downy	48	0.42%
poplar, spp.	44	0.39%
tree-of-heaven	43	0.38%
linden, American	43	0.38%
elm, hybrid	43	0.38%
vacant site, medium	37	0.33%
hemlock, eastern	37	0.33%
maple, Amur	36	0.32%

Common	Total	Percentage of Entire Population
arborvitae, eastern	35	0.31%
elm, American	32	0.28%
dogwood, Kousa	29	0.26%
birch, river	27	0.24%
beech, European	27	0.24%
ginkgo	24	0.21%
pine, red	23	0.20%
cherry, Higan	20	0.18%
maple, sycamore	18	0.16%
mulberry, white	17	0.15%
cherry, black	17	0.15%
oak, Shumard	16	0.14%
elm, Siberian	15	0.13%
boxelder	15	0.13%
oak, shingle	14	0.12%
catalpa, northern	14	0.12%
redcedar, eastern	13	0.11%
magnolia, saucer	13	0.11%
birch, paper	13	0.11%
unknown	12	0.11%
tuliptree	11	0.10%
oak, white	11	0.10%
hawthorn, spp.	11	0.10%
dogwood, flowering	11	0.10%
spruce, Colorado	10	0.09%
oak, English	10	0.09%
cherry/plum, spp.	10	0.09%
linden, silver	9	0.08%
katsuratree	9	0.08%
larch, European	8	0.07%
fir, white	8	0.07%
birch, European white	8	0.07%
spruce, Norway	7	0.06%
douglas-fir	7	0.06%
maple, black	6	0.05%
oak, swamp white	5	0.04%
horsechestnut	5	0.04%
dawn redwood	5	0.04%

Common	Total	Percentage of Entire Population
maple, Japanese	4	0.04%
elm, slippery	4	0.04%
elm, Chinese	4	0.04%
oak, bur	3	0.03%
mountainash, European	3	0.03%
magnolia, spp.	3	0.03%
dogwood, corneliancherry	3	0.03%
cottonwood, eastern	3	0.03%
ash, European	3	0.03%
Amur corktree	3	0.03%
yellowwood, American	2	0.02%
plum, cherry	2	0.02%
Kentucky coffeetree	2	0.02%
juniper, spp.	2	0.02%
hornbeam, American	2	0.02%
falsecypress, Hinoki	2	0.02%
cedar, Atlas	2	0.02%
willow, pussy	1	0.01%
walnut, black	1	0.01%
spruce, white	1	0.01%
spruce, spp.	1	0.01%
smoketree, American	1	0.01%
rose of sharon	1	0.01%
redbud, eastern	1	0.01%
pine, Japanese white	1	0.01%
maple, trident	1	0.01%
maple, striped	1	0.01%
maple, spp.	1	0.01%
magnolia, star	1	0.01%
hawthorn, Washington	1	0.01%
goldenraintree	1	0.01%
filbert, Turkish	1	0.01%
elm, rock	1	0.01%
elm, camperdown	1	0.01%
cherry, pin	1	0.01%
Grand Total	*11372*	*100%*

Common	Total	Percentage of Entire Population
Amur corktree	3	0.03%
arborvitae, eastern	35	0.31%
ash, European	3	0.03%
ash, green	924	8.13%
ash, white	117	1.03%
beech, European	27	0.24%
birch, European white	8	0.07%
birch, paper	13	0.11%
birch, river	27	0.24%
boxelder	15	0.13%
catalpa, northern	14	0.12%
cedar, Atlas	2	0.02%
cherry, black	17	0.15%
cherry, Higan	20	0.18%
cherry, Japanese flowering	266	2.34%
cherry, pin	1	0.01%
cherry/plum, spp.	10	0.09%
cottonwood, eastern	3	0.03%
crabapple, flowering	193	1.70%
dawn redwood	5	0.04%
dogwood, cornelianchERRY	3	0.03%
dogwood, flowering	11	0.10%
dogwood, Kousa	29	0.26%
douglas-fir	7	0.06%
elm, American	32	0.28%
elm, camperdown	1	0.01%
elm, Chinese	4	0.04%
elm, hybrid	43	0.38%
elm, rock	1	0.01%
elm, Siberian	15	0.13%
elm, slippery	4	0.04%
falsecypress, Hinoki	2	0.02%
filbert, Turkish	1	0.01%
fir, white	8	0.07%
ginkgo	24	0.21%

Common	Total	Percentage of Entire Population
goldenraintree	1	0.01%
hawthorn, spp.	11	0.10%
hawthorn, Washington	1	0.01%
hemlock, eastern	37	0.33%
honeylocust, thornless	965	8.49%
hornbeam, American	2	0.02%
hornbeam, European	54	0.47%
horsechestnut	5	0.04%
Japanese pagodatree	62	0.55%
juniper, spp.	2	0.02%
katsuratree	9	0.08%
Kentucky coffeetree	2	0.02%
larch, European	8	0.07%
lilac, Japanese tree	198	1.74%
linden, American	43	0.38%
linden, littleleaf	872	7.67%
linden, silver	9	0.08%
locust, black	65	0.57%
magnolia, saucer	13	0.11%
magnolia, spp.	3	0.03%
magnolia, star	1	0.01%
maple, Amur	36	0.32%
maple, black	6	0.05%
maple, hedge	53	0.47%
maple, Japanese	4	0.04%
maple, Norway	2153	18.93%
maple, red	1079	9.49%
maple, silver	108	0.95%
maple, spp.	1	0.01%
maple, striped	1	0.01%
maple, sugar	103	0.91%
maple, sycamore	18	0.16%
maple, trident	1	0.01%
mountainash, European	3	0.03%
mulberry, white	17	0.15%
oak, bur	3	0.03%
oak, English	10	0.09%
oak, northern red	150	1.32%

Common	Total	Percentage of Entire Population
oak, pin	181	1.59%
oak, shingle	14	0.12%
oak, Shumard	16	0.14%
oak, swamp white	5	0.04%
oak, white	11	0.10%
pear, callery	1577	13.87%
pine, Austrian	53	0.47%
pine, eastern white	71	0.62%
pine, Japanese white	1	0.01%
pine, red	23	0.20%
planetree, London	333	2.93%
plum, cherry	2	0.02%
poplar, spp.	44	0.39%
redbud, eastern	1	0.01%
redcedar, eastern	13	0.11%
rose of sharon	1	0.01%
serviceberry, downy	48	0.42%
smoketree, American	1	0.01%
spruce, Colorado	10	0.09%
spruce, Norway	7	0.06%
spruce, spp.	1	0.01%
spruce, white	1	0.01%
stump	66	0.58%
sweetgum, American	93	0.82%
sycamore, American	95	0.84%
tree-of-heaven	43	0.38%
tuliptree	11	0.10%
unknown	12	0.11%
vacant site, large	58	0.51%
vacant site, medium	37	0.33%
vacant site, small	149	1.31%
walnut, black	1	0.01%
willow, pussy	1	0.01%
yellowwood, American	2	0.02%
zelkova, Japanese	393	3.46%
Grand Total	*11372*	*100%*

Quantity Report: Common (Non-Street Sites)

Common	Total	Percentage of Entire Population
crabapple, flowering	173	8.19%
maple, Norway	161	7.62%
pear, callery	135	6.39%
linden, littleleaf	129	6.11%
honeylocust, thornless	126	5.97%
maple, red	123	5.82%
ash, green	96	4.55%
zelkova, Japanese	74	3.50%
oak, pin	74	3.50%
pine, eastern white	66	3.13%
maple, sugar	64	3.03%
oak, northern red	62	2.94%
locust, black	62	2.94%
pine, Austrian	48	2.27%
poplar, spp.	44	2.08%
cherry, Japanese flowering	43	2.04%
planetree, London	39	1.85%
maple, silver	37	1.75%
hemlock, eastern	37	1.75%
hornbeam, European	30	1.42%
dogwood, Kousa	28	1.33%
birch, river	26	1.23%
beech, European	25	1.18%
pine, red	23	1.09%
tree-of-heaven	19	0.90%
Japanese pagodatree	19	0.90%
ash, white	18	0.85%
cherry, Higan	16	0.76%
elm, American	15	0.71%
serviceberry, downy	12	0.57%
cherry, black	12	0.57%
arborvitae, eastern	12	0.57%
redcedar, eastern	11	0.52%
maple, sycamore	11	0.52%
lilac, Japanese tree	11	0.52%

Common	Total	Percentage of Entire Population
ginkgo	11	0.52%
oak, white	10	0.47%
magnolia, saucer	10	0.47%
catalpa, northern	10	0.47%
sweetgum, American	9	0.43%
mulberry, white	9	0.43%
dogwood, flowering	9	0.43%
larch, European	8	0.38%
fir, white	8	0.38%
elm, Siberian	8	0.38%
birch, paper	8	0.38%
birch, European white	8	0.38%
vacant site, medium	7	0.33%
tuliptree	7	0.33%
hawthorn, spp.	7	0.33%
douglas-fir	7	0.33%
katsuratree	6	0.28%
elm, hybrid	6	0.28%
unknown	5	0.24%
stump	5	0.24%
spruce, Colorado	5	0.24%
dawn redwood	5	0.24%
boxelder	5	0.24%
oak, Shumard	4	0.19%
maple, hedge	4	0.19%
linden, American	4	0.19%
spruce, Norway	3	0.14%
dogwood, corneliancherry	3	0.14%
cottonwood, eastern	3	0.14%
yellowwood, American	2	0.09%
sycamore, American	2	0.09%
oak, swamp white	2	0.09%
oak, English	2	0.09%
maple, black	2	0.09%
magnolia, spp.	2	0.09%
juniper, spp.	2	0.09%
falsecypress, Hinoki	2	0.09%
elm, slippery	2	0.09%

Common	Total	Percentage of Entire Population
cherry/plum, spp.	2	0.09%
cedar, Atlas	2	0.09%
Amur corktree	2	0.09%
spruce, white	1	0.05%
spruce, spp.	1	0.05%
smoketree, American	1	0.05%
redbud, eastern	1	0.05%
oak, bur	1	0.05%
mountainash, European	1	0.05%
maple, Japanese	1	0.05%
linden, silver	1	0.05%
Kentucky coffeetree	1	0.05%
horsechestnut	1	0.05%
goldenraintree	1	0.05%
elm, camperdown	1	0.05%
cherry, pin	1	0.05%
Grand Total	2112	100%

Somerville, MA

Quantity Report: Common

Common	Total	Percentage of Entire Population
vacant site, small	149	61.07%
vacant site, large	58	23.77%
vacant site, medium	37	15.16%
Grand Total	*244*	*100%*

Common	Total	Percentage of Entire Population
maple, Norway	1992	21.51%
pear, callery	1442	15.57%
maple, red	956	10.32%
honeylocust, thornless	839	9.06%
ash, green	828	8.94%
linden, littleleaf	743	8.02%
zelkova, Japanese	319	3.44%
planetree, London	294	3.17%
cherry, Japanese flowering	223	2.41%
lilac, Japanese tree	187	2.02%
vacant site, small	149	1.61%
oak, pin	107	1.16%
ash, white	99	1.07%
sycamore, American	93	1.00%
oak, northern red	88	0.95%
sweetgum, American	84	0.91%
maple, silver	71	0.77%
stump	61	0.66%
vacant site, large	58	0.63%
maple, hedge	49	0.53%
Japanese pagodatree	43	0.46%
maple, sugar	39	0.42%
linden, American	39	0.42%
elm, hybrid	37	0.40%
serviceberry, downy	36	0.39%
maple, Amur	36	0.39%
vacant site, medium	30	0.32%
tree-of-heaven	24	0.26%
hornbeam, European	24	0.26%
arborvitae, eastern	23	0.25%
crabapple, flowering	20	0.22%
elm, American	17	0.18%
oak, shingle	14	0.15%
ginkgo	13	0.14%
oak, Shumard	12	0.13%

Common	Total	Percentage of Entire Population
boxelder	10	0.11%
oak, English	8	0.09%
mulberry, white	8	0.09%
linden, silver	8	0.09%
cherry/plum, spp.	8	0.09%
unknown	7	0.08%
maple, sycamore	7	0.08%
elm, Siberian	7	0.08%
spruce, Colorado	5	0.05%
pine, eastern white	5	0.05%
pine, Austrian	5	0.05%
cherry, black	5	0.05%
birch, paper	5	0.05%
tuliptree	4	0.04%
spruce, Norway	4	0.04%
maple, black	4	0.04%
horsechestnut	4	0.04%
hawthorn, spp.	4	0.04%
elm, Chinese	4	0.04%
cherry, Higan	4	0.04%
catalpa, northern	4	0.04%
oak, swamp white	3	0.03%
maple, Japanese	3	0.03%
magnolia, saucer	3	0.03%
locust, black	3	0.03%
katsuratree	3	0.03%
ash, European	3	0.03%
redcedar, eastern	2	0.02%
plum, cherry	2	0.02%
oak, bur	2	0.02%
mountainash, European	2	0.02%
hornbeam, American	2	0.02%
elm, slippery	2	0.02%
dogwood, flowering	2	0.02%
beech, European	2	0.02%
willow, pussy	1	0.01%
walnut, black	1	0.01%
rose of sharon	1	0.01%

Common	Total	Percentage of Entire Population
pine, Japanese white	1	0.01%
oak, white	1	0.01%
maple, trident	1	0.01%
maple, striped	1	0.01%
maple, spp.	1	0.01%
magnolia, star	1	0.01%
magnolia, spp.	1	0.01%
Kentucky coffeetree	1	0.01%
hawthorn, Washington	1	0.01%
filbert, Turkish	1	0.01%
elm, rock	1	0.01%
dogwood, Kousa	1	0.01%
birch, river	1	0.01%
Amur corktree	1	0.01%
Grand Total	*9260*	*100%*

Genus	Total	Percentage of Entire Population
Acer	3578	31.46%
Pyrus	1577	13.87%
Fraxinus	1044	9.18%
Gleditsia	965	8.49%
Tilia	924	8.13%
Platanus	428	3.76%
Zelkova	393	3.46%
Quercus	390	3.43%
Prunus	316	2.78%
vacant	244	2.15%
Syringa	198	1.74%
Malus	193	1.70%
Pinus	148	1.30%
Ulmus	100	0.88%
Liquidambar	93	0.82%
stump	66	0.58%
Robinia	65	0.57%
Styphnolobium	62	0.55%
Carpinus	56	0.49%
Betula	48	0.42%
Amelanchier	48	0.42%
Populus	47	0.41%
Cornus	43	0.38%
Ailanthus	43	0.38%
Tsuga	37	0.33%
Thuja	35	0.31%
Fagus	27	0.24%
Ginkgo	24	0.21%
Picea	19	0.17%
Morus	17	0.15%
Magnolia	17	0.15%
Juniperus	15	0.13%
Catalpa	14	0.12%
unknown	12	0.11%
Crataegus	12	0.11%

Genus	Total	Percentage of Entire Population
Liriodendron	11	0.10%
Cercidiphyllum	9	0.08%
Larix	8	0.07%
Abies	8	0.07%
Pseudotsuga	7	0.06%
Metasequoia	5	0.04%
Aesculus	5	0.04%
Sorbus	3	0.03%
Phellodendron	3	0.03%
Gymnocladus	2	0.02%
Cladrastis	2	0.02%
Chamaecyparis	2	0.02%
Cedrus	2	0.02%
Salix	1	0.01%
Koelreuteria	1	0.01%
Juglans	1	0.01%
Hibiscus	1	0.01%
Cotinus	1	0.01%
Corylus	1	0.01%
Cercis	1	0.01%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Genus

Genus	Total	Percentage of Entire Population
Abies	8	0.07%
Acer	3578	31.46%
Aesculus	5	0.04%
Ailanthus	43	0.38%
Amelanchier	48	0.42%
Betula	48	0.42%
Carpinus	56	0.49%
Catalpa	14	0.12%
Cedrus	2	0.02%
Cercidiphyllum	9	0.08%
Cercis	1	0.01%
Chamaecyparis	2	0.02%
Cladrastis	2	0.02%
Cornus	43	0.38%
Corylus	1	0.01%
Cotinus	1	0.01%
Crataegus	12	0.11%
Fagus	27	0.24%
Fraxinus	1044	9.18%
Ginkgo	24	0.21%
Gleditsia	965	8.49%
Gymnocladus	2	0.02%
Hibiscus	1	0.01%
Juglans	1	0.01%
Juniperus	15	0.13%
Koelreuteria	1	0.01%
Larix	8	0.07%
Liquidambar	93	0.82%
Liriodendron	11	0.10%
Magnolia	17	0.15%
Malus	193	1.70%
Metasequoia	5	0.04%
Morus	17	0.15%
Phellodendron	3	0.03%
Picea	19	0.17%

Genus	*Total*	*Percentage of Entire Population*
Pinus	148	1.30%
Platanus	428	3.76%
Populus	47	0.41%
Prunus	316	2.78%
Pseudotsuga	7	0.06%
Pyrus	1577	13.87%
Quercus	390	3.43%
Robinia	65	0.57%
Salix	1	0.01%
Sorbus	3	0.03%
stump	66	0.58%
Styphnolobium	62	0.55%
Syringa	198	1.74%
Thuja	35	0.31%
Tilia	924	8.13%
Tsuga	37	0.33%
Ulmus	100	0.88%
unknown	12	0.11%
vacant	244	2.15%
Zelkova	393	3.46%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Genus (Non-Street Sites)

Genus	*Total*	*Percentage of Entire Population*
Acer	408	19.32%
Malus	173	8.19%
Quercus	155	7.34%
Pinus	137	6.49%
Pyrus	135	6.39%
Tilia	134	6.34%
Gleditsia	126	5.97%
Fraxinus	114	5.40%
Zelkova	74	3.50%
Prunus	74	3.50%
Robinia	62	2.94%
Populus	47	2.23%
Betula	42	1.99%
Platanus	41	1.94%
Cornus	40	1.89%
Tsuga	37	1.75%
Ulmus	32	1.52%
Carpinus	30	1.42%
Fagus	25	1.18%
Styphnolobium	19	0.90%
Ailanthus	19	0.90%
Juniperus	13	0.62%
Thuja	12	0.57%
Magnolia	12	0.57%
Amelanchier	12	0.57%
Syringa	11	0.52%
Ginkgo	11	0.52%
Picea	10	0.47%
Catalpa	10	0.47%
Morus	9	0.43%
Liquidambar	9	0.43%
Larix	8	0.38%
Abies	8	0.38%
vacant	7	0.33%
Pseudotsuga	7	0.33%

Genus	Total	Percentage of Entire Population
Liriodendron	7	0.33%
Crataegus	7	0.33%
Cercidiphyllum	6	0.28%
unknown	5	0.24%
stump	5	0.24%
Metasequoia	5	0.24%
Phellodendron	2	0.09%
Cladrastis	2	0.09%
Chamaecyparis	2	0.09%
Cedrus	2	0.09%
Sorbus	1	0.05%
Koelreuteria	1	0.05%
Gymnocladus	1	0.05%
Cotinus	1	0.05%
Cercis	1	0.05%
Aesculus	1	0.05%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Genus (Street Sites)

Genus	*Total*	*Percentage of Entire Population*
Acer	3170	34.23%
Pyrus	1442	15.57%
Fraxinus	930	10.04%
Gleditsia	839	9.06%
Tilia	790	8.53%
Platanus	387	4.18%
Zelkova	319	3.44%
Prunus	242	2.61%
vacant	237	2.56%
Quercus	235	2.54%
Syringa	187	2.02%
Liquidambar	84	0.91%
Ulmus	68	0.73%
stump	61	0.66%
Styphnolobium	43	0.46%
Amelanchier	36	0.39%
Carpinus	26	0.28%
Ailanthus	24	0.26%
Thuja	23	0.25%
Malus	20	0.22%
Ginkgo	13	0.14%
Pinus	11	0.12%
Picea	9	0.10%
Morus	8	0.09%
unknown	7	0.08%
Betula	6	0.06%
Magnolia	5	0.05%
Crataegus	5	0.05%
Liriodendron	4	0.04%
Catalpa	4	0.04%
Aesculus	4	0.04%
Robinia	3	0.03%
Cornus	3	0.03%
Cercidiphyllum	3	0.03%
Sorbus	2	0.02%

Genus	Total	Percentage of Entire Population
Juniperus	2	0.02%
Fagus	2	0.02%
Salix	1	0.01%
Phellodendron	1	0.01%
Juglans	1	0.01%
Hibiscus	1	0.01%
Gymnocladus	1	0.01%
Corylus	1	0.01%
Grand Total	*9260*	*100%*

DAVEY

Somerville, MA
Species/Condition Frequency Matrix

Common Name	Good	Fair	Poor	Dead	N/A	TOTAL
Amur corktree		2	1			3
arborvitae, eastern	26	9				35
ash, European		2	1			3
ash, green	215	598	110	1		924
ash, white	25	74	17	1		117
beech, European	19	8				27
birch, European white	6	2				8
birch, paper	7	5	1			13
birch, river	19	4	4			27
boxelder	1	9	5			15
catalpa, northern		9	5			14
cedar, Atlas	2					2
cherry, black	1	11	5			17
cherry, Higan	7	11	2			20
cherry, Japanese flowering	94	133	38	1		266
cherry, pin		1				1
cherry/plum, spp.	2	6	2			10
cottonwood, eastern	2	1				3
crabapple, flowering	78	96	14	5		193
dawn redwood	1	4				5
dogwood, corneliancherry		3				3
dogwood, flowering	3	6	1	1		11
dogwood, Kousa	12	15	2			29
douglas-fir	4	3				7
elm, American	10	20	2			32
elm, camperdown	1					1

Common Name	Good	Fair	Poor	Dead	N/A	TOTAL
elm, Chinese	3	1				4
elm, hybrid	16	20	7			43
elm, rock		1				1
elm, Siberian	1	10	4			15
elm, slippery		2	2			4
falsecypress, Hinoki	1	1				2
filbert, Turkish			1			1
fir, white	5	2	1			8
ginkgo	18	5	1			24
goldenraintree			1			1
hawthorn, spp.	5	5	1			11
hawthorn, Washington		1				1
hemlock, eastern	24	11	2			37
honeylocust, thornless	317	604	42	2		965
hornbeam, American		1	1			2
hornbeam, European	23	28	3			54
horsechestnut		1	4			5
Japanese pagodatree	6	27	27	2		62
juniper, spp.		2				2
katsuratree	3	5	1			9
Kentucky coffeetree	2					2
larch, European	4	4				8
lilac, Japanese tree	72	101	23	2		198
linden, American	9	22	12			43
linden, littleleaf	105	578	187	2		872
linden, silver		5	4			9
locust, black	41	19	5			65
magnolia, saucer	8	2	3			13
magnolia, spp.	1	2				3
magnolia, star		1				1

Common Name	Good	Fair	Poor	Dead	N/A	TOTAL
maple, Amur	6	23	7			36
maple, black		3	3			6
maple, hedge	24	21	8			53
maple, Japanese	1	3				4
maple, Norway	297	1246	585	25		2153
maple, red	341	575	158	5		1079
maple, silver	15	70	23			108
maple, spp.				1		1
maple, striped		1				1
maple, sugar	35	42	25	1		103
maple, sycamore	1	13	4			18
maple, trident			1			1
mountainash, European	1	1	1			3
mulberry, white	3	12	2			17
oak, bur	1	2				3
oak, English	6	4				10
oak, northern red	68	68	14			150
oak, pin	87	82	12			181
oak, shingle	12	2				14
oak, Shumard	9	6	1			16
oak, swamp white	3	2				5
oak, white	8	2	1			11
pear, callery	266	1086	212	13		1577
pine, Austrian	10	33	8	2		53
pine, eastern white	25	41	5			71
pine, Japanese white	1					1
pine, red	3	8	9	3		23
planetree, London	202	98	26	7		333
plum, cherry	1	1				2
poplar, spp.	37	4	3			44

Common Name	Good	Fair	Poor	Dead	N/A	TOTAL
redbud, eastern		1				1
redcedar, eastern	5	8				13
rose of sharon		1				1
serviceberry, downy	6	37	5			48
smoketree, American		1				1
spruce, Colorado	6	3	1			10
spruce, Norway	3	1	3			7
spruce, spp.				1		1
spruce, white	1					1
stump						66
sweetgum, American	59	24	8	2		93
sycamore, American	29	46	18	2		95
tree-of-heaven	3	27	13			43
tuliptree	4	3	4			11
unknown				12		12
vacant site, large						58
vacant site, medium						37
vacant site, small						149
walnut, black		1				1
willow, pussy		1				1
yellowwood, American		1	1			2
zelkova, Japanese	23	292	74	4		393
Grand Total:	2801	6389	1777	95		11372

Species	N/A	1 - 3	4 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 +	TOTAL
Amur corktree				1	1	1					3
arborvitae, eastern		33		1	1						35
ash, European			1	1	1						3
ash, green		8	100	601	177	31	4	2	1		924
ash, white		5	21	68	8	8	3	3		1	117
beech, European		7	4	6		5	4	1			27
birch, European white		6		2							8
birch, paper			2	7	3	1					13
birch, river		22	2	2		1					27
boxelder		2	1	5	6				1		15
catalpa, northern		1	2	3	3	3	1	1			14
cedar, Atlas		2									2
cherry, black		3	1	5	5	3					17
cherry, Higan		10	7	3							20
cherry, Japanese flowering		50	75	130	8	3					266
cherry, pin			1								1
cherry/plum, spp.		2	1	7							10
cottonwood, eastern				1		1	1				3
crabapple, flowering		66	84	39	4						193
dawn redwood				2	3						5
dogwood, corneliancherry		3									3
dogwood, flowering		3	6	2							11

Species	N/A	1 - 3	4 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 +	TOTAL
dogwood, Kousa		25	4								29
douglas-fir			1	3	2	1					7
elm, American		2	3	10	6	2	2	2	2	3	32
elm, camperdown		1									1
elm, Chinese			3	1							4
elm, hybrid		9	6	12	11		2	1	1	1	43
elm, rock							1				1
elm, Siberian		1	1	1	3	2	4	2	1		15
elm, slippery			1					1	1	1	4
falsecypress, Hinoki		2									2
filbert, Turkish			1								1
fir, white			2	5	1						8
ginkgo		6	10	5	1	2					24
goldenraintree		1									1
hawthorn, spp.		4	2	5							11
hawthorn, Washington				1							1
hemlock, eastern			2	32	3						37
honeylocust, thornless		45	60	460	363	35	2				965
hornbeam, American			1	1							2
hornbeam, European		32	15	6			1				54
horsechestnut		1					2		2		5
Japanese pagodatree		1	3	48	10						62
juniper, spp.		2									2
katsuratree		4	1	2	2						9

Species	N/A	1 - 3	4 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 +	TOTAL
Kentucky coffeetree				2							2
larch, European				1	4	2	1				8
lilac, Japanese tree		149	48	1							198
linden, American				12	13	4	8	5	1		43
linden, littleleaf		7	32	347	344	94	39	8	1		872
linden, silver					7	2					9
locust, black		3	4	24	27	7					65
magnolia, saucer		10		3							13
magnolia, spp.		1	2								3
magnolia, star		1									1
maple, Amur		2	22	12							36
maple, black				3		3					6
maple, hedge		3	11	38		1					53
maple, Japanese		1	1	2							4
maple, Norway		62	152	985	597	250	90	16		1	2153
maple, red		340	148	450	118	15	5	2	1		1079
maple, silver		5	14	10	23	19	23	10	3	1	108
maple, spp.		1									1
maple, striped					1						1
maple, sugar		2	12	40	15	21	9	4			103
maple, sycamore		2	2	13		1					18
maple, trident				1							1
mountainash, European			1	2							3
mulberry, white		5	3	6	1	1		1			17

Species	N/A	1 - 3	4 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 +	TOTAL
oak, bur		1					1			1	3
oak, English		3	5	1		1					10
oak, northern red		3	7	26	44	28	13	15	12	2	150
oak, pin		15	18	42	49	33	17	6	1		181
oak, shingle		3	9	2							14
oak, Shumard				2	5	8	1				16
oak, swamp white			2	1		1				1	5
oak, white			1	2	6	1	1				11
pear, callery		379	214	785	194	4		1			1577
pine, Austrian		3	4	19	25	2					53
pine, eastern white		7		34	20	9	1				71
pine, Japanese white				1							1
pine, red				5	13	5					23
planetree, London		22	21	172	94	20	1	1	1	1	333
plum, cherry		2									2
poplar, spp.		44									44
redbud, eastern			1								1
redcedar, eastern		8		5							13
rose of sharon		1									1
serviceberry, downy		10	19	19							48
smoketree, American		1									1
spruce, Colorado		5	1	3	1						10
spruce, Norway		1		1	3	2					7
spruce, spp.		1									1

Species	N/A	1 - 3	4 - 6	7 - 12	13 - 18	19 - 24	25 - 30	31 - 36	37 - 42	43 +	TOTAL
spruce, white		1									1
stump		3	10	34	2	9	5	2	1		66
sweetgum, American		24	29	40							93
sycamore, American		6	12	47	26	4					95
tree-of-heaven		3	1	17	13	7	1	1			43
tuliptree		4	5	2							11
unknown		4	3	3	2						12
vacant site, large	58										58
vacant site, medium	37										37
vacant site, small	149										149
walnut, black						1					1
willow, pussy			1								1
yellowwood, American				1	1						2
zelkova, Japanese		43	57	171	118	4					393
Grand Total	*244*	*1550*	*1296*	*4865*	*2388*	*658*	*243*	*85*	*30*	*13*	*11372*

Somerville, MA

Species/Maintenance Frequency Report

Common Name	Maintain	Remove	None	TOTAL
Amur corktree	3			3
arborvitae, eastern	35			35
ash, European	3			3
ash, green	882	42		924
ash, white	110	7		117
beech, European	27			27
birch, European white	8			8
birch, paper	12	1		13
birch, river	26	1		27
boxelder	11	4		15
catalpa, northern	11	3		14
cedar, Atlas	2			2
cherry, black	9	8		17
cherry, Higan	20			20
cherry, Japanese flowering	251	15		266
cherry, pin	1			1
cherry/plum, spp.	9	1		10
cottonwood, eastern	3			3

Common Name	Maintain	Remove	None	TOTAL
crabapple, flowering	182	11		193
dawn redwood	5			5
dogwood, corneliancherry	3			3
dogwood, flowering	10	1		11
dogwood, Kousa	29			29
douglas-fir	7			7
elm, American	29	3		32
elm, camperdown	1			1
elm, Chinese	4			4
elm, hybrid	38	5		43
elm, rock	1			1
elm, Siberian	13	2		15
elm, slippery	3	1		4
falsecypress, Hinoki	2			2
filbert, Turkish	1			1
fir, white	7	1		8
ginkgo	24			24
goldenraintree	1			1
hawthorn, spp.	10	1		11
hawthorn, Washington	1			1

Common Name	Maintain	Remove	None	TOTAL
hemlock, eastern	37			37
honeylocust, thornless	948	17		965
hornbeam, American	2			2
hornbeam, European	53	1		54
horsechestnut	3	2		5
Japanese pagodatree	47	15		62
juniper, spp.	2			2
katsuratree	8	1		9
Kentucky coffeetree	2			2
larch, European	8			8
lilac, Japanese tree	189	9		198
linden, American	36	7		43
linden, littleleaf	815	57		872
linden, silver	7	2		9
locust, black	59	6		65
magnolia, saucer	11	2		13
magnolia, spp.	3			3
magnolia, star	1			1
maple, Amur	35	1		36
maple, black	6			6

Common Name	Maintain	Remove	None	TOTAL
maple, hedge	51	2		53
maple, Japanese	4			4
maple, Norway	1845	308		2153
maple, red	1013	66		1079
maple, silver	95	13		108
maple, spp.		1		1
maple, striped	1			1
maple, sugar	85	18		103
maple, sycamore	15	3		18
maple, trident	1			1
mountainash, European	3			3
mulberry, white	15	2		17
oak, bur	3			3
oak, English	10			10
oak, northern red	145	5		150
oak, pin	178	3		181
oak, shingle	14			14
oak, Shumard	15	1		16
oak, swamp white	5			5
oak, white	10	1		11

Common Name	Maintain	Remove	None	TOTAL
pear, callery	1475	102		1577
pine, Austrian	48	5		53
pine, eastern white	69	2		71
pine, Japanese white	1			1
pine, red	18	5		23
planetree, London	313	20		333
plum, cherry	2			2
poplar, spp.	44			44
redbud, eastern	1			1
redcedar, eastern	13			13
rose of sharon	1			1
serviceberry, downy	46	2		48
smoketree, American	1			1
spruce, Colorado	10			10
spruce, Norway	7			7
spruce, spp.		1		1
spruce, white	1			1
stump		66		66
sweetgum, American	87	6		93
sycamore, American	88	7		95

Common Name	Maintain	Remove	None	TOTAL
tree-of-heaven	23	20		43
tuliptree	8	3		11
unknown		12		12
vacant site, large			58	58
vacant site, medium			37	37
vacant site, small			149	149
walnut, black	1			1
willow, pussy	1			1
yellowwood, American	1	1		2
zelkova, Japanese	361	32		393
Grand Total	10194	934	244	11372

Appendix B
Tree Condition Reports

DAVEY

Somerville, MA

Quantity Report: Condition

Condition	Total	Percentage of Entire Population
Fair	6389	56.18%
Good	2801	24.63%
Poor	1777	15.63%
Plant	244	2.15%
Dead	95	0.84%
None	66	0.58%
Grand Total	*11372*	*100%*

Somerville, MA

Frequency Report: Condition by Diameter Class

Diameter Class	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Dead			
7 - 12	36	37.89%	0.32%
1 - 3	32	33.68%	0.28%
4 - 6	14	14.74%	0.12%
13 - 18	10	10.53%	0.09%
19 - 24	2	2.11%	0.02%
31 - 36	1	1.05%	0.01%
Summary for Dead (6 items)			
Sum	*95*	*100%*	*0.84%*
Fair			
7 - 12	3000	46.96%	26.38%
13 - 18	1570	24.57%	13.81%
1 - 3	654	10.24%	5.75%
4 - 6	633	9.91%	5.57%
19 - 24	331	5.18%	2.91%
25 - 30	127	1.99%	1.12%
31 - 36	51	0.80%	0.45%
37 - 42	12	0.19%	0.11%
43 +	11	0.17%	0.10%
Summary for Fair (9 items)			
Sum	*6389*	*100%*	*56.18%*
Good			
7 - 12	1170	41.77%	10.29%
1 - 3	662	23.63%	5.82%
4 - 6	427	15.24%	3.75%
13 - 18	377	13.46%	3.32%
19 - 24	114	4.07%	1.00%
25 - 30	29	1.04%	0.26%
31 - 36	13	0.46%	0.11%
37 - 42	8	0.29%	0.07%

Diameter Class	Total	Percent of Sub-Category Pop.	Percent of Entire Population
43 +	1	0.04%	0.01%
Summary for Good (9 items)			
Sum	*2801*	*100%*	*24.63%*
None			
7 - 12	34	51.52%	0.30%
4 - 6	10	15.15%	0.09%
19 - 24	9	13.64%	0.08%
25 - 30	5	7.58%	0.04%
1 - 3	3	4.55%	0.03%
31 - 36	2	3.03%	0.02%
13 - 18	2	3.03%	0.02%
37 - 42	1	1.52%	0.01%
Summary for None (8 items)			
Sum	*66*	*100%*	*0.58%*
Plant			
N/A	244	100.00%	2.15%
Summary for Plant (1 item)			
Sum	*244*	*100%*	*2.15%*
Poor			
7 - 12	625	35.17%	5.50%
13 - 18	429	24.14%	3.77%
4 - 6	212	11.93%	1.86%
19 - 24	202	11.37%	1.78%
1 - 3	199	11.20%	1.75%
25 - 30	82	4.61%	0.72%
31 - 36	18	1.01%	0.16%
37 - 42	9	0.51%	0.08%
43 +	1	0.06%	0.01%
Summary for Poor (9 items)			
Sum	*1777*	*100%*	*15.63%*
Grand Total	*11372*		

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Dead			
Acer	32	33.68%	0.28%
Pyrus	13	13.68%	0.11%
unknown	12	12.63%	0.11%
Platanus	9	9.47%	0.08%
Pinus	5	5.26%	0.04%
Malus	5	5.26%	0.04%
Zelkova	4	4.21%	0.04%
Tilia	2	2.11%	0.02%
Syringa	2	2.11%	0.02%
Styphnolobium	2	2.11%	0.02%
Liquidambar	2	2.11%	0.02%
Gleditsia	2	2.11%	0.02%
Fraxinus	2	2.11%	0.02%
Prunus	1	1.05%	0.01%
Picea	1	1.05%	0.01%
Cornus	1	1.05%	0.01%
Summary for Dead (16 items)			
Sum	*95*	*100%*	*0.84%*
Fair			
Acer	2006	31.40%	17.64%
Pyrus	1086	17.00%	9.55%
Fraxinus	674	10.55%	5.93%
Tilia	605	9.47%	5.32%
Gleditsia	604	9.45%	5.31%
Zelkova	292	4.57%	2.57%
Quercus	168	2.63%	1.48%
Prunus	163	2.55%	1.43%
Platanus	144	2.25%	1.27%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Syringa	101	1.58%	0.89%
Malus	96	1.50%	0.84%
Pinus	82	1.28%	0.72%
Ulmus	54	0.85%	0.47%
Amelanchier	37	0.58%	0.33%
Carpinus	29	0.45%	0.26%
Styphnolobium	27	0.42%	0.24%
Ailanthus	27	0.42%	0.24%
Liquidambar	24	0.38%	0.21%
Cornus	24	0.38%	0.21%
Robinia	19	0.30%	0.17%
Morus	12	0.19%	0.11%
Tsuga	11	0.17%	0.10%
Betula	11	0.17%	0.10%
Juniperus	10	0.16%	0.09%
Thuja	9	0.14%	0.08%
Catalpa	9	0.14%	0.08%
Fagus	8	0.13%	0.07%
Crataegus	6	0.09%	0.05%
Populus	5	0.08%	0.04%
Magnolia	5	0.08%	0.04%
Ginkgo	5	0.08%	0.04%
Cercidiphyllum	5	0.08%	0.04%
Picea	4	0.06%	0.04%
Metasequoia	4	0.06%	0.04%
Larix	4	0.06%	0.04%
Pseudotsuga	3	0.05%	0.03%
Liriodendron	3	0.05%	0.03%
Phellodendron	2	0.03%	0.02%
Abies	2	0.03%	0.02%
Sorbus	1	0.02%	0.01%
Salix	1	0.02%	0.01%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Juglans	1	0.02%	0.01%
Hibiscus	1	0.02%	0.01%
Cotinus	1	0.02%	0.01%
Cladrastis	1	0.02%	0.01%
Chamaecyparis	1	0.02%	0.01%
Cercis	1	0.02%	0.01%
Aesculus	1	0.02%	0.01%
Summary for Fair (48 items)			
Sum	*6389*	*100%*	*56.18%*
Good			
Acer	721	25.74%	6.34%
Gleditsia	317	11.32%	2.79%
Pyrus	266	9.50%	2.34%
Fraxinus	240	8.57%	2.11%
Platanus	231	8.25%	2.03%
Quercus	194	6.93%	1.71%
Tilia	114	4.07%	1.00%
Prunus	105	3.75%	0.92%
Malus	78	2.78%	0.69%
Syringa	72	2.57%	0.63%
Liquidambar	59	2.11%	0.52%
Robinia	41	1.46%	0.36%
Populus	39	1.39%	0.34%
Pinus	39	1.39%	0.34%
Betula	32	1.14%	0.28%
Ulmus	31	1.11%	0.27%
Thuja	26	0.93%	0.23%
Tsuga	24	0.86%	0.21%
Zelkova	23	0.82%	0.20%
Carpinus	23	0.82%	0.20%
Fagus	19	0.68%	0.17%
Ginkgo	18	0.64%	0.16%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Cornus	15	0.54%	0.13%
Picea	10	0.36%	0.09%
Magnolia	9	0.32%	0.08%
Styphnolobium	6	0.21%	0.05%
Amelanchier	6	0.21%	0.05%
Juniperus	5	0.18%	0.04%
Crataegus	5	0.18%	0.04%
Abies	5	0.18%	0.04%
Pseudotsuga	4	0.14%	0.04%
Liriodendron	4	0.14%	0.04%
Larix	4	0.14%	0.04%
Morus	3	0.11%	0.03%
Cercidiphyllum	3	0.11%	0.03%
Ailanthus	3	0.11%	0.03%
Gymnocladus	2	0.07%	0.02%
Cedrus	2	0.07%	0.02%
Sorbus	1	0.04%	0.01%
Metasequoia	1	0.04%	0.01%
Chamaecyparis	1	0.04%	0.01%
Summary for Good (41 items)			
Sum	*2801*	*100%*	*24.63%*
None			
stump	66	100.00%	0.58%
Summary for None (1 item)			
Sum	*66*	*100%*	*0.58%*
Plant			
vacant	244	100.00%	2.15%
Summary for Plant (1 item)			
Sum	*244*	*100%*	*2.15%*
Poor			
Acer	819	46.09%	7.20%
Pyrus	212	11.93%	1.86%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Tilia	203	11.42%	1.79%
Fraxinus	128	7.20%	1.13%
Zelkova	74	4.16%	0.65%
Prunus	47	2.64%	0.41%
Platanus	44	2.48%	0.39%
Gleditsia	42	2.36%	0.37%
Quercus	28	1.58%	0.25%
Styphnolobium	27	1.52%	0.24%
Syringa	23	1.29%	0.20%
Pinus	22	1.24%	0.19%
Ulmus	15	0.84%	0.13%
Malus	14	0.79%	0.12%
Ailanthus	13	0.73%	0.11%
Liquidambar	8	0.45%	0.07%
Robinia	5	0.28%	0.04%
Catalpa	5	0.28%	0.04%
Betula	5	0.28%	0.04%
Amelanchier	5	0.28%	0.04%
Picea	4	0.23%	0.04%
Liriodendron	4	0.23%	0.04%
Carpinus	4	0.23%	0.04%
Aesculus	4	0.23%	0.04%
Populus	3	0.17%	0.03%
Magnolia	3	0.17%	0.03%
Cornus	3	0.17%	0.03%
Tsuga	2	0.11%	0.02%
Morus	2	0.11%	0.02%
Sorbus	1	0.06%	0.01%
Phellodendron	1	0.06%	0.01%
Koelreuteria	1	0.06%	0.01%
Ginkgo	1	0.06%	0.01%
Crataegus	1	0.06%	0.01%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Corylus	1	0.06%	0.01%
Cladrastis	1	0.06%	0.01%
Cercidiphyllum	1	0.06%	0.01%
Abies	1	0.06%	0.01%
Summary for Poor (38 items)			
Sum	*1777*	*100%*	*15.63%*
Grand Total	*11372*		

Somerville, MA

Frequency Report: Condition by Maintenance

Maintenance	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Dead			
Remove	95	100.00%	0.84%
Summary for Dead (1 item)			
Sum	*95*	*100%*	*0.84%*
Fair			
Maintain	6352	99.42%	55.86%
Remove	37	0.58%	0.33%
Summary for Fair (2 items)			
Sum	*6389*	*100%*	*56.18%*
Good			
Maintain	2800	99.96%	24.62%
Remove	1	0.04%	0.01%
Summary for Good (2 items)			
Sum	*2801*	*100%*	*24.63%*
None			
Remove	66	100.00%	0.58%
Summary for None (1 item)			
Sum	*66*	*100%*	*0.58%*
Plant			
None	244	100.00%	2.15%
Summary for Plant (1 item)			
Sum	*244*	*100%*	*2.15%*
Poor			
Maintain	1042	58.64%	9.16%
Remove	735	41.36%	6.46%
Summary for Poor (2 items)			
Sum	*1777*	*100%*	*15.63%*
Grand Total	*11372*		

Somerville, MA

Quantity Report: Condition (Non-Street Sites)

Condition	*Total*	*Percentage of Entire Population*
Fair	1040	49.24%
Good	863	40.86%
Poor	178	8.43%
Dead	19	0.90%
Plant	7	0.33%
None	5	0.24%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Condition (Street Sites)

Condition	Total	Percentage of Entire Population
Fair	5349	57.76%
Good	1938	20.93%
Poor	1599	17.27%
Plant	237	2.56%
Dead	76	0.82%
None	61	0.66%
Grand Total	*9260*	*100%*

Appendix C
Tree Diameter Frequency Reports

Somerville, MA

Quantity Report: Diameter

Diameter	*Total*	*Percentage of Entire Population*
N/A	244	2.15%
1	222	1.95%
2	557	4.90%
3	771	6.78%
4	381	3.35%
5	437	3.84%
6	478	4.20%
7	958	8.42%
8	625	5.50%
9	1079	9.49%
10	620	5.45%
11	992	8.72%
12	591	5.20%
13	791	6.96%
14	414	3.64%
15	487	4.28%
16	270	2.37%
17	264	2.32%
18	162	1.42%
19	190	1.67%
20	105	0.92%
21	125	1.10%
22	95	0.84%
23	83	0.73%
24	60	0.53%
25	46	0.40%
26	62	0.55%
27	50	0.44%
28	30	0.26%
29	29	0.26%
30	26	0.23%
31	22	0.19%
32	22	0.19%
33	13	0.11%
34	12	0.11%

Diameter	*Total*	*Percentage of Entire Population*
35	8	0.07%
36	8	0.07%
37	3	0.03%
38	6	0.05%
39	5	0.04%
40	4	0.04%
41	9	0.08%
42	3	0.03%
43	3	0.03%
44	3	0.03%
45	1	0.01%
46	1	0.01%
48	3	0.03%
54	1	0.01%
60	1	0.01%
Grand Total	*11372*	*100%*

DAVEY

Somerville, MA

Quantity Report: Diameter Class

Diameter Class	*Total*	*Percentage of Entire Population*
1 - 3	1550	13.63%
4 - 6	1296	11.40%
7 - 12	4865	42.78%
13 - 18	2388	21.00%
19 - 24	658	5.79%
25 - 30	243	2.14%
31 - 36	85	0.75%
37 - 42	30	0.26%
43 +	13	0.11%
N/A	244	2.15%
Grand Total	*11372*	*100%*

Condition	Total	Percent of Sub-Category Pop.	Percent of Entire Population
1 - 3			
Good	662	42.71%	5.82%
Fair	654	42.19%	5.75%
Poor	199	12.84%	1.75%
Dead	32	2.06%	0.28%
None	3	0.19%	0.03%
Summary for 1 - 3 (5 items)			
Sum	*1550*	*100%*	*13.63%*
4 - 6			
Fair	633	48.84%	5.57%
Good	427	32.95%	3.75%
Poor	212	16.36%	1.86%
Dead	14	1.08%	0.12%
None	10	0.77%	0.09%
Summary for 4 - 6 (5 items)			
Sum	*1296*	*100%*	*11.40%*
7 - 12			
Fair	3000	61.66%	26.38%
Good	1170	24.05%	10.29%
Poor	625	12.85%	5.50%
Dead	36	0.74%	0.32%
None	34	0.70%	0.30%
Summary for 7 - 12 (5 items)			
Sum	*4865*	*100%*	*42.78%*
13 - 18			
Fair	1570	65.75%	13.81%
Poor	429	17.96%	3.77%
Good	377	15.79%	3.32%
Dead	10	0.42%	0.09%
None	2	0.08%	0.02%

Condition	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Summary for 13 - 18 (5 items)			
Sum	*2388*	*100%*	*21.00%*
19 - 24			
Fair	331	50.30%	2.91%
Poor	202	30.70%	1.78%
Good	114	17.33%	1.00%
None	9	1.37%	0.08%
Dead	2	0.30%	0.02%
Summary for 19 - 24 (5 items)			
Sum	*658*	*100%*	*5.79%*
25 - 30			
Fair	127	52.26%	1.12%
Poor	82	33.74%	0.72%
Good	29	11.93%	0.26%
None	5	2.06%	0.04%
Summary for 25 - 30 (4 items)			
Sum	*243*	*100%*	*2.14%*
31 - 36			
Fair	51	60.00%	0.45%
Poor	18	21.18%	0.16%
Good	13	15.29%	0.11%
None	2	2.35%	0.02%
Dead	1	1.18%	0.01%
Summary for 31 - 36 (5 items)			
Sum	*85*	*100%*	*0.75%*
37 - 42			
Fair	12	40.00%	0.11%
Poor	9	30.00%	0.08%
Good	8	26.67%	0.07%
None	1	3.33%	0.01%
Summary for 37 - 42 (4 items)			
Sum	*30*	*100%*	*0.26%*
43 +			

Condition	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Fair	11	84.62%	0.10%
Poor	1	7.69%	0.01%
Good	1	7.69%	0.01%
Summary for 43 + (3 items)			
Sum	*13*	*100%*	*0.11%*
N/A			
Plant	244	100.00%	2.15%
Summary for N/A (1 item)			
Sum	*244*	*100%*	*2.15%*
Grand Total	*11372*		

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
1 - 3			
Acer	420	27.10%	3.69%
Pyrus	379	24.45%	3.33%
Syringa	149	9.61%	1.31%
Prunus	67	4.32%	0.59%
Malus	66	4.26%	0.58%
Gleditsia	45	2.90%	0.40%
Populus	44	2.84%	0.39%
Zelkova	43	2.77%	0.38%
Thuja	33	2.13%	0.29%
Carpinus	32	2.06%	0.28%
Cornus	31	2.00%	0.27%
Platanus	28	1.81%	0.25%
Betula	28	1.81%	0.25%
Quercus	25	1.61%	0.22%
Liquidambar	24	1.55%	0.21%
Ulmus	13	0.84%	0.11%
Fraxinus	13	0.84%	0.11%
Magnolia	12	0.77%	0.11%
Pinus	10	0.65%	0.09%
Juniperus	10	0.65%	0.09%
Amelanchier	10	0.65%	0.09%
Picea	8	0.52%	0.07%
Tilia	7	0.45%	0.06%
Fagus	7	0.45%	0.06%
Ginkgo	6	0.39%	0.05%
Morus	5	0.32%	0.04%
unknown	4	0.26%	0.04%
Liriodendron	4	0.26%	0.04%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Crataegus	4	0.26%	0.04%
Cercidiphyllum	4	0.26%	0.04%
stump	3	0.19%	0.03%
Robinia	3	0.19%	0.03%
Ailanthus	3	0.19%	0.03%
Chamaecyparis	2	0.13%	0.02%
Cedrus	2	0.13%	0.02%
Styphnolobium	1	0.06%	0.01%
Koelreuteria	1	0.06%	0.01%
Hibiscus	1	0.06%	0.01%
Cotinus	1	0.06%	0.01%
Catalpa	1	0.06%	0.01%
Aesculus	1	0.06%	0.01%
Summary for 1 - 3 (41 items)			
Sum	*1550*	*100%*	*13.63%*
4 - 6			
Acer	363	28.01%	3.19%
Pyrus	214	16.51%	1.88%
Fraxinus	122	9.41%	1.07%
Prunus	85	6.56%	0.75%
Malus	84	6.48%	0.74%
Gleditsia	60	4.63%	0.53%
Zelkova	57	4.40%	0.50%
Syringa	48	3.70%	0.42%
Quercus	42	3.24%	0.37%
Platanus	33	2.55%	0.29%
Tilia	32	2.47%	0.28%
Liquidambar	29	2.24%	0.26%
Amelanchier	19	1.47%	0.17%
Carpinus	16	1.23%	0.14%
Ulmus	14	1.08%	0.12%
stump	10	0.77%	0.09%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Ginkgo	10	0.77%	0.09%
Cornus	10	0.77%	0.09%
Liriodendron	5	0.39%	0.04%
Robinia	4	0.31%	0.04%
Pinus	4	0.31%	0.04%
Fagus	4	0.31%	0.04%
Betula	4	0.31%	0.04%
unknown	3	0.23%	0.03%
Styphnolobium	3	0.23%	0.03%
Morus	3	0.23%	0.03%
Tsuga	2	0.15%	0.02%
Magnolia	2	0.15%	0.02%
Crataegus	2	0.15%	0.02%
Catalpa	2	0.15%	0.02%
Abies	2	0.15%	0.02%
Sorbus	1	0.08%	0.01%
Salix	1	0.08%	0.01%
Pseudotsuga	1	0.08%	0.01%
Picea	1	0.08%	0.01%
Corylus	1	0.08%	0.01%
Cercis	1	0.08%	0.01%
Cercidiphyllum	1	0.08%	0.01%
Ailanthus	1	0.08%	0.01%
Summary for 4 - 6 (39 items)			
Sum	*1296*	*100%*	*11.40%*
7 - 12			
Acer	1559	32.05%	13.71%
Pyrus	785	16.14%	6.90%
Fraxinus	670	13.77%	5.89%
Gleditsia	460	9.46%	4.05%
Tilia	359	7.38%	3.16%
Platanus	219	4.50%	1.93%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Zelkova	171	3.51%	1.50%
Prunus	145	2.98%	1.28%
Quercus	76	1.56%	0.67%
Pinus	59	1.21%	0.52%
Styphnolobium	48	0.99%	0.42%
Liquidambar	40	0.82%	0.35%
Malus	39	0.80%	0.34%
stump	34	0.70%	0.30%
Tsuga	32	0.66%	0.28%
Ulmus	24	0.49%	0.21%
Robinia	24	0.49%	0.21%
Amelanchier	19	0.39%	0.17%
Ailanthus	17	0.35%	0.15%
Betula	11	0.23%	0.10%
Carpinus	7	0.14%	0.06%
Morus	6	0.12%	0.05%
Fagus	6	0.12%	0.05%
Crataegus	6	0.12%	0.05%
Juniperus	5	0.10%	0.04%
Ginkgo	5	0.10%	0.04%
Abies	5	0.10%	0.04%
Picea	4	0.08%	0.04%
unknown	3	0.06%	0.03%
Pseudotsuga	3	0.06%	0.03%
Magnolia	3	0.06%	0.03%
Catalpa	3	0.06%	0.03%
Sorbus	2	0.04%	0.02%
Metasequoia	2	0.04%	0.02%
Liriodendron	2	0.04%	0.02%
Gymnocladus	2	0.04%	0.02%
Cornus	2	0.04%	0.02%
Cercidiphyllum	2	0.04%	0.02%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Thuja	1	0.02%	0.01%
Syringa	1	0.02%	0.01%
Populus	1	0.02%	0.01%
Phellodendron	1	0.02%	0.01%
Larix	1	0.02%	0.01%
Cladrastis	1	0.02%	0.01%

Summary for 7 - 12 (44 items)

Sum	*4865*	*100%*	*42.78%*

13 - 18

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Acer	760	31.83%	6.68%
Tilia	364	15.24%	3.20%
Gleditsia	363	15.20%	3.19%
Pyrus	194	8.12%	1.71%
Fraxinus	186	7.79%	1.64%
Platanus	120	5.03%	1.06%
Zelkova	118	4.94%	1.04%
Quercus	104	4.36%	0.91%
Pinus	58	2.43%	0.51%
Robinia	27	1.13%	0.24%
Ulmus	20	0.84%	0.18%
Prunus	13	0.54%	0.11%
Ailanthus	13	0.54%	0.11%
Styphnolobium	10	0.42%	0.09%
Picea	4	0.17%	0.04%
Malus	4	0.17%	0.04%
Larix	4	0.17%	0.04%
Tsuga	3	0.13%	0.03%
Metasequoia	3	0.13%	0.03%
Catalpa	3	0.13%	0.03%
Betula	3	0.13%	0.03%
unknown	2	0.08%	0.02%
stump	2	0.08%	0.02%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Pseudotsuga	2	0.08%	0.02%
Cercidiphyllum	2	0.08%	0.02%
Thuja	1	0.04%	0.01%
Phellodendron	1	0.04%	0.01%
Morus	1	0.04%	0.01%
Ginkgo	1	0.04%	0.01%
Cladrastis	1	0.04%	0.01%
Abies	1	0.04%	0.01%
Summary for 13 - 18 (31 items)			
Sum	*2388*	*100%*	*21.00%*
19 - 24			
Acer	310	47.11%	2.73%
Tilia	100	15.20%	0.88%
Quercus	72	10.94%	0.63%
Fraxinus	39	5.93%	0.34%
Gleditsia	35	5.32%	0.31%
Platanus	24	3.65%	0.21%
Pinus	16	2.43%	0.14%
stump	9	1.37%	0.08%
Robinia	7	1.06%	0.06%
Ailanthus	7	1.06%	0.06%
Prunus	6	0.91%	0.05%
Fagus	5	0.76%	0.04%
Zelkova	4	0.61%	0.04%
Ulmus	4	0.61%	0.04%
Pyrus	4	0.61%	0.04%
Catalpa	3	0.46%	0.03%
Picea	2	0.30%	0.02%
Larix	2	0.30%	0.02%
Ginkgo	2	0.30%	0.02%
Betula	2	0.30%	0.02%
Pseudotsuga	1	0.15%	0.01%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Populus	1	0.15%	0.01%
Phellodendron	1	0.15%	0.01%
Morus	1	0.15%	0.01%
Juglans	1	0.15%	0.01%
Summary for 19 - 24 (25 items)			
Sum	*658*	*100%*	*5.79%*
25 - 30			
Acer	127	52.26%	1.12%
Tilia	47	19.34%	0.41%
Quercus	33	13.58%	0.29%
Ulmus	9	3.70%	0.08%
Fraxinus	7	2.88%	0.06%
stump	5	2.06%	0.04%
Fagus	4	1.65%	0.04%
Gleditsia	2	0.82%	0.02%
Aesculus	2	0.82%	0.02%
Populus	1	0.41%	0.01%
Platanus	1	0.41%	0.01%
Pinus	1	0.41%	0.01%
Larix	1	0.41%	0.01%
Catalpa	1	0.41%	0.01%
Carpinus	1	0.41%	0.01%
Ailanthus	1	0.41%	0.01%
Summary for 25 - 30 (16 items)			
Sum	*243*	*100%*	*2.14%*
31 - 36			
Acer	32	37.65%	0.28%
Quercus	21	24.71%	0.18%
Tilia	13	15.29%	0.11%
Ulmus	6	7.06%	0.05%
Fraxinus	5	5.88%	0.04%
stump	2	2.35%	0.02%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Pyrus	1	1.18%	0.01%
Platanus	1	1.18%	0.01%
Morus	1	1.18%	0.01%
Fagus	1	1.18%	0.01%
Catalpa	1	1.18%	0.01%
Ailanthus	1	1.18%	0.01%
Summary for 31 - 36 (12 items)			
Sum	*85*	*100%*	*0.75%*
37 - 42			
Quercus	13	43.33%	0.11%
Ulmus	5	16.67%	0.04%
Acer	5	16.67%	0.04%
Tilia	2	6.67%	0.02%
Aesculus	2	6.67%	0.02%
stump	1	3.33%	0.01%
Platanus	1	3.33%	0.01%
Fraxinus	1	3.33%	0.01%
Summary for 37 - 42 (8 items)			
Sum	*30*	*100%*	*0.26%*
43 +			
Ulmus	5	38.46%	0.04%
Quercus	4	30.77%	0.04%
Acer	2	15.38%	0.02%
Platanus	1	7.69%	0.01%
Fraxinus	1	7.69%	0.01%
Summary for 43 + (5 items)			
Sum	*13*	*100%*	*0.11%*
N/A			
vacant	244	100.00%	2.15%
Summary for N/A (1 item)			
Sum	*244*	*100%*	*2.15%*
Grand Total	*11372*		

Somerville, MA

Frequency Report: Diameter Class by Maintenance

Maintenance	Total	Percent of Sub-Category Pop.	Percent of Entire Population
1 - 3			
Maintain	1424	91.87%	12.52%
Remove	126	8.13%	1.11%
Summary for 1 - 3 (2 items)			
Sum	*1550*	*100%*	*13.63%*
4 - 6			
Maintain	1181	91.13%	10.39%
Remove	115	8.87%	1.01%
Summary for 4 - 6 (2 items)			
Sum	*1296*	*100%*	*11.40%*
7 - 12			
Maintain	4545	93.42%	39.97%
Remove	320	6.58%	2.81%
Summary for 7 - 12 (2 items)			
Sum	*4865*	*100%*	*42.78%*
13 - 18			
Maintain	2210	92.55%	19.43%
Remove	178	7.45%	1.57%
Summary for 13 - 18 (2 items)			
Sum	*2388*	*100%*	*21.00%*
19 - 24			
Maintain	538	81.76%	4.73%
Remove	120	18.24%	1.06%
Summary for 19 - 24 (2 items)			
Sum	*658*	*100%*	*5.79%*
25 - 30			
Maintain	188	77.37%	1.65%
Remove	55	22.63%	0.48%
Summary for 25 - 30 (2 items)			
Sum	*243*	*100%*	*2.14%*

Maintenance	Total	Percent of Sub-Category Pop.	Percent of Entire Population
31 - 36			
Maintain	71	83.53%	0.62%
Remove	14	16.47%	0.12%
Summary for 31 - 36 (2 items)			
Sum	*85*	*100%*	*0.75%*
37 - 42			
Maintain	24	80.00%	0.21%
Remove	6	20.00%	0.05%
Summary for 37 - 42 (2 items)			
Sum	*30*	*100%*	*0.26%*
43 +			
Maintain	13	100.00%	0.11%
Summary for 43 + (1 item)			
Sum	*13*	*100%*	*0.11%*
N/A			
None	244	100.00%	2.15%
Summary for N/A (1 item)			
Sum	*244*	*100%*	*2.15%*
Grand Total	*11372*		

DAVEY

Somerville, MA

Quantity Report: Diameter Class (Non-Street Sites)

Diameter Class	*Total*	*Percentage of Entire Population*
1 - 3	430	20.36%
4 - 6	283	13.40%
7 - 12	756	35.80%
13 - 18	427	20.22%
19 - 24	132	6.25%
25 - 30	46	2.18%
31 - 36	19	0.90%
37 - 42	10	0.47%
43 +	2	0.09%
N/A	7	0.33%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Diameter Class (Street Sites)

Diameter Class	*Total*	*Percentage of Entire Population*
1 - 3	1120	12.10%
4 - 6	1013	10.94%
7 - 12	4109	44.37%
13 - 18	1961	21.18%
19 - 24	526	5.68%
25 - 30	197	2.13%
31 - 36	66	0.71%
37 - 42	20	0.22%
43 +	11	0.12%
N/A	237	2.56%
Grand Total	*9260*	*100%*

Appendix D
Tree Maintenance Frequency Reports

DAVEY

Somerville, MA

Maintenance/DBH Class Matrix Report

Maintenance	*N/A*	*1 - 3*	*4 - 6*	*7 - 12*	*13 - 18*	*19 - 24*	*25 - 30*	*31 - 36*	*37 - 42*	*43 +*	*TOTAL*
Maintain		1424	1181	4545	2210	538	188	71	24	13	10194
None	244										244
Remove		126	115	320	178	120	55	14	6		934
Grand Total	*244*	*1550*	*1296*	*4865*	*2388*	*658*	*243*	*85*	*30*	*13*	*11372*

DAVEY

Somerville, MA

Quantity Report: Maintenance

Maintenance	Total	Percentage of Entire Population
Maintain	10194	89.64%
Remove	934	8.21%
None	244	2.15%
Grand Total	*11372*	*100%*

DAVEY

Somerville, MA

Frequency Report: Maintenance by Condition

Condition	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Maintain			
Fair	6352	62.31%	55.86%
Good	2800	27.47%	24.62%
Poor	1042	10.22%	9.16%
Summary for Maintain (3 items)			
Sum	*10194*	*100%*	*89.64%*
None			
Plant	244	100.00%	2.15%
Summary for None (1 item)			
Sum	*244*	*100%*	*2.15%*
Remove			
Poor	735	78.69%	6.46%
Dead	95	10.17%	0.84%
None	66	7.07%	0.58%
Fair	37	3.96%	0.33%
Good	1	0.11%	0.01%
Summary for Remove (5 items)			
Sum	*934*	*100%*	*8.21%*
Grand Total	*11372*		

Somerville, MA

Frequency Report: Maintenance by Diameter Class

Diameter Class	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Maintain			
7 - 12	4545	44.59%	39.97%
13 - 18	2210	21.68%	19.43%
1 - 3	1424	13.97%	12.52%
4 - 6	1181	11.59%	10.39%
19 - 24	538	5.28%	4.73%
25 - 30	188	1.84%	1.65%
31 - 36	71	0.70%	0.62%
37 - 42	24	0.24%	0.21%
43 +	13	0.13%	0.11%
Summary for Maintain (9 items)			
Sum	*10194*	*100%*	*89.64%*
None			
N/A	244	100.00%	2.15%
Summary for None (1 item)			
Sum	*244*	*100%*	*2.15%*
Remove			
7 - 12	320	34.26%	2.81%
13 - 18	178	19.06%	1.57%
1 - 3	126	13.49%	1.11%
19 - 24	120	12.85%	1.06%
4 - 6	115	12.31%	1.01%
25 - 30	55	5.89%	0.48%
31 - 36	14	1.50%	0.12%
37 - 42	6	0.64%	0.05%
Summary for Remove (8 items)			
Sum	*934*	*100%*	*8.21%*
Grand Total	*11372*		

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Maintain			
Acer	3162	31.02%	27.81%
Pyrus	1475	14.47%	12.97%
Fraxinus	995	9.76%	8.75%
Gleditsia	948	9.30%	8.34%
Tilia	858	8.42%	7.54%
Platanus	401	3.93%	3.53%
Quercus	380	3.73%	3.34%
Zelkova	361	3.54%	3.17%
Prunus	292	2.86%	2.57%
Syringa	189	1.85%	1.66%
Malus	182	1.79%	1.60%
Pinus	136	1.33%	1.20%
Ulmus	89	0.87%	0.78%
Liquidambar	87	0.85%	0.77%
Robinia	59	0.58%	0.52%
Carpinus	55	0.54%	0.48%
Styphnolobium	47	0.46%	0.41%
Populus	47	0.46%	0.41%
Betula	46	0.45%	0.40%
Amelanchier	46	0.45%	0.40%
Cornus	42	0.41%	0.37%
Tsuga	37	0.36%	0.33%
Thuja	35	0.34%	0.31%
Fagus	27	0.26%	0.24%
Ginkgo	24	0.24%	0.21%
Ailanthus	23	0.23%	0.20%
Picea	18	0.18%	0.16%
Morus	15	0.15%	0.13%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Magnolia	15	0.15%	0.13%
Juniperus	15	0.15%	0.13%
Crataegus	11	0.11%	0.10%
Catalpa	11	0.11%	0.10%
Liriodendron	8	0.08%	0.07%
Larix	8	0.08%	0.07%
Cercidiphyllum	8	0.08%	0.07%
Pseudotsuga	7	0.07%	0.06%
Abies	7	0.07%	0.06%
Metasequoia	5	0.05%	0.04%
Sorbus	3	0.03%	0.03%
Phellodendron	3	0.03%	0.03%
Aesculus	3	0.03%	0.03%
Gymnocladus	2	0.02%	0.02%
Chamaecyparis	2	0.02%	0.02%
Cedrus	2	0.02%	0.02%
Salix	1	0.01%	0.01%
Koelreuteria	1	0.01%	0.01%
Juglans	1	0.01%	0.01%
Hibiscus	1	0.01%	0.01%
Cotinus	1	0.01%	0.01%
Corylus	1	0.01%	0.01%
Cladrastis	1	0.01%	0.01%
Cercis	1	0.01%	0.01%
Summary for Maintain (52 items)			
Sum	*10194*	*100%*	*89.64%*
None			
vacant	244	100.00%	2.15%
Summary for None (1 item)			
Sum	*244*	*100%*	*2.15%*
Remove			
Acer	416	44.54%	3.66%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Pyrus	102	10.92%	0.90%
Tilia	66	7.07%	0.58%
stump	66	7.07%	0.58%
Fraxinus	49	5.25%	0.43%
Zelkova	32	3.43%	0.28%
Platanus	27	2.89%	0.24%
Prunus	24	2.57%	0.21%
Ailanthus	20	2.14%	0.18%
Gleditsia	17	1.82%	0.15%
Styphnolobium	15	1.61%	0.13%
unknown	12	1.28%	0.11%
Pinus	12	1.28%	0.11%
Ulmus	11	1.18%	0.10%
Malus	11	1.18%	0.10%
Quercus	10	1.07%	0.09%
Syringa	9	0.96%	0.08%
Robinia	6	0.64%	0.05%
Liquidambar	6	0.64%	0.05%
Liriodendron	3	0.32%	0.03%
Catalpa	3	0.32%	0.03%
Morus	2	0.21%	0.02%
Magnolia	2	0.21%	0.02%
Betula	2	0.21%	0.02%
Amelanchier	2	0.21%	0.02%
Aesculus	2	0.21%	0.02%
Picea	1	0.11%	0.01%
Crataegus	1	0.11%	0.01%
Cornus	1	0.11%	0.01%
Cladrastis	1	0.11%	0.01%
Cercidiphyllum	1	0.11%	0.01%
Carpinus	1	0.11%	0.01%
Abies	1	0.11%	0.01%

Genus	Total	Percent of Sub-Category Pop.	Percent of Entire Population
Summary for Remove (33 items)			
Sum	934	100%	8.21%
Grand Total	11372		

Somerville, MA

Quantity Report: Maintenance (Non-Street Sites)

Maintenance	Total	Percentage of Entire Population
Maintain	1989	94.18%
Remove	116	5.49%
None	7	0.33%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Maintenance (Street Sites)

Maintenance	*Total*	*Percentage of Entire Population*
Maintain	8205	88.61%
Remove	818	8.83%
None	237	2.56%
Grand Total	*9260*	*100%*

Appendix E
Risk Rating Frequency Reports

Somerville, MA

Quantity Report: Hazard Rating

Hazard Rating	*Total*	*Percentage of Entire Population*
5	4274	37.58%
4	3009	26.46%
6	2141	18.83%
7	994	8.74%
8	413	3.63%
N/A	310	2.73%
9	160	1.41%
10	40	0.35%
3	24	0.21%
11	7	0.06%
Grand Total	*11372*	*100%*

Somerville, MA

Frequency Report: Hazard Rating by Maintenance

Maintenance	*Total*	*Percent of Sub-Category Pop.*	*Percent of Entire Population*
N/A			
None	244	78.71%	2.15%
Remove	66	21.29%	0.58%
Summary for 0 (2 items)			
Sum	*310*	*100%*	*2.73%*
3			
Maintain	23	95.83%	0.20%
Remove	1	4.17%	0.01%
Summary for 3 (2 items)			
Sum	*24*	*100%*	*0.21%*
4			
Maintain	2989	99.34%	26.28%
Remove	20	0.66%	0.18%
Summary for 4 (2 items)			
Sum	*3009*	*100%*	*26.46%*
5			
Maintain	4219	98.71%	37.10%
Remove	55	1.29%	0.48%
Summary for 5 (2 items)			
Sum	*4274*	*100%*	*37.58%*
6			
Maintain	1972	92.11%	17.34%
Remove	169	7.89%	1.49%
Summary for 6 (2 items)			
Sum	*2141*	*100%*	*18.83%*
7			
Maintain	759	76.36%	6.67%
Remove	235	23.64%	2.07%
Summary for 7 (2 items)			
Sum	*994*	*100%*	*8.74%*

Maintenance	Total	Percent of Sub-Category Pop.	Percent of Entire Population
8			
Remove	224	54.24%	1.97%
Maintain	189	45.76%	1.66%
Summary for 8 (2 items)			
Sum	*413*	*100%*	*3.63%*
9			
Remove	124	77.50%	1.09%
Maintain	36	22.50%	0.32%
Summary for 9 (2 items)			
Sum	*160*	*100%*	*1.41%*
10			
Remove	35	87.50%	0.31%
Maintain	5	12.50%	0.04%
Summary for 10 (2 items)			
Sum	*40*	*100%*	*0.35%*
11			
Remove	5	71.43%	0.04%
Maintain	2	28.57%	0.02%
Summary for 11 (2 items)			
Sum	*7*	*100%*	*0.06%*
Grand Total	*11372*		

Somerville, MA

Quantity Report: Hazard Rating (Non-Street Sites)

Hazard Rating	*Total*	*Percentage of Entire Population*
5	1227	58.10%
6	466	22.06%
4	208	9.85%
7	157	7.43%
8	27	1.28%
9	13	0.62%
N/A	12	0.57%
10	1	0.05%
3	1	0.05%
Grand Total	*2112*	*100%*

Somerville, MA

Quantity Report: Hazard Rating (Street Sites)

Hazard Rating	Total	Percentage of Entire Population
5	3047	32.90%
4	2801	30.25%
6	1675	18.09%
7	837	9.04%
8	386	4.17%
N/A	298	3.22%
9	147	1.59%
10	39	0.42%
3	23	0.25%
11	7	0.08%
Grand Total	*9260*	*100%*

Appendix F
Additional Consult, Weak Fork, Cavity, Percentage Deadwood Reports

Somerville, MA

Quantity Report: Cavity Present

Cavity Present	Total	Percentage of Entire Population
No	9696	85.26%
Yes	1676	14.74%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: MT CLEAN

MT CLEAN	*Total*	*Percentage of Entire Population*
No	8996	79.11%
Yes	2376	20.89%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Consult

Consult	Total	Percentage of Entire Population
No	11249	98.92%
Yes	123	1.08%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: MT Ground Level

MT Ground Level	*Total*	*Percentage of Entire Population*
No	10778	94.78%
Yes	594	5.22%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Percentage Dead Wood

Percentage Dead Wood	Total	Percentage of Entire Population
None	7111	62.53%
0 - 25	3540	31.13%
26 - 50	416	3.66%
76 - 100	192	1.69%
51 - 75	113	0.99%
Grand Total	*11372*	*100%*

DAVEY

Somerville, MA

Quantity Report: MT RAISE

MT RAISE	Total	Percentage of Entire Population
No	7272	63.95%
Yes	4100	36.05%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: MT REDUCE

MT REDUCE	Total	Percentage of Entire Population
No	10478	92.14%
Yes	894	7.86%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Weak Fork

Weak Fork	Total	Percentage of Entire Population
No	8651	76.07%
Yes	2721	23.93%
Grand Total	*11372*	*100%*

Appendix G
Growing Space Type/Size Frequency Reports

Somerville, MA

Quantity Report: Area

Area	Total	Percentage of Entire Population
6	2070	18.20%
1	1975	17.37%
3	1664	14.63%
7	1588	13.96%
2	1573	13.83%
5	1346	11.84%
4	1156	10.17%
Grand Total	*11372*	*100%*

DAVEY

Somerville, MA

Quantity Report: Location Type

Location Type	Total	Percentage of Entire Population
Street	9230	81.16%
Park or Public Space	2112	18.57%
Borderline	30	0.26%
Grand Total	*11372*	*100%*

DAVEY

Somerville, MA

Quantity Report: Planting Location

Planting Location	Total	Percentage of Entire Population
Above 4	1503	13.22%
Below 4	190	1.67%
Open or Unrestricted	1360	11.96%
Tree Pit or Planter	8319	73.15%
Grand Total	*11372*	*100%*

ON_STREET	Total	Percentage of Entire Population
BROADWAY	438	3.85%
HIGHLAND AVE	224	1.97%
SOMERVILLE AVE	200	1.76%
POWDER HOUSE BOULEVARD	195	1.71%
NATHAN TUFTS/POWDERHOUSE PARK	171	1.50%
COMMUNITY PATH	162	1.42%
ALEWIFE BROOK PARKWAY	151	1.33%
CONWAY PARK	136	1.20%
PEARL ST	135	1.19%
FOSS PARK	133	1.17%
WASHINGTON ST	124	1.09%
MEDFORD ST	118	1.04%
WILLOW AVE	117	1.03%
SUMMER ST	114	1.00%
ALEWIFE LINEAR PARK	114	1.00%
SOMERVILLE HIGH SCHOOL	106	0.93%
LOWELL ST	101	0.89%
INNER BELT RD	92	0.81%
PROSPECT HILL PARK	90	0.79%
WALNUT ST	85	0.75%
EDWARD LEATHERS PARK	83	0.73%
SOMERVILLE LIBRARY	80	0.70%
GLEN PARK/JAMES MCCARTHY FIELD	78	0.69%
HIGHLAND RD	75	0.66%
LINCOLN PARK	72	0.63%
BEACON ST	71	0.62%
CENTRAL ST	69	0.61%
ELM ST	67	0.59%
LINWOOD ST	65	0.57%
SEVEN HILLS PARK	62	0.55%
SCHOOL ST	62	0.55%
PERRY PARK	61	0.54%
CEDAR ST	59	0.52%
PENNSYLVANIA AVE	57	0.50%
MORRISON AVE	57	0.50%

ON_STREET	Total	Percentage of Entire Population
HOLLAND ST	57	0.50%
ALBION ST	57	0.50%
GLEN ST	56	0.49%
FRANKLIN ST	56	0.49%
COLLEGE AVE	56	0.49%
ORCHARD ST	54	0.47%
FELLSWAY WEST	53	0.47%
POWDERHOUSE SCHOOL PLGD	52	0.46%
JAQUES ST	52	0.46%
PACKARD AVE	51	0.45%
COLUMBUS AVE	51	0.45%
EAST SOMERVILLE SCHOOL PLGD	50	0.44%
ROGERS AVE	49	0.43%
WINTER HILL SCHOOL PLGD	48	0.42%
KENNEDY SCHOOL PLGD	48	0.42%
OSSIPEE RD	47	0.41%
JOSEPHINE AVE	47	0.41%
BOSTON AVE	47	0.41%
GLENWOOD RD	46	0.40%
WALLACE ST	45	0.40%
OXFORD ST	45	0.40%
HANCOCK ST	44	0.39%
TEMPLE ST	43	0.38%
PUTNAM ST	43	0.38%
NORTH ST	43	0.38%
MUNROE ST	43	0.38%
MARSHALL ST	43	0.38%
HUDSON ST	43	0.38%
PORTER ST	42	0.37%
KENNEY PARK	42	0.37%
CROSS ST	41	0.36%
PERKINS ST	40	0.35%
MYRTLE ST	40	0.35%
HEATH ST	40	0.35%
BROMFIELD RD	40	0.35%
BOSTON ST	40	0.35%
FLINT ST	39	0.34%
GILMAN ST	38	0.33%

ON_STREET	Total	Percentage of Entire Population
DARTMOUTH ST	37	0.33%
CONCORD AVE	37	0.33%
CAMERON AVE	37	0.33%
BARTLETT ST	37	0.33%
ARGENZIANO SCHOOL	37	0.33%
UNION SQUARE	36	0.32%
PROFESSORS ROW	36	0.32%
PEARSON RD	36	0.32%
PEARSON AVE	36	0.32%
PARTRIDGE AVE	36	0.32%
ELECTRIC AVE	36	0.32%
LOWDEN AVE	35	0.31%
HEALY SCHOOL COMMUNITY PLGD	35	0.31%
CHANDLER ST	35	0.31%
BAY STATE AVE	35	0.31%
THURSTON ST	34	0.30%
MIDDLESEX AVE	34	0.30%
McGRATH HIGHWAY	34	0.30%
CHURCH ST	34	0.30%
MT VERNON ST	33	0.29%
LINDEN AVE	33	0.29%
VINAL AVE	32	0.28%
TUFTS ST	32	0.28%
SYCAMORE ST	32	0.28%
RUSSELL ST	32	0.28%
MYSTIC VALLEY PARKWAY	32	0.28%
KIDDER AVE	32	0.28%
IRVING ST	32	0.28%
BANKS ST	32	0.28%
WEBSTER AVE	29	0.26%
RAYMOND AVE	29	0.26%
PRESCOTT ST	29	0.26%
MORELAND ST	29	0.26%
EDGAR AVE	29	0.26%
CRAIGIE ST	29	0.26%
WHITFIELD RD	28	0.25%
TEN HILLS RD	28	0.25%
SOUTH ST	28	0.25%

ON_STREET	Total	Percentage of Entire Population
GORDON ST	28	0.25%
COTTAGE AVE	28	0.25%
CENTRAL HILL PARK	28	0.25%
BOW ST	28	0.25%
WINSLOW AVE	27	0.24%
RUSH ST	27	0.24%
GREENVILLE ST	27	0.24%
ELMWOOD ST	27	0.24%
DANA ST	27	0.24%
CUTLER ST	27	0.24%
W. SOMERVILLE SCHOOL PLGD	26	0.23%
VICTORIA ST	26	0.23%
PRICHARD AVE	26	0.23%
PINCKNEY ST	26	0.23%
HOYT-SULLIVAN PLGD	26	0.23%
BRASTOW AVE	26	0.23%
SIMPSON AVE	25	0.22%
HOLYOKE RD	25	0.22%
HARVARD ST	25	0.22%
PAULINA ST	24	0.21%
OTIS ST	24	0.21%
MYSTIC AVE	24	0.21%
MEACHAM ST	24	0.21%
LEXINGTON AVE	24	0.21%
GRANT ST	24	0.21%
DELL ST	24	0.21%
WIGGLESWORTH ST	23	0.20%
WALKER ST	23	0.20%
ST JAMES AVE	23	0.20%
PRESTON RD	23	0.20%
CONWELL AVE	23	0.20%
CHERRY ST	23	0.20%
TENNYSON ST	22	0.19%
CITY HALL	22	0.19%
BERKELEY ST	22	0.19%
AVON ST	22	0.19%
ADAMS ST	22	0.19%
TREMONT ST	21	0.18%

ON_STREET	Total	Percentage of Entire Population
RICHDALE AVE	21	0.18%
PURITAN RD	21	0.18%
PROSPECT ST	21	0.18%
PROSPECT HILL AVE	21	0.18%
MARSHALL STREET PLGD	21	0.18%
HENERY HANSEN PARK	21	0.18%
FIRE STATION	21	0.18%
DERBY ST	21	0.18%
CROSS ST EAST	21	0.18%
CORINTHIAN RD	21	0.18%
TEMPLE RD	20	0.18%
SPENCER AVE	20	0.18%
LIBERTY AVE	20	0.18%
BELMONT ST	20	0.18%
WISCONSIN AVE	19	0.17%
SUNSET ROAD	19	0.17%
ROBINSON ST	19	0.17%
PERRY ST	19	0.17%
OAK ST	19	0.17%
CLARENDON AVE	19	0.17%
CHESTNUT ST	19	0.17%
BURNSIDE AVE	19	0.17%
WATERHOUSE ST	18	0.16%
RUSSELL RD	18	0.16%
QUINCY ST PARK	18	0.16%
PARK ST	18	0.16%
MONTROSE ST	18	0.16%
LINCOLN ST	18	0.16%
HOWARD ST	18	0.16%
HOUGHTON ST	18	0.16%
FREMONT AVE	18	0.16%
FLORENCE ST	18	0.16%
DAVIS SQUARE	18	0.16%
CURTIS AVE	18	0.16%
BROWNING RD	18	0.16%
SARGENT AVE	17	0.15%
ROSSMORE ST	17	0.15%
NORFORK ST	17	0.15%

ON_STREET	Total	Percentage of Entire Population
MINNESOTA AVE	17	0.15%
MICHIGAN AVE	17	0.15%
ENDICOTT AVE	17	0.15%
DIMICK ST	17	0.15%
AMES ST	17	0.15%
ADRIAN ST	17	0.15%
SUMMIT AVE	16	0.14%
STERLING ST	16	0.14%
QUINCY ST	16	0.14%
POWDER HOUSE TERRACE	16	0.14%
OLIVER ST	16	0.14%
NEWBURY ST	16	0.14%
MARION ST	16	0.14%
LAUREL ST	16	0.14%
JACKSON RD	16	0.14%
HARRISON ST	16	0.14%
FOSKET ST	16	0.14%
EVERGREEN AVE	16	0.14%
DICKINSON ST	16	0.14%
CUTTER AVE	16	0.14%
CROCKER ST	16	0.14%
BUENA VISTA ROAD	16	0.14%
BONAIR ST	16	0.14%
BARTON ST	16	0.14%
ATHERTON ST	16	0.14%
ALDRICH ST	16	0.14%
ALDERSEY ST	16	0.14%
WINDSOR RD	15	0.13%
WESTSIDE LIBRARY	15	0.13%
WEST ST	15	0.13%
TUFTS COMMUNITY GARDEN	15	0.13%
TEELE AVE	15	0.13%
NORWOOD AVE	15	0.13%
McARTHUR ST	15	0.13%
IVALOO ST	15	0.13%
IRVINGTON ROAD	15	0.13%
GRANITE ST	15	0.13%
GORHAM ST	15	0.13%

ON_STREET	Total	Percentage of Entire Population
GIBBENS ST	15	0.13%
APPLETON ST	15	0.13%
WOODS AVE	14	0.12%
WHEATLAND ST	14	0.12%
TRULL ST	14	0.12%
MEAD ST	14	0.12%
MADISON ST	14	0.12%
LESLEY AVE	14	0.12%
ILLINOIS AVE	14	0.12%
HENRY AVE	14	0.12%
GRAND VIEW AVE	14	0.12%
FRANCESCA AVE	14	0.12%
FAIRMOUNT AVE	14	0.12%
FAIRFAX ST	14	0.12%
WOODSTOCK PLAYGROUND	13	0.11%
WARNER ST	13	0.11%
SEWALL ST	13	0.11%
ROSE ST	13	0.11%
MORSE-KELLEY PLGD	13	0.11%
MEACHAM RD	13	0.11%
INDIANA AVE	13	0.11%
GARFIELD AVE	13	0.11%
DAY ST	13	0.11%
CAMBRIA ST	13	0.11%
BOND ST	13	0.11%
WEBSTER ST	12	0.11%
WARWICK ST	12	0.11%
WARREN AVE	12	0.11%
VIRGINIA ST	12	0.11%
UPLAND ROAD	12	0.11%
TRUM PLAYGROUND	12	0.11%
TOWER ST	12	0.11%
SOMERVILLE JUNCTION PARK	12	0.11%
NUNZIATO FIELD	12	0.11%
NEW WASHINGTON STREET	12	0.11%
MOORE ST	12	0.11%
MAGNUS AVE	12	0.11%
LINCOLN PARKWAY	12	0.11%

ON_STREET	Total	Percentage of Entire Population
LANGMAID AVE	12	0.11%
JAY ST	12	0.11%
HAMILTON RD	12	0.11%
HALL AVE	12	0.11%
CURTIS ST	12	0.11%
CHARNWOOD RD	12	0.11%
BURNHAM ST	12	0.11%
WYATT ST	11	0.10%
WHITMAN ST	11	0.10%
WESTWOOD RD	11	0.10%
STONE PL PARK	11	0.10%
SPRINGFIELD ST	11	0.10%
PUTNAM RD	11	0.10%
PLEASANT AVE	11	0.10%
NEWTON ST	11	0.10%
NEW ROAD	11	0.10%
LORING ST	11	0.10%
HILL ST	11	0.10%
HIGH ST	11	0.10%
HAROLD RD	11	0.10%
HALL ST	11	0.10%
GILMAN TER	11	0.10%
FRANEY RD	11	0.10%
FLORENCE PLAYGOUND	11	0.10%
FENWICK ST	11	0.10%
EVERETT AVE	11	0.10%
DOVER ST	11	0.10%
CLAREMON ST	11	0.10%
CAMPBELL PK	11	0.10%
BRADLEY ST	11	0.10%
BOLTON ST	11	0.10%
BILLINGHAM ST	11	0.10%
BENTON RD	11	0.10%
BAILEY RD	11	0.10%
BAILEY PARK	11	0.10%
ASH AVE	11	0.10%
ARLINGTON ST	11	0.10%
WEST ADAMS ST	10	0.09%

ON_STREET	Total	Percentage of Entire Population
WARE ST	10	0.09%
PROPERZI WAY	10	0.09%
PARKER ST	10	0.09%
MALVERN AVE	10	0.09%
MAIN ST	10	0.09%
LEWIS ST	10	0.09%
KINGSTON ST	10	0.09%
JASPER ST	10	0.09%
GROVE ST	10	0.09%
GREENE ST	10	0.09%
GOV WINTHROP RD	10	0.09%
BROOK ST	10	0.09%
ABERDEEN RD	10	0.09%
YORKTOWN ST	9	0.08%
WILTON ST	9	0.08%
VERNON ST	9	0.08%
SYDNEY ST	9	0.08%
STICKNEY AVE	9	0.08%
SPRING ST	9	0.08%
RADCLIFFE RD	9	0.08%
PEMBROKE ST	9	0.08%
PARKDALE ST	9	0.08%
OSGOOD PARK	9	0.08%
NORTH STREET/VETERANS PLAYGROU	9	0.08%
MERRIAM ST	9	0.08%
MANSFIELD ST	9	0.08%
LEONARD ST	9	0.08%
KNOWLTON ST	9	0.08%
HILLSDALE RD	9	0.08%
HAMMOND ST	9	0.08%
FARRAGUT AVE	9	0.08%
DOW ST	9	0.08%
DICKERMAN PLAYGROUND	9	0.08%
CONWELL ST	9	0.08%
CHAPEL ST	9	0.08%
BAILEY ST	9	0.08%
ALPINE ST	9	0.08%
WILLOUGHBY ST	8	0.07%

ON_STREET	Total	Percentage of Entire Population
THORNDIKE ST	8	0.07%
OAKLAND AVE	8	0.07%
MT PLEASANT ST	8	0.07%
LEXINGTON PARK	8	0.07%
LEE ST	8	0.07%
GARRISON AVE	8	0.07%
FREMONT ST	8	0.07%
EAST LIBRARY	8	0.07%
EARLE STREET	8	0.07%
DANE ST	8	0.07%
CORBETT-MCKENNA PARK	8	0.07%
CONCORD SQUARE	8	0.07%
CLIFTON ST	8	0.07%
CHARLES E RYAN ROAD	8	0.07%
CENTRAL RD	8	0.07%
BUTLER DRIVE	8	0.07%
WHEELER ST	7	0.06%
WATSON ST	7	0.06%
WALDO ST	7	0.06%
STONE AVE	7	0.06%
RHODE ISLAND AVE	7	0.06%
MUSEUM ST	7	0.06%
MONTGOMERY AVE	7	0.06%
JAMES ST	7	0.06%
IBBETSON ST	7	0.06%
HOWE ST	7	0.06%
FOLEY ST	7	0.06%
DELAWARE ST	7	0.06%
DANE AVE	7	0.06%
COLLEGE HILL RD	7	0.06%
BOWDOIN ST	7	0.06%
BIGELOW ST	7	0.06%
WALTER TER	6	0.05%
SUMMIT ST	6	0.05%
SKILTON AVE	6	0.05%
POLICE & FIRE STATION	6	0.05%
PARK AVE	6	0.05%
MINER ST	6	0.05%

ON_STREET	Total	Percentage of Entire Population
MAINE AVE	6	0.05%
KNAPP ST	6	0.05%
JOSEPH ST	6	0.05%
HATHORN ST	6	0.05%
HARRIS PLAYGROUND	6	0.05%
GLENDALE AVE	6	0.05%
GEORGE ST	6	0.05%
ELSTON ST	6	0.05%
ELIOT ST	6	0.05%
DEARBORN RD	6	0.05%
CHETWYND ROAD	6	0.05%
CHESTER ST	6	0.05%
BUCKINGHAM ST	6	0.05%
BROWN SCHOOL PLGD	6	0.05%
BEECH ST	6	0.05%
AUSTIN ST	6	0.05%
ALSTON ST	6	0.05%
WESLEY ST	5	0.04%
VERMONT AVE	5	0.04%
ROBERTS ST	5	0.04%
RICHARDSON ST	5	0.04%
POPLAR ST	5	0.04%
PALMACCI PLAYGROUND	5	0.04%
OTIS PLAYGROUND	5	0.04%
NASHUA ST	5	0.04%
MOSSLAND STREET	5	0.04%
MILTON ST	5	0.04%
MASON ST	5	0.04%
MAPLE AVE	5	0.04%
MALLET ST	5	0.04%
LANDERS ST	5	0.04%
KENWOOD ST	5	0.04%
KENSINGTON AVE	5	0.04%
HOOKER AVE	5	0.04%
HINCKLEY ST	5	0.04%
HARDAN RD	5	0.04%
FORSTER ST	5	0.04%
FLINT AVE	5	0.04%

ON_STREET	Total	Percentage of Entire Population
ESSEX ST	5	0.04%
ELLSWORTH ST	5	0.04%
EDMANDS ST	5	0.04%
EDGAR CT	5	0.04%
DURHAM ST	5	0.04%
DICKSON ST	5	0.04%
CYPRESS ST	5	0.04%
CVS PARKING LOT	5	0.04%
COMMUNITY YOUTH CENTER	5	0.04%
CENTURY ST	5	0.04%
BELKNAP ST	5	0.04%
WOODSTOCK ST	4	0.04%
WINDSOR ST	4	0.04%
WILLIAM ST	4	0.04%
WALNUT STREET PARK	4	0.04%
WALNUT RD	4	0.04%
VILLA AVE	4	0.04%
TRUM FIELD	4	0.04%
TALBOT AVE	4	0.04%
SUNNYSIDE AVE	4	0.04%
SHERMAN CT	4	0.04%
SACRAMENTO ST	4	0.04%
ROSELAND ST	4	0.04%
POWDERHOUSE ROTARY	4	0.04%
PERKINS PLAYGROUND	4	0.04%
MORTON ST	4	0.04%
MELVIN ST	4	0.04%
MELVILLE RD	4	0.04%
HAWKINS ST	4	0.04%
EDGAR TER	4	0.04%
DPW HEADQUARTERS	4	0.04%
CUMMINGS ST	4	0.04%
CONNECTICUT AVE	4	0.04%
CLYDE ST	4	0.04%
CARLTON ST	4	0.04%
BLAKELEY AVE	4	0.04%
AUBURN AVE	4	0.04%
WESTMINSTER ST	3	0.03%

ON_STREET	Total	Percentage of Entire Population
WEST QUINCY	3	0.03%
WESLEY PARK	3	0.03%
TYLER ST	3	0.03%
THIRD AVE	3	0.03%
TAYLOR ST	3	0.03%
NEWBERNE ST	3	0.03%
LINCOLN AVE	3	0.03%
LELAND ST	3	0.03%
KIMBALL ST	3	0.03%
HOMER SQ	3	0.03%
HILLSIDE PARK	3	0.03%
EAST ALBION ST	3	0.03%
DURELL POCKET PARK	3	0.03%
CUMMINGS SCHOOL COMMUNITY PLGD	3	0.03%
CLEVELAND ST	3	0.03%
CLARK ST	3	0.03%
CADY AVE	3	0.03%
BENEDICT ST	3	0.03%
ALLEN ST PARK	3	0.03%
WOODBINE ST	2	0.02%
WELLINGTON AVE	2	0.02%
WALDO AVE	2	0.02%
STONE PL	2	0.02%
SHORE DRIVE	2	0.02%
SANBORN AVE	2	0.02%
PRINCETON ST	2	0.02%
OSGOOD ST	2	0.02%
NO. UNION ST	2	0.02%
NEW HAMPSHIRE AVE	2	0.02%
MORGAN ST	2	0.02%
MAINE TER	2	0.02%
LINE ST	2	0.02%
LEON ST	2	0.02%
LATIN WAY	2	0.02%
HUNTING ST	2	0.02%
HERBERT ST	2	0.02%
HENDERSON ST	2	0.02%
HARVARD PL	2	0.02%

ON_STREET	Total	Percentage of Entire Population
HANSON ST	2	0.02%
CROWN ST	2	0.02%
CENTRE ST	2	0.02%
CALVIN ST	2	0.02%
BRADFORD AVE	2	0.02%
ASSEMBLY SQUARE DRIVE	2	0.02%
WINDOM ST	1	0.01%
TAUNTON ST	1	0.01%
SMITH AVE	1	0.01%
SEVEN PINES AVE	1	0.01%
PROSPECT HILL PARKWAY	1	0.01%
PAUL REVERE PARK	1	0.01%
MT VERNON AVE	1	0.01%
HARDING ST	1	0.01%
FRANKLIN AVE	1	0.01%
FRANCIS ST	1	0.01%
FOUNTAIN AVE	1	0.01%
FOREST ST	1	0.01%
ELLINGTON RD	1	0.01%
CREST HILL RD	1	0.01%
CITY HALL ANNEX	1	0.01%
CARTER TER	1	0.01%
BENNETT ST	1	0.01%
BELMONT PL	1	0.01%
ASHLAND ST	1	0.01%
ALLEN ST	1	0.01%
ALBION TER	1	0.01%
Grand Total	*11372*	*100%*

ON_STREET	Total	Percentage of Entire Population
ABERDEEN RD	10	0.09%
ADAMS ST	22	0.19%
ADRIAN ST	17	0.15%
ALBION ST	57	0.50%
ALBION TER	1	0.01%
ALDERSEY ST	16	0.14%
ALDRICH ST	16	0.14%
ALEWIFE BROOK PARKWAY	151	1.33%
ALEWIFE LINEAR PARK	114	1.00%
ALLEN ST	1	0.01%
ALLEN ST PARK	3	0.03%
ALPINE ST	9	0.08%
ALSTON ST	6	0.05%
AMES ST	17	0.15%
APPLETON ST	15	0.13%
ARGENZIANO SCHOOL	37	0.33%
ARLINGTON ST	11	0.10%
ASH AVE	11	0.10%
ASHLAND ST	1	0.01%
ASSEMBLY SQUARE DRIVE	2	0.02%
ATHERTON ST	16	0.14%
AUBURN AVE	4	0.04%
AUSTIN ST	6	0.05%
AVON ST	22	0.19%
BAILEY PARK	11	0.10%
BAILEY RD	11	0.10%
BAILEY ST	9	0.08%
BANKS ST	32	0.28%
BARTLETT ST	37	0.33%
BARTON ST	16	0.14%
BAY STATE AVE	35	0.31%
BEACON ST	71	0.62%
BEECH ST	6	0.05%
BELKNAP ST	5	0.04%
BELMONT PL	1	0.01%

ON_STREET	Total	Percentage of Entire Population
BELMONT ST	20	0.18%
BENEDICT ST	3	0.03%
BENNETT ST	1	0.01%
BENTON RD	11	0.10%
BERKELEY ST	22	0.19%
BIGELOW ST	7	0.06%
BILLINGHAM ST	11	0.10%
BLAKELEY AVE	4	0.04%
BOLTON ST	11	0.10%
BONAIR ST	16	0.14%
BOND ST	13	0.11%
BOSTON AVE	47	0.41%
BOSTON ST	40	0.35%
BOW ST	28	0.25%
BOWDOIN ST	7	0.06%
BRADFORD AVE	2	0.02%
BRADLEY ST	11	0.10%
BRASTOW AVE	26	0.23%
BROADWAY	438	3.85%
BROMFIELD RD	40	0.35%
BROOK ST	10	0.09%
BROWN SCHOOL PLGD	6	0.05%
BROWNING RD	18	0.16%
BUCKINGHAM ST	6	0.05%
BUENA VISTA ROAD	16	0.14%
BURNHAM ST	12	0.11%
BURNSIDE AVE	19	0.17%
BUTLER DRIVE	8	0.07%
CADY AVE	3	0.03%
CALVIN ST	2	0.02%
CAMBRIA ST	13	0.11%
CAMERON AVE	37	0.33%
CAMPBELL PK	11	0.10%
CARLTON ST	4	0.04%
CARTER TER	1	0.01%
CEDAR ST	59	0.52%
CENTRAL HILL PARK	28	0.25%
CENTRAL RD	8	0.07%

ON_STREET	Total	Percentage of Entire Population
CENTRAL ST	69	0.61%
CENTRE ST	2	0.02%
CENTURY ST	5	0.04%
CHANDLER ST	35	0.31%
CHAPEL ST	9	0.08%
CHARLES E RYAN ROAD	8	0.07%
CHARNWOOD RD	12	0.11%
CHERRY ST	23	0.20%
CHESTER ST	6	0.05%
CHESTNUT ST	19	0.17%
CHETWYND ROAD	6	0.05%
CHURCH ST	34	0.30%
CITY HALL	22	0.19%
CITY HALL ANNEX	1	0.01%
CLAREMON ST	11	0.10%
CLARENDON AVE	19	0.17%
CLARK ST	3	0.03%
CLEVELAND ST	3	0.03%
CLIFTON ST	8	0.07%
CLYDE ST	4	0.04%
COLLEGE AVE	56	0.49%
COLLEGE HILL RD	7	0.06%
COLUMBUS AVE	51	0.45%
COMMUNITY PATH	162	1.42%
COMMUNITY YOUTH CENTER	5	0.04%
CONCORD AVE	37	0.33%
CONCORD SQUARE	8	0.07%
CONNECTICUT AVE	4	0.04%
CONWAY PARK	136	1.20%
CONWELL AVE	23	0.20%
CONWELL ST	9	0.08%
CORBETT-MCKENNA PARK	8	0.07%
CORINTHIAN RD	21	0.18%
COTTAGE AVE	28	0.25%
CRAIGIE ST	29	0.26%
CREST HILL RD	1	0.01%
CROCKER ST	16	0.14%
CROSS ST	41	0.36%

ON_STREET	Total	Percentage of Entire Population
CROSS ST EAST	21	0.18%
CROWN ST	2	0.02%
CUMMINGS SCHOOL COMMUNITY PLGD	3	0.03%
CUMMINGS ST	4	0.04%
CURTIS AVE	18	0.16%
CURTIS ST	12	0.11%
CUTLER ST	27	0.24%
CUTTER AVE	16	0.14%
CVS PARKING LOT	5	0.04%
CYPRESS ST	5	0.04%
DANA ST	27	0.24%
DANE AVE	7	0.06%
DANE ST	8	0.07%
DARTMOUTH ST	37	0.33%
DAVIS SQUARE	18	0.16%
DAY ST	13	0.11%
DEARBORN RD	6	0.05%
DELAWARE ST	7	0.06%
DELL ST	24	0.21%
DERBY ST	21	0.18%
DICKERMAN PLAYGROUND	9	0.08%
DICKINSON ST	16	0.14%
DICKSON ST	5	0.04%
DIMICK ST	17	0.15%
DOVER ST	11	0.10%
DOW ST	9	0.08%
DPW HEADQUARTERS	4	0.04%
DURELL POCKET PARK	3	0.03%
DURHAM ST	5	0.04%
EARLE STREET	8	0.07%
EAST ALBION ST	3	0.03%
EAST LIBRARY	8	0.07%
EAST SOMERVILLE SCHOOL PLGD	50	0.44%
EDGAR AVE	29	0.26%
EDGAR CT	5	0.04%
EDGAR TER	4	0.04%
EDMANDS ST	5	0.04%
EDWARD LEATHERS PARK	83	0.73%

ON_STREET	Total	Percentage of Entire Population
ELECTRIC AVE	36	0.32%
ELIOT ST	6	0.05%
ELLINGTON RD	1	0.01%
ELLSWORTH ST	5	0.04%
ELM ST	67	0.59%
ELMWOOD ST	27	0.24%
ELSTON ST	6	0.05%
ENDICOTT AVE	17	0.15%
ESSEX ST	5	0.04%
EVERETT AVE	11	0.10%
EVERGREEN AVE	16	0.14%
FAIRFAX ST	14	0.12%
FAIRMOUNT AVE	14	0.12%
FARRAGUT AVE	9	0.08%
FELLSWAY WEST	53	0.47%
FENWICK ST	11	0.10%
FIRE STATION	21	0.18%
FLINT AVE	5	0.04%
FLINT ST	39	0.34%
FLORENCE PLAYGOUND	11	0.10%
FLORENCE ST	18	0.16%
FOLEY ST	7	0.06%
FOREST ST	1	0.01%
FORSTER ST	5	0.04%
FOSKET ST	16	0.14%
FOSS PARK	133	1.17%
FOUNTAIN AVE	1	0.01%
FRANCESCA AVE	14	0.12%
FRANCIS ST	1	0.01%
FRANEY RD	11	0.10%
FRANKLIN AVE	1	0.01%
FRANKLIN ST	56	0.49%
FREMONT AVE	18	0.16%
FREMONT ST	8	0.07%
GARFIELD AVE	13	0.11%
GARRISON AVE	8	0.07%
GEORGE ST	6	0.05%
GIBBENS ST	15	0.13%

ON_STREET	Total	Percentage of Entire Population
GILMAN ST	38	0.33%
GILMAN TER	11	0.10%
GLEN PARK/JAMES MCCARTHY FIELD	78	0.69%
GLEN ST	56	0.49%
GLENDALE AVE	6	0.05%
GLENWOOD RD	46	0.40%
GORDON ST	28	0.25%
GORHAM ST	15	0.13%
GOV WINTHROP RD	10	0.09%
GRAND VIEW AVE	14	0.12%
GRANITE ST	15	0.13%
GRANT ST	24	0.21%
GREENE ST	10	0.09%
GREENVILLE ST	27	0.24%
GROVE ST	10	0.09%
HALL AVE	12	0.11%
HALL ST	11	0.10%
HAMILTON RD	12	0.11%
HAMMOND ST	9	0.08%
HANCOCK ST	44	0.39%
HANSON ST	2	0.02%
HARDAN RD	5	0.04%
HARDING ST	1	0.01%
HAROLD RD	11	0.10%
HARRIS PLAYGROUND	6	0.05%
HARRISON ST	16	0.14%
HARVARD PL	2	0.02%
HARVARD ST	25	0.22%
HATHORN ST	6	0.05%
HAWKINS ST	4	0.04%
HEALY SCHOOL COMMUNITY PLGD	35	0.31%
HEATH ST	40	0.35%
HENDERSON ST	2	0.02%
HENERY HANSEN PARK	21	0.18%
HENRY AVE	14	0.12%
HERBERT ST	2	0.02%
HIGH ST	11	0.10%
HIGHLAND AVE	224	1.97%

ON_STREET	Total	Percentage of Entire Population
HIGHLAND RD	75	0.66%
HILL ST	11	0.10%
HILLSDALE RD	9	0.08%
HILLSIDE PARK	3	0.03%
HINCKLEY ST	5	0.04%
HOLLAND ST	57	0.50%
HOLYOKE RD	25	0.22%
HOMER SQ	3	0.03%
HOOKER AVE	5	0.04%
HOUGHTON ST	18	0.16%
HOWARD ST	18	0.16%
HOWE ST	7	0.06%
HOYT-SULLIVAN PLGD	26	0.23%
HUDSON ST	43	0.38%
HUNTING ST	2	0.02%
IBBETSON ST	7	0.06%
ILLINOIS AVE	14	0.12%
INDIANA AVE	13	0.11%
INNER BELT RD	92	0.81%
IRVING ST	32	0.28%
IRVINGTON ROAD	15	0.13%
IVALOO ST	15	0.13%
JACKSON RD	16	0.14%
JAMES ST	7	0.06%
JAQUES ST	52	0.46%
JASPER ST	10	0.09%
JAY ST	12	0.11%
JOSEPH ST	6	0.05%
JOSEPHINE AVE	47	0.41%
KENNEDY SCHOOL PLGD	48	0.42%
KENNEY PARK	42	0.37%
KENSINGTON AVE	5	0.04%
KENWOOD ST	5	0.04%
KIDDER AVE	32	0.28%
KIMBALL ST	3	0.03%
KINGSTON ST	10	0.09%
KNAPP ST	6	0.05%
KNOWLTON ST	9	0.08%

ON_STREET	Total	Percentage of Entire Population
LANDERS ST	5	0.04%
LANGMAID AVE	12	0.11%
LATIN WAY	2	0.02%
LAUREL ST	16	0.14%
LEE ST	8	0.07%
LELAND ST	3	0.03%
LEON ST	2	0.02%
LEONARD ST	9	0.08%
LESLEY AVE	14	0.12%
LEWIS ST	10	0.09%
LEXINGTON AVE	24	0.21%
LEXINGTON PARK	8	0.07%
LIBERTY AVE	20	0.18%
LINCOLN AVE	3	0.03%
LINCOLN PARK	72	0.63%
LINCOLN PARKWAY	12	0.11%
LINCOLN ST	18	0.16%
LINDEN AVE	33	0.29%
LINE ST	2	0.02%
LINWOOD ST	65	0.57%
LORING ST	11	0.10%
LOWDEN AVE	35	0.31%
LOWELL ST	101	0.89%
MADISON ST	14	0.12%
MAGNUS AVE	12	0.11%
MAIN ST	10	0.09%
MAINE AVE	6	0.05%
MAINE TER	2	0.02%
MALLET ST	5	0.04%
MALVERN AVE	10	0.09%
MANSFIELD ST	9	0.08%
MAPLE AVE	5	0.04%
MARION ST	16	0.14%
MARSHALL ST	43	0.38%
MARSHALL STREET PLGD	21	0.18%
MASON ST	5	0.04%
McARTHUR ST	15	0.13%
McGRATH HIGHWAY	34	0.30%

ON_STREET	Total	Percentage of Entire Population
MEACHAM RD	13	0.11%
MEACHAM ST	24	0.21%
MEAD ST	14	0.12%
MEDFORD ST	118	1.04%
MELVILLE RD	4	0.04%
MELVIN ST	4	0.04%
MERRIAM ST	9	0.08%
MICHIGAN AVE	17	0.15%
MIDDLESEX AVE	34	0.30%
MILTON ST	5	0.04%
MINER ST	6	0.05%
MINNESOTA AVE	17	0.15%
MONTGOMERY AVE	7	0.06%
MONTROSE ST	18	0.16%
MOORE ST	12	0.11%
MORELAND ST	29	0.26%
MORGAN ST	2	0.02%
MORRISON AVE	57	0.50%
MORSE-KELLEY PLGD	13	0.11%
MORTON ST	4	0.04%
MOSSLAND STREET	5	0.04%
MT PLEASANT ST	8	0.07%
MT VERNON AVE	1	0.01%
MT VERNON ST	33	0.29%
MUNROE ST	43	0.38%
MUSEUM ST	7	0.06%
MYRTLE ST	40	0.35%
MYSTIC AVE	24	0.21%
MYSTIC VALLEY PARKWAY	32	0.28%
NASHUA ST	5	0.04%
NATHAN TUFTS/POWDERHOUSE PARK	171	1.50%
NEW HAMPSHIRE AVE	2	0.02%
NEW ROAD	11	0.10%
NEW WASHINGTON STREET	12	0.11%
NEWBERNE ST	3	0.03%
NEWBURY ST	16	0.14%
NEWTON ST	11	0.10%
NO. UNION ST	2	0.02%

ON_STREET	Total	Percentage of Entire Population
NORFORK ST	17	0.15%
NORTH ST	43	0.38%
NORTH STREET/VETERANS PLAYGROU	9	0.08%
NORWOOD AVE	15	0.13%
NUNZIATO FIELD	12	0.11%
OAK ST	19	0.17%
OAKLAND AVE	8	0.07%
OLIVER ST	16	0.14%
ORCHARD ST	54	0.47%
OSGOOD PARK	9	0.08%
OSGOOD ST	2	0.02%
OSSIPEE RD	47	0.41%
OTIS PLAYGROUND	5	0.04%
OTIS ST	24	0.21%
OXFORD ST	45	0.40%
PACKARD AVE	51	0.45%
PALMACCI PLAYGROUND	5	0.04%
PARK AVE	6	0.05%
PARK ST	18	0.16%
PARKDALE ST	9	0.08%
PARKER ST	10	0.09%
PARTRIDGE AVE	36	0.32%
PAUL REVERE PARK	1	0.01%
PAULINA ST	24	0.21%
PEARL ST	135	1.19%
PEARSON AVE	36	0.32%
PEARSON RD	36	0.32%
PEMBROKE ST	9	0.08%
PENNSYLVANIA AVE	57	0.50%
PERKINS PLAYGROUND	4	0.04%
PERKINS ST	40	0.35%
PERRY PARK	61	0.54%
PERRY ST	19	0.17%
PINCKNEY ST	26	0.23%
PLEASANT AVE	11	0.10%
POLICE & FIRE STATION	6	0.05%
POPLAR ST	5	0.04%
PORTER ST	42	0.37%

ON_STREET	Total	Percentage of Entire Population
POWDER HOUSE BOULEVARD	195	1.71%
POWDER HOUSE TERRACE	16	0.14%
POWDERHOUSE ROTARY	4	0.04%
POWDERHOUSE SCHOOL PLGD	52	0.46%
PRESCOTT ST	29	0.26%
PRESTON RD	23	0.20%
PRICHARD AVE	26	0.23%
PRINCETON ST	2	0.02%
PROFESSORS ROW	36	0.32%
PROPERZI WAY	10	0.09%
PROSPECT HILL AVE	21	0.18%
PROSPECT HILL PARK	90	0.79%
PROSPECT HILL PARKWAY	1	0.01%
PROSPECT ST	21	0.18%
PURITAN RD	21	0.18%
PUTNAM RD	11	0.10%
PUTNAM ST	43	0.38%
QUINCY ST	16	0.14%
QUINCY ST PARK	18	0.16%
RADCLIFFE RD	9	0.08%
RAYMOND AVE	29	0.26%
RHODE ISLAND AVE	7	0.06%
RICHARDSON ST	5	0.04%
RICHDALE AVE	21	0.18%
ROBERTS ST	5	0.04%
ROBINSON ST	19	0.17%
ROGERS AVE	49	0.43%
ROSE ST	13	0.11%
ROSELAND ST	4	0.04%
ROSSMORE ST	17	0.15%
RUSH ST	27	0.24%
RUSSELL RD	18	0.16%
RUSSELL ST	32	0.28%
SACRAMENTO ST	4	0.04%
SANBORN AVE	2	0.02%
SARGENT AVE	17	0.15%
SCHOOL ST	62	0.55%
SEVEN HILLS PARK	62	0.55%

ON_STREET	Total	Percentage of Entire Population
SEVEN PINES AVE	1	0.01%
SEWALL ST	13	0.11%
SHERMAN CT	4	0.04%
SHORE DRIVE	2	0.02%
SIMPSON AVE	25	0.22%
SKILTON AVE	6	0.05%
SMITH AVE	1	0.01%
SOMERVILLE AVE	200	1.76%
SOMERVILLE HIGH SCHOOL	106	0.93%
SOMERVILLE JUNCTION PARK	12	0.11%
SOMERVILLE LIBRARY	80	0.70%
SOUTH ST	28	0.25%
SPENCER AVE	20	0.18%
SPRING ST	9	0.08%
SPRINGFIELD ST	11	0.10%
ST JAMES AVE	23	0.20%
STERLING ST	16	0.14%
STICKNEY AVE	9	0.08%
STONE AVE	7	0.06%
STONE PL	2	0.02%
STONE PL PARK	11	0.10%
SUMMER ST	114	1.00%
SUMMIT AVE	16	0.14%
SUMMIT ST	6	0.05%
SUNNYSIDE AVE	4	0.04%
SUNSET ROAD	19	0.17%
SYCAMORE ST	32	0.28%
SYDNEY ST	9	0.08%
TALBOT AVE	4	0.04%
TAUNTON ST	1	0.01%
TAYLOR ST	3	0.03%
TEELE AVE	15	0.13%
TEMPLE RD	20	0.18%
TEMPLE ST	43	0.38%
TEN HILLS RD	28	0.25%
TENNYSON ST	22	0.19%
THIRD AVE	3	0.03%
THORNDIKE ST	8	0.07%

ON_STREET	Total	Percentage of Entire Population
THURSTON ST	34	0.30%
TOWER ST	12	0.11%
TREMONT ST	21	0.18%
TRULL ST	14	0.12%
TRUM FIELD	4	0.04%
TRUM PLAYGROUND	12	0.11%
TUFTS COMMUNITY GARDEN	15	0.13%
TUFTS ST	32	0.28%
TYLER ST	3	0.03%
UNION SQUARE	36	0.32%
UPLAND ROAD	12	0.11%
VERMONT AVE	5	0.04%
VERNON ST	9	0.08%
VICTORIA ST	26	0.23%
VILLA AVE	4	0.04%
VINAL AVE	32	0.28%
VIRGINIA ST	12	0.11%
W. SOMERVILLE SCHOOL PLGD	26	0.23%
WALDO AVE	2	0.02%
WALDO ST	7	0.06%
WALKER ST	23	0.20%
WALLACE ST	45	0.40%
WALNUT RD	4	0.04%
WALNUT ST	85	0.75%
WALNUT STREET PARK	4	0.04%
WALTER TER	6	0.05%
WARE ST	10	0.09%
WARNER ST	13	0.11%
WARREN AVE	12	0.11%
WARWICK ST	12	0.11%
WASHINGTON ST	124	1.09%
WATERHOUSE ST	18	0.16%
WATSON ST	7	0.06%
WEBSTER AVE	29	0.26%
WEBSTER ST	12	0.11%
WELLINGTON AVE	2	0.02%
WESLEY PARK	3	0.03%
WESLEY ST	5	0.04%

ON_STREET	Total	Percentage of Entire Population
WEST ADAMS ST	10	0.09%
WEST QUINCY	3	0.03%
WEST ST	15	0.13%
WESTMINSTER ST	3	0.03%
WESTSIDE LIBRARY	15	0.13%
WESTWOOD RD	11	0.10%
WHEATLAND ST	14	0.12%
WHEELER ST	7	0.06%
WHITFIELD RD	28	0.25%
WHITMAN ST	11	0.10%
WIGGLESWORTH ST	23	0.20%
WILLIAM ST	4	0.04%
WILLOUGHBY ST	8	0.07%
WILLOW AVE	117	1.03%
WILTON ST	9	0.08%
WINDOM ST	1	0.01%
WINDSOR RD	15	0.13%
WINDSOR ST	4	0.04%
WINSLOW AVE	27	0.24%
WINTER HILL SCHOOL PLGD	48	0.42%
WISCONSIN AVE	19	0.17%
WOODBINE ST	2	0.02%
WOODS AVE	14	0.12%
WOODSTOCK PLAYGROUND	13	0.11%
WOODSTOCK ST	4	0.04%
WYATT ST	11	0.10%
YORKTOWN ST	9	0.08%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: ON_STREET (Non-Street Sites)

ON_STREET	*Total*	*Percentage of Entire Population*
NATHAN TUFTS/POWDERHOUSE PARK	171	8.10%
COMMUNITY PATH	162	7.67%
CONWAY PARK	136	6.44%
FOSS PARK	133	6.30%
ALEWIFE LINEAR PARK	114	5.40%
SOMERVILLE HIGH SCHOOL	106	5.02%
PROSPECT HILL PARK	90	4.26%
EDWARD LEATHERS PARK	83	3.93%
SOMERVILLE LIBRARY	80	3.79%
GLEN PARK/JAMES MCCARTHY FIELD	78	3.69%
LINCOLN PARK	72	3.41%
SEVEN HILLS PARK	62	2.94%
PERRY PARK	61	2.89%
POWDERHOUSE SCHOOL PLGD	52	2.46%
EAST SOMERVILLE SCHOOL PLGD	50	2.37%
WINTER HILL SCHOOL PLGD	48	2.27%
KENNEDY SCHOOL PLGD	48	2.27%
KENNEY PARK	42	1.99%
ARGENZIANO SCHOOL	37	1.75%
HEALY SCHOOL COMMUNITY PLGD	35	1.66%
UNION SQUARE	31	1.47%
CENTRAL HILL PARK	28	1.33%
W. SOMERVILLE SCHOOL PLGD	26	1.23%
HOYT-SULLIVAN PLGD	26	1.23%
CITY HALL	22	1.04%
MARSHALL STREET PLGD	21	0.99%
FIRE STATION	21	0.99%
QUINCY ST PARK	18	0.85%
DAVIS SQUARE	18	0.85%
WESTSIDE LIBRARY	15	0.71%
TUFTS COMMUNITY GARDEN	15	0.71%
WOODSTOCK PLAYGROUND	13	0.62%
MORSE-KELLEY PLGD	13	0.62%
TRUM PLAYGROUND	12	0.57%
SOMERVILLE JUNCTION PARK	12	0.57%

ON_STREET	Total	Percentage of Entire Population
NUNZIATO FIELD	12	0.57%
STONE PL PARK	11	0.52%
FLORENCE PLAYGOUND	11	0.52%
BAILEY PARK	11	0.52%
OSGOOD PARK	9	0.43%
NORTH STREET/VETERANS PLAYGROU	9	0.43%
DICKERMAN PLAYGROUND	9	0.43%
LEXINGTON PARK	8	0.38%
EAST LIBRARY	8	0.38%
CORBETT-MCKENNA PARK	8	0.38%
POLICE & FIRE STATION	6	0.28%
HARRIS PLAYGROUND	6	0.28%
BROWN SCHOOL PLGD	6	0.28%
PALMACCI PLAYGROUND	5	0.24%
OTIS PLAYGROUND	5	0.24%
CVS PARKING LOT	5	0.24%
COMMUNITY YOUTH CENTER	5	0.24%
WALNUT STREET PARK	4	0.19%
TRUM FIELD	4	0.19%
PERKINS PLAYGROUND	4	0.19%
DPW HEADQUARTERS	4	0.19%
DURELL POCKET PARK	3	0.14%
CUMMINGS SCHOOL COMMUNITY PLGD	3	0.14%
ALLEN ST PARK	3	0.14%
PAUL REVERE PARK	1	0.05%
CITY HALL ANNEX	1	0.05%
Grand Total	*2112*	*100%*

DAVEY

Somerville, MA

Quantity Report: ON_STREET (Non-Street Sites)

ON_STREET	Total	Percentage of Entire Population
ALEWIFE LINEAR PARK	114	5.40%
ALLEN ST PARK	3	0.14%
ARGENZIANO SCHOOL	37	1.75%
BAILEY PARK	11	0.52%
BROWN SCHOOL PLGD	6	0.28%
CENTRAL HILL PARK	28	1.33%
CITY HALL	22	1.04%
CITY HALL ANNEX	1	0.05%
COMMUNITY PATH	162	7.67%
COMMUNITY YOUTH CENTER	5	0.24%
CONWAY PARK	136	6.44%
CORBETT-MCKENNA PARK	8	0.38%
CUMMINGS SCHOOL COMMUNITY PLGD	3	0.14%
CVS PARKING LOT	5	0.24%
DAVIS SQUARE	18	0.85%
DICKERMAN PLAYGROUND	9	0.43%
DPW HEADQUARTERS	4	0.19%
DURELL POCKET PARK	3	0.14%
EAST LIBRARY	8	0.38%
EAST SOMERVILLE SCHOOL PLGD	50	2.37%
EDWARD LEATHERS PARK	83	3.93%
FIRE STATION	21	0.99%
FLORENCE PLAYGOUND	11	0.52%
FOSS PARK	133	6.30%
GLEN PARK/JAMES MCCARTHY FIELD	78	3.69%
HARRIS PLAYGROUND	6	0.28%
HEALY SCHOOL COMMUNITY PLGD	35	1.66%
HOYT-SULLIVAN PLGD	26	1.23%
KENNEDY SCHOOL PLGD	48	2.27%
KENNEY PARK	42	1.99%
LEXINGTON PARK	8	0.38%
LINCOLN PARK	72	3.41%
MARSHALL STREET PLGD	21	0.99%
MORSE-KELLEY PLGD	13	0.62%
NATHAN TUFTS/POWDERHOUSE PARK	171	8.10%

ON_STREET	Total	Percentage of Entire Population
NORTH STREET/VETERANS PLAYGROU	9	0.43%
NUNZIATO FIELD	12	0.57%
OSGOOD PARK	9	0.43%
OTIS PLAYGROUND	5	0.24%
PALMACCI PLAYGROUND	5	0.24%
PAUL REVERE PARK	1	0.05%
PERKINS PLAYGROUND	4	0.19%
PERRY PARK	61	2.89%
POLICE & FIRE STATION	6	0.28%
POWDERHOUSE SCHOOL PLGD	52	2.46%
PROSPECT HILL PARK	90	4.26%
QUINCY ST PARK	18	0.85%
SEVEN HILLS PARK	62	2.94%
SOMERVILLE HIGH SCHOOL	106	5.02%
SOMERVILLE JUNCTION PARK	12	0.57%
SOMERVILLE LIBRARY	80	3.79%
STONE PL PARK	11	0.52%
TRUM FIELD	4	0.19%
TRUM PLAYGROUND	12	0.57%
TUFTS COMMUNITY GARDEN	15	0.71%
UNION SQUARE	31	1.47%
W. SOMERVILLE SCHOOL PLGD	26	1.23%
WALNUT STREET PARK	4	0.19%
WESTSIDE LIBRARY	15	0.71%
WINTER HILL SCHOOL PLGD	48	2.27%
WOODSTOCK PLAYGROUND	13	0.62%
Grand Total	*2112*	*100%*

ON_STREET	Total	Percentage of Entire Population
BROADWAY	438	4.73%
HIGHLAND AVE	224	2.42%
SOMERVILLE AVE	200	2.16%
POWDER HOUSE BOULEVARD	195	2.11%
ALEWIFE BROOK PARKWAY	151	1.63%
PEARL ST	135	1.46%
WASHINGTON ST	124	1.34%
MEDFORD ST	118	1.27%
WILLOW AVE	117	1.26%
SUMMER ST	114	1.23%
LOWELL ST	101	1.09%
INNER BELT RD	92	0.99%
WALNUT ST	85	0.92%
HIGHLAND RD	75	0.81%
BEACON ST	71	0.77%
CENTRAL ST	69	0.75%
ELM ST	67	0.72%
LINWOOD ST	65	0.70%
SCHOOL ST	62	0.67%
CEDAR ST	59	0.64%
PENNSYLVANIA AVE	57	0.62%
MORRISON AVE	57	0.62%
HOLLAND ST	57	0.62%
ALBION ST	57	0.62%
GLEN ST	56	0.60%
FRANKLIN ST	56	0.60%
COLLEGE AVE	56	0.60%
ORCHARD ST	54	0.58%
FELLSWAY WEST	53	0.57%
JAQUES ST	52	0.56%
PACKARD AVE	51	0.55%
COLUMBUS AVE	51	0.55%
ROGERS AVE	49	0.53%
OSSIPEE RD	47	0.51%
JOSEPHINE AVE	47	0.51%

ON_STREET	Total	Percentage of Entire Population
BOSTON AVE	47	0.51%
GLENWOOD RD	46	0.50%
WALLACE ST	45	0.49%
OXFORD ST	45	0.49%
HANCOCK ST	44	0.48%
TEMPLE ST	43	0.46%
PUTNAM ST	43	0.46%
NORTH ST	43	0.46%
MUNROE ST	43	0.46%
MARSHALL ST	43	0.46%
HUDSON ST	43	0.46%
PORTER ST	42	0.45%
CROSS ST	41	0.44%
PERKINS ST	40	0.43%
MYRTLE ST	40	0.43%
HEATH ST	40	0.43%
BROMFIELD RD	40	0.43%
BOSTON ST	40	0.43%
FLINT ST	39	0.42%
GILMAN ST	38	0.41%
DARTMOUTH ST	37	0.40%
CONCORD AVE	37	0.40%
CAMERON AVE	37	0.40%
BARTLETT ST	37	0.40%
PROFESSORS ROW	36	0.39%
PEARSON RD	36	0.39%
PEARSON AVE	36	0.39%
PARTRIDGE AVE	36	0.39%
ELECTRIC AVE	36	0.39%
LOWDEN AVE	35	0.38%
CHANDLER ST	35	0.38%
BAY STATE AVE	35	0.38%
THURSTON ST	34	0.37%
MIDDLESEX AVE	34	0.37%
McGRATH HIGHWAY	34	0.37%
CHURCH ST	34	0.37%
MT VERNON ST	33	0.36%
LINDEN AVE	33	0.36%

ON_STREET	Total	Percentage of Entire Population
VINAL AVE	32	0.35%
TUFTS ST	32	0.35%
SYCAMORE ST	32	0.35%
RUSSELL ST	32	0.35%
MYSTIC VALLEY PARKWAY	32	0.35%
KIDDER AVE	32	0.35%
IRVING ST	32	0.35%
BANKS ST	32	0.35%
WEBSTER AVE	29	0.31%
RAYMOND AVE	29	0.31%
PRESCOTT ST	29	0.31%
MORELAND ST	29	0.31%
EDGAR AVE	29	0.31%
CRAIGIE ST	29	0.31%
WHITFIELD RD	28	0.30%
TEN HILLS RD	28	0.30%
SOUTH ST	28	0.30%
GORDON ST	28	0.30%
COTTAGE AVE	28	0.30%
BOW ST	28	0.30%
WINSLOW AVE	27	0.29%
RUSH ST	27	0.29%
GREENVILLE ST	27	0.29%
ELMWOOD ST	27	0.29%
DANA ST	27	0.29%
CUTLER ST	27	0.29%
VICTORIA ST	26	0.28%
PRICHARD AVE	26	0.28%
PINCKNEY ST	26	0.28%
BRASTOW AVE	26	0.28%
SIMPSON AVE	25	0.27%
HOLYOKE RD	25	0.27%
HARVARD ST	25	0.27%
PAULINA ST	24	0.26%
OTIS ST	24	0.26%
MYSTIC AVE	24	0.26%
MEACHAM ST	24	0.26%
LEXINGTON AVE	24	0.26%

ON_STREET	Total	Percentage of Entire Population
GRANT ST	24	0.26%
DELL ST	24	0.26%
WIGGLESWORTH ST	23	0.25%
WALKER ST	23	0.25%
ST JAMES AVE	23	0.25%
PRESTON RD	23	0.25%
CONWELL AVE	23	0.25%
CHERRY ST	23	0.25%
TENNYSON ST	22	0.24%
BERKELEY ST	22	0.24%
AVON ST	22	0.24%
ADAMS ST	22	0.24%
TREMONT ST	21	0.23%
RICHDALE AVE	21	0.23%
PURITAN RD	21	0.23%
PROSPECT ST	21	0.23%
PROSPECT HILL AVE	21	0.23%
HENERY HANSEN PARK	21	0.23%
DERBY ST	21	0.23%
CROSS ST EAST	21	0.23%
CORINTHIAN RD	21	0.23%
TEMPLE RD	20	0.22%
SPENCER AVE	20	0.22%
LIBERTY AVE	20	0.22%
BELMONT ST	20	0.22%
WISCONSIN AVE	19	0.21%
SUNSET ROAD	19	0.21%
ROBINSON ST	19	0.21%
PERRY ST	19	0.21%
OAK ST	19	0.21%
CLARENDON AVE	19	0.21%
CHESTNUT ST	19	0.21%
BURNSIDE AVE	19	0.21%
WATERHOUSE ST	18	0.19%
RUSSELL RD	18	0.19%
PARK ST	18	0.19%
MONTROSE ST	18	0.19%
LINCOLN ST	18	0.19%

ON_STREET	Total	Percentage of Entire Population
HOWARD ST	18	0.19%
HOUGHTON ST	18	0.19%
FREMONT AVE	18	0.19%
FLORENCE ST	18	0.19%
CURTIS AVE	18	0.19%
BROWNING RD	18	0.19%
SARGENT AVE	17	0.18%
ROSSMORE ST	17	0.18%
NORFORK ST	17	0.18%
MINNESOTA AVE	17	0.18%
MICHIGAN AVE	17	0.18%
ENDICOTT AVE	17	0.18%
DIMICK ST	17	0.18%
AMES ST	17	0.18%
ADRIAN ST	17	0.18%
SUMMIT AVE	16	0.17%
STERLING ST	16	0.17%
QUINCY ST	16	0.17%
POWDER HOUSE TERRACE	16	0.17%
OLIVER ST	16	0.17%
NEWBURY ST	16	0.17%
MARION ST	16	0.17%
LAUREL ST	16	0.17%
JACKSON RD	16	0.17%
HARRISON ST	16	0.17%
FOSKET ST	16	0.17%
EVERGREEN AVE	16	0.17%
DICKINSON ST	16	0.17%
CUTTER AVE	16	0.17%
CROCKER ST	16	0.17%
BUENA VISTA ROAD	16	0.17%
BONAIR ST	16	0.17%
BARTON ST	16	0.17%
ATHERTON ST	16	0.17%
ALDRICH ST	16	0.17%
ALDERSEY ST	16	0.17%
WINDSOR RD	15	0.16%
WEST ST	15	0.16%

ON_STREET	Total	Percentage of Entire Population
TEELE AVE	15	0.16%
NORWOOD AVE	15	0.16%
McARTHUR ST	15	0.16%
IVALOO ST	15	0.16%
IRVINGTON ROAD	15	0.16%
GRANITE ST	15	0.16%
GORHAM ST	15	0.16%
GIBBENS ST	15	0.16%
APPLETON ST	15	0.16%
WOODS AVE	14	0.15%
WHEATLAND ST	14	0.15%
TRULL ST	14	0.15%
MEAD ST	14	0.15%
MADISON ST	14	0.15%
LESLEY AVE	14	0.15%
ILLINOIS AVE	14	0.15%
HENRY AVE	14	0.15%
GRAND VIEW AVE	14	0.15%
FRANCESCA AVE	14	0.15%
FAIRMOUNT AVE	14	0.15%
FAIRFAX ST	14	0.15%
WARNER ST	13	0.14%
SEWALL ST	13	0.14%
ROSE ST	13	0.14%
MEACHAM RD	13	0.14%
INDIANA AVE	13	0.14%
GARFIELD AVE	13	0.14%
DAY ST	13	0.14%
CAMBRIA ST	13	0.14%
BOND ST	13	0.14%
WEBSTER ST	12	0.13%
WARWICK ST	12	0.13%
WARREN AVE	12	0.13%
VIRGINIA ST	12	0.13%
UPLAND ROAD	12	0.13%
TOWER ST	12	0.13%
NEW WASHINGTON STREET	12	0.13%
MOORE ST	12	0.13%

ON_STREET	Total	Percentage of Entire Population
MAGNUS AVE	12	0.13%
LINCOLN PARKWAY	12	0.13%
LANGMAID AVE	12	0.13%
JAY ST	12	0.13%
HAMILTON RD	12	0.13%
HALL AVE	12	0.13%
CURTIS ST	12	0.13%
CHARNWOOD RD	12	0.13%
BURNHAM ST	12	0.13%
WYATT ST	11	0.12%
WHITMAN ST	11	0.12%
WESTWOOD RD	11	0.12%
SPRINGFIELD ST	11	0.12%
PUTNAM RD	11	0.12%
PLEASANT AVE	11	0.12%
NEWTON ST	11	0.12%
NEW ROAD	11	0.12%
LORING ST	11	0.12%
HILL ST	11	0.12%
HIGH ST	11	0.12%
HAROLD RD	11	0.12%
HALL ST	11	0.12%
GILMAN TER	11	0.12%
FRANEY RD	11	0.12%
FENWICK ST	11	0.12%
EVERETT AVE	11	0.12%
DOVER ST	11	0.12%
CLAREMON ST	11	0.12%
CAMPBELL PK	11	0.12%
BRADLEY ST	11	0.12%
BOLTON ST	11	0.12%
BILLINGHAM ST	11	0.12%
BENTON RD	11	0.12%
BAILEY RD	11	0.12%
ASH AVE	11	0.12%
ARLINGTON ST	11	0.12%
WEST ADAMS ST	10	0.11%
WARE ST	10	0.11%

ON_STREET	Total	Percentage of Entire Population
PROPERZI WAY	10	0.11%
PARKER ST	10	0.11%
MALVERN AVE	10	0.11%
MAIN ST	10	0.11%
LEWIS ST	10	0.11%
KINGSTON ST	10	0.11%
JASPER ST	10	0.11%
GROVE ST	10	0.11%
GREENE ST	10	0.11%
GOV WINTHROP RD	10	0.11%
BROOK ST	10	0.11%
ABERDEEN RD	10	0.11%
YORKTOWN ST	9	0.10%
WILTON ST	9	0.10%
VERNON ST	9	0.10%
SYDNEY ST	9	0.10%
STICKNEY AVE	9	0.10%
SPRING ST	9	0.10%
RADCLIFFE RD	9	0.10%
PEMBROKE ST	9	0.10%
PARKDALE ST	9	0.10%
MERRIAM ST	9	0.10%
MANSFIELD ST	9	0.10%
LEONARD ST	9	0.10%
KNOWLTON ST	9	0.10%
HILLSDALE RD	9	0.10%
HAMMOND ST	9	0.10%
FARRAGUT AVE	9	0.10%
DOW ST	9	0.10%
CONWELL ST	9	0.10%
CHAPEL ST	9	0.10%
BAILEY ST	9	0.10%
ALPINE ST	9	0.10%
WILLOUGHBY ST	8	0.09%
THORNDIKE ST	8	0.09%
OAKLAND AVE	8	0.09%
MT PLEASANT ST	8	0.09%
LEE ST	8	0.09%

ON_STREET	Total	Percentage of Entire Population
GARRISON AVE	8	0.09%
FREMONT ST	8	0.09%
EARLE STREET	8	0.09%
DANE ST	8	0.09%
CONCORD SQUARE	8	0.09%
CLIFTON ST	8	0.09%
CHARLES E RYAN ROAD	8	0.09%
CENTRAL RD	8	0.09%
BUTLER DRIVE	8	0.09%
WHEELER ST	7	0.08%
WATSON ST	7	0.08%
WALDO ST	7	0.08%
STONE AVE	7	0.08%
RHODE ISLAND AVE	7	0.08%
MUSEUM ST	7	0.08%
MONTGOMERY AVE	7	0.08%
JAMES ST	7	0.08%
IBBETSON ST	7	0.08%
HOWE ST	7	0.08%
FOLEY ST	7	0.08%
DELAWARE ST	7	0.08%
DANE AVE	7	0.08%
COLLEGE HILL RD	7	0.08%
BOWDOIN ST	7	0.08%
BIGELOW ST	7	0.08%
WALTER TER	6	0.06%
SUMMIT ST	6	0.06%
SKILTON AVE	6	0.06%
PARK AVE	6	0.06%
MINER ST	6	0.06%
MAINE AVE	6	0.06%
KNAPP ST	6	0.06%
JOSEPH ST	6	0.06%
HATHORN ST	6	0.06%
GLENDALE AVE	6	0.06%
GEORGE ST	6	0.06%
ELSTON ST	6	0.06%
ELIOT ST	6	0.06%

ON_STREET	Total	Percentage of Entire Population
DEARBORN RD	6	0.06%
CHETWYND ROAD	6	0.06%
CHESTER ST	6	0.06%
BUCKINGHAM ST	6	0.06%
BEECH ST	6	0.06%
AUSTIN ST	6	0.06%
ALSTON ST	6	0.06%
WESLEY ST	5	0.05%
VERMONT AVE	5	0.05%
UNION SQUARE	5	0.05%
ROBERTS ST	5	0.05%
RICHARDSON ST	5	0.05%
POPLAR ST	5	0.05%
NASHUA ST	5	0.05%
MOSSLAND STREET	5	0.05%
MILTON ST	5	0.05%
MASON ST	5	0.05%
MAPLE AVE	5	0.05%
MALLET ST	5	0.05%
LANDERS ST	5	0.05%
KENWOOD ST	5	0.05%
KENSINGTON AVE	5	0.05%
HOOKER AVE	5	0.05%
HINCKLEY ST	5	0.05%
HARDAN RD	5	0.05%
FORSTER ST	5	0.05%
FLINT AVE	5	0.05%
ESSEX ST	5	0.05%
ELLSWORTH ST	5	0.05%
EDMANDS ST	5	0.05%
EDGAR CT	5	0.05%
DURHAM ST	5	0.05%
DICKSON ST	5	0.05%
CYPRESS ST	5	0.05%
CENTURY ST	5	0.05%
BELKNAP ST	5	0.05%
WOODSTOCK ST	4	0.04%
WINDSOR ST	4	0.04%

ON_STREET	Total	Percentage of Entire Population
WILLIAM ST	4	0.04%
WALNUT RD	4	0.04%
VILLA AVE	4	0.04%
TALBOT AVE	4	0.04%
SUNNYSIDE AVE	4	0.04%
SHERMAN CT	4	0.04%
SACRAMENTO ST	4	0.04%
ROSELAND ST	4	0.04%
POWDERHOUSE ROTARY	4	0.04%
MORTON ST	4	0.04%
MELVIN ST	4	0.04%
MELVILLE RD	4	0.04%
HAWKINS ST	4	0.04%
EDGAR TER	4	0.04%
CUMMINGS ST	4	0.04%
CONNECTICUT AVE	4	0.04%
CLYDE ST	4	0.04%
CARLTON ST	4	0.04%
BLAKELEY AVE	4	0.04%
AUBURN AVE	4	0.04%
WESTMINSTER ST	3	0.03%
WEST QUINCY	3	0.03%
WESLEY PARK	3	0.03%
TYLER ST	3	0.03%
THIRD AVE	3	0.03%
TAYLOR ST	3	0.03%
NEWBERNE ST	3	0.03%
LINCOLN AVE	3	0.03%
LELAND ST	3	0.03%
KIMBALL ST	3	0.03%
HOMER SQ	3	0.03%
HILLSIDE PARK	3	0.03%
EAST ALBION ST	3	0.03%
CLEVELAND ST	3	0.03%
CLARK ST	3	0.03%
CADY AVE	3	0.03%
BENEDICT ST	3	0.03%
WOODBINE ST	2	0.02%

ON_STREET	Total	Percentage of Entire Population
WELLINGTON AVE	2	0.02%
WALDO AVE	2	0.02%
STONE PL	2	0.02%
SHORE DRIVE	2	0.02%
SANBORN AVE	2	0.02%
PRINCETON ST	2	0.02%
OSGOOD ST	2	0.02%
NO. UNION ST	2	0.02%
NEW HAMPSHIRE AVE	2	0.02%
MORGAN ST	2	0.02%
MAINE TER	2	0.02%
LINE ST	2	0.02%
LEON ST	2	0.02%
LATIN WAY	2	0.02%
HUNTING ST	2	0.02%
HERBERT ST	2	0.02%
HENDERSON ST	2	0.02%
HARVARD PL	2	0.02%
HANSON ST	2	0.02%
CROWN ST	2	0.02%
CENTRE ST	2	0.02%
CALVIN ST	2	0.02%
BRADFORD AVE	2	0.02%
ASSEMBLY SQUARE DRIVE	2	0.02%
WINDOM ST	1	0.01%
TAUNTON ST	1	0.01%
SMITH AVE	1	0.01%
SEVEN PINES AVE	1	0.01%
PROSPECT HILL PARKWAY	1	0.01%
MT VERNON AVE	1	0.01%
HARDING ST	1	0.01%
FRANKLIN AVE	1	0.01%
FRANCIS ST	1	0.01%
FOUNTAIN AVE	1	0.01%
FOREST ST	1	0.01%
ELLINGTON RD	1	0.01%
CREST HILL RD	1	0.01%
CARTER TER	1	0.01%

ON_STREET	Total	Percentage of Entire Population
BENNETT ST	1	0.01%
BELMONT PL	1	0.01%
ASHLAND ST	1	0.01%
ALLEN ST	1	0.01%
ALBION TER	1	0.01%
Grand Total	*9260*	*100%*

ON_STREET	Total	Percentage of Entire Population
ABERDEEN RD	10	0.11%
ADAMS ST	22	0.24%
ADRIAN ST	17	0.18%
ALBION ST	57	0.62%
ALBION TER	1	0.01%
ALDERSEY ST	16	0.17%
ALDRICH ST	16	0.17%
ALEWIFE BROOK PARKWAY	151	1.63%
ALLEN ST	1	0.01%
ALPINE ST	9	0.10%
ALSTON ST	6	0.06%
AMES ST	17	0.18%
APPLETON ST	15	0.16%
ARLINGTON ST	11	0.12%
ASH AVE	11	0.12%
ASHLAND ST	1	0.01%
ASSEMBLY SQUARE DRIVE	2	0.02%
ATHERTON ST	16	0.17%
AUBURN AVE	4	0.04%
AUSTIN ST	6	0.06%
AVON ST	22	0.24%
BAILEY RD	11	0.12%
BAILEY ST	9	0.10%
BANKS ST	32	0.35%
BARTLETT ST	37	0.40%
BARTON ST	16	0.17%
BAY STATE AVE	35	0.38%
BEACON ST	71	0.77%
BEECH ST	6	0.06%
BELKNAP ST	5	0.05%
BELMONT PL	1	0.01%
BELMONT ST	20	0.22%
BENEDICT ST	3	0.03%
BENNETT ST	1	0.01%
BENTON RD	11	0.12%

ON_STREET	Total	Percentage of Entire Population
BERKELEY ST	22	0.24%
BIGELOW ST	7	0.08%
BILLINGHAM ST	11	0.12%
BLAKELEY AVE	4	0.04%
BOLTON ST	11	0.12%
BONAIR ST	16	0.17%
BOND ST	13	0.14%
BOSTON AVE	47	0.51%
BOSTON ST	40	0.43%
BOW ST	28	0.30%
BOWDOIN ST	7	0.08%
BRADFORD AVE	2	0.02%
BRADLEY ST	11	0.12%
BRASTOW AVE	26	0.28%
BROADWAY	438	4.73%
BROMFIELD RD	40	0.43%
BROOK ST	10	0.11%
BROWNING RD	18	0.19%
BUCKINGHAM ST	6	0.06%
BUENA VISTA ROAD	16	0.17%
BURNHAM ST	12	0.13%
BURNSIDE AVE	19	0.21%
BUTLER DRIVE	8	0.09%
CADY AVE	3	0.03%
CALVIN ST	2	0.02%
CAMBRIA ST	13	0.14%
CAMERON AVE	37	0.40%
CAMPBELL PK	11	0.12%
CARLTON ST	4	0.04%
CARTER TER	1	0.01%
CEDAR ST	59	0.64%
CENTRAL RD	8	0.09%
CENTRAL ST	69	0.75%
CENTRE ST	2	0.02%
CENTURY ST	5	0.05%
CHANDLER ST	35	0.38%
CHAPEL ST	9	0.10%
CHARLES E RYAN ROAD	8	0.09%

ON_STREET	Total	Percentage of Entire Population
CHARNWOOD RD	12	0.13%
CHERRY ST	23	0.25%
CHESTER ST	6	0.06%
CHESTNUT ST	19	0.21%
CHETWYND ROAD	6	0.06%
CHURCH ST	34	0.37%
CLAREMON ST	11	0.12%
CLARENDON AVE	19	0.21%
CLARK ST	3	0.03%
CLEVELAND ST	3	0.03%
CLIFTON ST	8	0.09%
CLYDE ST	4	0.04%
COLLEGE AVE	56	0.60%
COLLEGE HILL RD	7	0.08%
COLUMBUS AVE	51	0.55%
CONCORD AVE	37	0.40%
CONCORD SQUARE	8	0.09%
CONNECTICUT AVE	4	0.04%
CONWELL AVE	23	0.25%
CONWELL ST	9	0.10%
CORINTHIAN RD	21	0.23%
COTTAGE AVE	28	0.30%
CRAIGIE ST	29	0.31%
CREST HILL RD	1	0.01%
CROCKER ST	16	0.17%
CROSS ST	41	0.44%
CROSS ST EAST	21	0.23%
CROWN ST	2	0.02%
CUMMINGS ST	4	0.04%
CURTIS AVE	18	0.19%
CURTIS ST	12	0.13%
CUTLER ST	27	0.29%
CUTTER AVE	16	0.17%
CYPRESS ST	5	0.05%
DANA ST	27	0.29%
DANE AVE	7	0.08%
DANE ST	8	0.09%
DARTMOUTH ST	37	0.40%

ON_STREET	Total	Percentage of Entire Population
DAY ST	13	0.14%
DEARBORN RD	6	0.06%
DELAWARE ST	7	0.08%
DELL ST	24	0.26%
DERBY ST	21	0.23%
DICKINSON ST	16	0.17%
DICKSON ST	5	0.05%
DIMICK ST	17	0.18%
DOVER ST	11	0.12%
DOW ST	9	0.10%
DURHAM ST	5	0.05%
EARLE STREET	8	0.09%
EAST ALBION ST	3	0.03%
EDGAR AVE	29	0.31%
EDGAR CT	5	0.05%
EDGAR TER	4	0.04%
EDMANDS ST	5	0.05%
ELECTRIC AVE	36	0.39%
ELIOT ST	6	0.06%
ELLINGTON RD	1	0.01%
ELLSWORTH ST	5	0.05%
ELM ST	67	0.72%
ELMWOOD ST	27	0.29%
ELSTON ST	6	0.06%
ENDICOTT AVE	17	0.18%
ESSEX ST	5	0.05%
EVERETT AVE	11	0.12%
EVERGREEN AVE	16	0.17%
FAIRFAX ST	14	0.15%
FAIRMOUNT AVE	14	0.15%
FARRAGUT AVE	9	0.10%
FELLSWAY WEST	53	0.57%
FENWICK ST	11	0.12%
FLINT AVE	5	0.05%
FLINT ST	39	0.42%
FLORENCE ST	18	0.19%
FOLEY ST	7	0.08%
FOREST ST	1	0.01%

ON_STREET	Total	Percentage of Entire Population
FORSTER ST	5	0.05%
FOSKET ST	16	0.17%
FOUNTAIN AVE	1	0.01%
FRANCESCA AVE	14	0.15%
FRANCIS ST	1	0.01%
FRANEY RD	11	0.12%
FRANKLIN AVE	1	0.01%
FRANKLIN ST	56	0.60%
FREMONT AVE	18	0.19%
FREMONT ST	8	0.09%
GARFIELD AVE	13	0.14%
GARRISON AVE	8	0.09%
GEORGE ST	6	0.06%
GIBBENS ST	15	0.16%
GILMAN ST	38	0.41%
GILMAN TER	11	0.12%
GLEN ST	56	0.60%
GLENDALE AVE	6	0.06%
GLENWOOD RD	46	0.50%
GORDON ST	28	0.30%
GORHAM ST	15	0.16%
GOV WINTHROP RD	10	0.11%
GRAND VIEW AVE	14	0.15%
GRANITE ST	15	0.16%
GRANT ST	24	0.26%
GREENE ST	10	0.11%
GREENVILLE ST	27	0.29%
GROVE ST	10	0.11%
HALL AVE	12	0.13%
HALL ST	11	0.12%
HAMILTON RD	12	0.13%
HAMMOND ST	9	0.10%
HANCOCK ST	44	0.48%
HANSON ST	2	0.02%
HARDAN RD	5	0.05%
HARDING ST	1	0.01%
HAROLD RD	11	0.12%
HARRISON ST	16	0.17%

ON_STREET	Total	Percentage of Entire Population
HARVARD PL	2	0.02%
HARVARD ST	25	0.27%
HATHORN ST	6	0.06%
HAWKINS ST	4	0.04%
HEATH ST	40	0.43%
HENDERSON ST	2	0.02%
HENERY HANSEN PARK	21	0.23%
HENRY AVE	14	0.15%
HERBERT ST	2	0.02%
HIGH ST	11	0.12%
HIGHLAND AVE	224	2.42%
HIGHLAND RD	75	0.81%
HILL ST	11	0.12%
HILLSDALE RD	9	0.10%
HILLSIDE PARK	3	0.03%
HINCKLEY ST	5	0.05%
HOLLAND ST	57	0.62%
HOLYOKE RD	25	0.27%
HOMER SQ	3	0.03%
HOOKER AVE	5	0.05%
HOUGHTON ST	18	0.19%
HOWARD ST	18	0.19%
HOWE ST	7	0.08%
HUDSON ST	43	0.46%
HUNTING ST	2	0.02%
IBBETSON ST	7	0.08%
ILLINOIS AVE	14	0.15%
INDIANA AVE	13	0.14%
INNER BELT RD	92	0.99%
IRVING ST	32	0.35%
IRVINGTON ROAD	15	0.16%
IVALOO ST	15	0.16%
JACKSON RD	16	0.17%
JAMES ST	7	0.08%
JAQUES ST	52	0.56%
JASPER ST	10	0.11%
JAY ST	12	0.13%
JOSEPH ST	6	0.06%

ON_STREET	Total	Percentage of Entire Population
JOSEPHINE AVE	47	0.51%
KENSINGTON AVE	5	0.05%
KENWOOD ST	5	0.05%
KIDDER AVE	32	0.35%
KIMBALL ST	3	0.03%
KINGSTON ST	10	0.11%
KNAPP ST	6	0.06%
KNOWLTON ST	9	0.10%
LANDERS ST	5	0.05%
LANGMAID AVE	12	0.13%
LATIN WAY	2	0.02%
LAUREL ST	16	0.17%
LEE ST	8	0.09%
LELAND ST	3	0.03%
LEON ST	2	0.02%
LEONARD ST	9	0.10%
LESLEY AVE	14	0.15%
LEWIS ST	10	0.11%
LEXINGTON AVE	24	0.26%
LIBERTY AVE	20	0.22%
LINCOLN AVE	3	0.03%
LINCOLN PARKWAY	12	0.13%
LINCOLN ST	18	0.19%
LINDEN AVE	33	0.36%
LINE ST	2	0.02%
LINWOOD ST	65	0.70%
LORING ST	11	0.12%
LOWDEN AVE	35	0.38%
LOWELL ST	101	1.09%
MADISON ST	14	0.15%
MAGNUS AVE	12	0.13%
MAIN ST	10	0.11%
MAINE AVE	6	0.06%
MAINE TER	2	0.02%
MALLET ST	5	0.05%
MALVERN AVE	10	0.11%
MANSFIELD ST	9	0.10%
MAPLE AVE	5	0.05%

ON_STREET	Total	Percentage of Entire Population
MARION ST	16	0.17%
MARSHALL ST	43	0.46%
MASON ST	5	0.05%
McARTHUR ST	15	0.16%
McGRATH HIGHWAY	34	0.37%
MEACHAM RD	13	0.14%
MEACHAM ST	24	0.26%
MEAD ST	14	0.15%
MEDFORD ST	118	1.27%
MELVILLE RD	4	0.04%
MELVIN ST	4	0.04%
MERRIAM ST	9	0.10%
MICHIGAN AVE	17	0.18%
MIDDLESEX AVE	34	0.37%
MILTON ST	5	0.05%
MINER ST	6	0.06%
MINNESOTA AVE	17	0.18%
MONTGOMERY AVE	7	0.08%
MONTROSE ST	18	0.19%
MOORE ST	12	0.13%
MORELAND ST	29	0.31%
MORGAN ST	2	0.02%
MORRISON AVE	57	0.62%
MORTON ST	4	0.04%
MOSSLAND STREET	5	0.05%
MT PLEASANT ST	8	0.09%
MT VERNON AVE	1	0.01%
MT VERNON ST	33	0.36%
MUNROE ST	43	0.46%
MUSEUM ST	7	0.08%
MYRTLE ST	40	0.43%
MYSTIC AVE	24	0.26%
MYSTIC VALLEY PARKWAY	32	0.35%
NASHUA ST	5	0.05%
NEW HAMPSHIRE AVE	2	0.02%
NEW ROAD	11	0.12%
NEW WASHINGTON STREET	12	0.13%
NEWBERNE ST	3	0.03%

ON_STREET	Total	Percentage of Entire Population
NEWBURY ST	16	0.17%
NEWTON ST	11	0.12%
NO. UNION ST	2	0.02%
NORFORK ST	17	0.18%
NORTH ST	43	0.46%
NORWOOD AVE	15	0.16%
OAK ST	19	0.21%
OAKLAND AVE	8	0.09%
OLIVER ST	16	0.17%
ORCHARD ST	54	0.58%
OSGOOD ST	2	0.02%
OSSIPEE RD	47	0.51%
OTIS ST	24	0.26%
OXFORD ST	45	0.49%
PACKARD AVE	51	0.55%
PARK AVE	6	0.06%
PARK ST	18	0.19%
PARKDALE ST	9	0.10%
PARKER ST	10	0.11%
PARTRIDGE AVE	36	0.39%
PAULINA ST	24	0.26%
PEARL ST	135	1.46%
PEARSON AVE	36	0.39%
PEARSON RD	36	0.39%
PEMBROKE ST	9	0.10%
PENNSYLVANIA AVE	57	0.62%
PERKINS ST	40	0.43%
PERRY ST	19	0.21%
PINCKNEY ST	26	0.28%
PLEASANT AVE	11	0.12%
POPLAR ST	5	0.05%
PORTER ST	42	0.45%
POWDER HOUSE BOULEVARD	195	2.11%
POWDER HOUSE TERRACE	16	0.17%
POWDERHOUSE ROTARY	4	0.04%
PRESCOTT ST	29	0.31%
PRESTON RD	23	0.25%
PRICHARD AVE	26	0.28%

ON_STREET	Total	Percentage of Entire Population
PRINCETON ST	2	0.02%
PROFESSORS ROW	36	0.39%
PROPERZI WAY	10	0.11%
PROSPECT HILL AVE	21	0.23%
PROSPECT HILL PARKWAY	1	0.01%
PROSPECT ST	21	0.23%
PURITAN RD	21	0.23%
PUTNAM RD	11	0.12%
PUTNAM ST	43	0.46%
QUINCY ST	16	0.17%
RADCLIFFE RD	9	0.10%
RAYMOND AVE	29	0.31%
RHODE ISLAND AVE	7	0.08%
RICHARDSON ST	5	0.05%
RICHDALE AVE	21	0.23%
ROBERTS ST	5	0.05%
ROBINSON ST	19	0.21%
ROGERS AVE	49	0.53%
ROSE ST	13	0.14%
ROSELAND ST	4	0.04%
ROSSMORE ST	17	0.18%
RUSH ST	27	0.29%
RUSSELL RD	18	0.19%
RUSSELL ST	32	0.35%
SACRAMENTO ST	4	0.04%
SANBORN AVE	2	0.02%
SARGENT AVE	17	0.18%
SCHOOL ST	62	0.67%
SEVEN PINES AVE	1	0.01%
SEWALL ST	13	0.14%
SHERMAN CT	4	0.04%
SHORE DRIVE	2	0.02%
SIMPSON AVE	25	0.27%
SKILTON AVE	6	0.06%
SMITH AVE	1	0.01%
SOMERVILLE AVE	200	2.16%
SOUTH ST	28	0.30%
SPENCER AVE	20	0.22%

ON_STREET	Total	Percentage of Entire Population
SPRING ST	9	0.10%
SPRINGFIELD ST	11	0.12%
ST JAMES AVE	23	0.25%
STERLING ST	16	0.17%
STICKNEY AVE	9	0.10%
STONE AVE	7	0.08%
STONE PL	2	0.02%
SUMMER ST	114	1.23%
SUMMIT AVE	16	0.17%
SUMMIT ST	6	0.06%
SUNNYSIDE AVE	4	0.04%
SUNSET ROAD	19	0.21%
SYCAMORE ST	32	0.35%
SYDNEY ST	9	0.10%
TALBOT AVE	4	0.04%
TAUNTON ST	1	0.01%
TAYLOR ST	3	0.03%
TEELE AVE	15	0.16%
TEMPLE RD	20	0.22%
TEMPLE ST	43	0.46%
TEN HILLS RD	28	0.30%
TENNYSON ST	22	0.24%
THIRD AVE	3	0.03%
THORNDIKE ST	8	0.09%
THURSTON ST	34	0.37%
TOWER ST	12	0.13%
TREMONT ST	21	0.23%
TRULL ST	14	0.15%
TUFTS ST	32	0.35%
TYLER ST	3	0.03%
UNION SQUARE	5	0.05%
UPLAND ROAD	12	0.13%
VERMONT AVE	5	0.05%
VERNON ST	9	0.10%
VICTORIA ST	26	0.28%
VILLA AVE	4	0.04%
VINAL AVE	32	0.35%
VIRGINIA ST	12	0.13%

ON_STREET	Total	Percentage of Entire Population
WALDO AVE	2	0.02%
WALDO ST	7	0.08%
WALKER ST	23	0.25%
WALLACE ST	45	0.49%
WALNUT RD	4	0.04%
WALNUT ST	85	0.92%
WALTER TER	6	0.06%
WARE ST	10	0.11%
WARNER ST	13	0.14%
WARREN AVE	12	0.13%
WARWICK ST	12	0.13%
WASHINGTON ST	124	1.34%
WATERHOUSE ST	18	0.19%
WATSON ST	7	0.08%
WEBSTER AVE	29	0.31%
WEBSTER ST	12	0.13%
WELLINGTON AVE	2	0.02%
WESLEY PARK	3	0.03%
WESLEY ST	5	0.05%
WEST ADAMS ST	10	0.11%
WEST QUINCY	3	0.03%
WEST ST	15	0.16%
WESTMINSTER ST	3	0.03%
WESTWOOD RD	11	0.12%
WHEATLAND ST	14	0.15%
WHEELER ST	7	0.08%
WHITFIELD RD	28	0.30%
WHITMAN ST	11	0.12%
WIGGLESWORTH ST	23	0.25%
WILLIAM ST	4	0.04%
WILLOUGHBY ST	8	0.09%
WILLOW AVE	117	1.26%
WILTON ST	9	0.10%
WINDOM ST	1	0.01%
WINDSOR RD	15	0.16%
WINDSOR ST	4	0.04%
WINSLOW AVE	27	0.29%
WISCONSIN AVE	19	0.21%

ON_STREET	Total	Percentage of Entire Population
WOODBINE ST	2	0.02%
WOODS AVE	14	0.15%
WOODSTOCK ST	4	0.04%
WYATT ST	11	0.12%
YORKTOWN ST	9	0.10%
Grand Total	*9260*	*100%*

Appendix H
Miscellaneous Reports

DAVEY

Somerville, MA

Quantity Report: Observation

Observation	Total	Percentage of Entire Population
None	8794	77.33%
Poor Root System	796	7.00%
Remove Hardware	263	2.31%
Improperly Mulched	245	2.15%
Poor Structure	242	2.13%
Cavity or Decay	201	1.77%
Improperly Installed	191	1.68%
Signs of Stress	138	1.21%
Mechanical Damage	121	1.06%
Improperly Pruned	121	1.06%
Serious Decline	96	0.84%
Pest Problem	70	0.62%
Poor Location	53	0.47%
Grate or Guard	26	0.23%
Nutrient Deficiency	12	0.11%
Memorial Tree	3	0.03%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Trunks

Trunks	Total	Percentage of Entire Population
1	10815	95.10%
N/A	244	2.15%
2	141	1.24%
3	94	0.83%
4	48	0.42%
5	12	0.11%
7	5	0.04%
6	5	0.04%
10	3	0.03%
12	2	0.02%
14	1	0.01%
9	1	0.01%
8	1	0.01%
Grand Total	*11372*	*100%*

Somerville, MA

Quantity Report: Utilities

Utilities	*Total*	*Percentage of Entire Population*
No	5998	52.74%
Yes	5374	47.26%
Grand Total	*11372*	*100%*

Appendix I
Suggested Tree Species

Suggested Tree Species

The tree species listed are considered for such factors as: size, disease resistance, pest problems, location suitability, seed or fruit set and visual appearance. Another factor that can be considered in species selection is which trees are presently doing well and are relatively free from insects and disease. While efforts have been made to make appropriate recommendations, nurseries may have further information as to specific cultivars or varieties, which may be more suitable for your location or climate.

Deciduous Trees

Large Trees: Greater than 50 Feet in Height when Mature

Scientific Name	Common Name	Cultivar
Eucommia ulmoides	Hardy Rubber Tree	
Fraxinus americana	White Ash	Autumn Purple®
Ginkgo biloba	Ginkgo	(Choose male trees only)
Gleditsia triacanthos inermis	Thornless Honeylocust	'Skyline'
Gymnocladus dioicus	Kentucky Coffeetree	Prairie Titan®
Metasequoia glyptostroboides	Dawn Redwood	'Emerald Feathers'
Nyssa sylvatica	Black Tupelo	
Quercus bicolor	Swamp White Oak	
Quercus imbricaria	Shingle Oak	
Quercus macrocarpa	Bur Oak	
Quercus rubra	Northern Red Oak	'Splendens'
Taxodium distichum	Common Baldcypress	'Shawnee Brave'
Tilia tomentosa	Silver Linden	'Sterling'

Medium Trees: 26 to 49 Feet in Height when Mature

Scientific Name	Common Name	Cultivar
Acer campestre	Hedge Maple	
Aesculus x *carnea*	Red Horsechesnut	'Briotii'
Carpinus caroliniana	American Hornbeam	
Cercidiphyllum japonicum	Katsuratree	
Cladrastis kentukea	American Yellowwood	'Rosea'
Corylus colurna	Turkish Filbert	
Halesia tetraptera	Carolina Silverbell	
Koelreuteria paniculata	Goldenraintree	
Ostrya virginiana	American Hophornbeam	
Parrotia persica	Persian Parrotia	'Vanessa'
Phellodendron amurense	Amur Corktree	'Macho'
Ulmus parvifolia	Lacebark Elm	

Small Trees: 10 to 25 Feet in Height when Mature

Scientific Name	Common Name	Cultivar
Acer ginnala	Amur Maple	Red Rhapsody™
Amelanchier spp.	Serviceberry spp.	
Cercis canadensis	Eastern Redbud	'Forest Pansy'
Chionanthus retusus	Chinese Fringetree	
Cornus kousa	Kousa Dogwood	
Crataegus spp.	Hawthorn spp.	
Malus spp.	Flowering Crabapple	(Disease resistant only)
Syringa reticulata	Japanese Tree Lilac	'Ivory Silk'

Special Use Trees

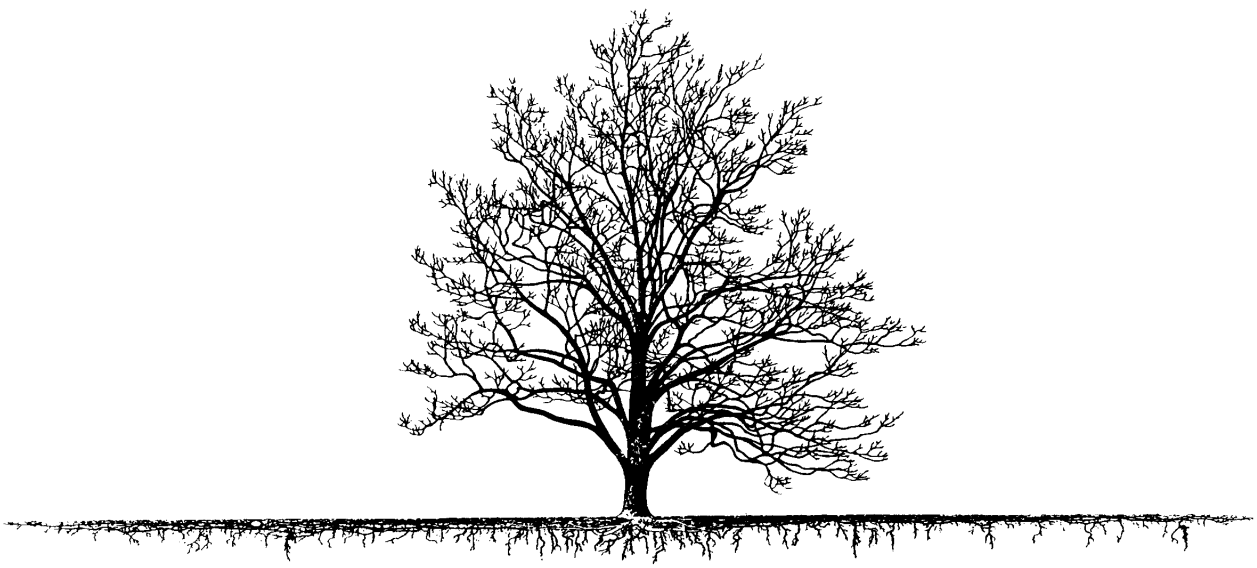
In certain areas of the city, such as the downtown business district or in areas of restricted aboveground space, the best tree choice may be those varieties that grow more upright in what is termed a fastigiate, or columnar, manner. This form achieves two purposes: (1) because of their tighter, upright habit, there is minimal storefront blockage; and (2) they will not be wide branching, thus avoiding sidewalk clearance concerns. The following tree species and varieties offer the described characteristics and should be considered for tight space situations:

Scientific Name	Common Name	Cultivar
Acer campestre	Hedge Maple	'Evelyn'
Acer rubrum	Red Maple	'Bowhall' 'Karpick'
Amelanchier arborea	Downy Serviceberry	'Cumulus' 'Robin Hill'
Carpinus betulus	European Hornbeam	'Fastigiata'
Ginkgo biloba	Ginkgo	'Lakeview' Princeton Sentry®
Malus spp.	Flowering Crabapple	'Centurion' 'Harvest Gold' Madonna™ 'Sentinel'
Prunus sargentii	Sargent Cherry	'Columnaris'
Prunus serrulata	Japanese Flowering Cherry	'Amanogawa'
Pyrus calleryana	Callery Pear	'Chanticleer'
Quercus robur	English Oak	Skyrocket™

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

Appendix J
Davey® Pruning Guidelines

Tree Pruning Guidelines



Introduction

Pruning consists of *selectively* removing branches (living and dead) from woody plants, ranging from pinching off a bud at the end of a twig to removing large limbs.

Proper pruning benefits trees, shrubs, and vines, and the associates of woody plants (including humans). Pruning branches can be one of the most beneficial or the most damaging practices arborists do to trees.

A basic principle of pruning is that the removal of any live stems, branches, twigs, and buds affects growth of the plant. Proper pruning prevents and corrects defective form that could result in branch or stem failure. Thus, knowledge of plant biology is essential for the correct methods of Davey pruning.

Most tree species evolved in competitive forest communities. Consequently, trees developed efficient branching systems to capture the energy of available light for photosynthesis.

Woody plants also evolved the ability to get rid of inefficient energy resources by *shedding* shaded branches (cladaptosis). A branch is naturally shed from its base. As natural shedding occurs, the wood tissue around the branch core within the stem protects against decay. Davey's limb removal cuts imitate natural branch shedding (natural target pruning).

Many people equate woody plant pruning to amputation, but there should be no fear of wise and careful use of pruning equipment. A properly pruned tree, shrub, or vine is a combination of art, science, and skill.

Davey Tree surgeons adhere to Davey and industry pruning standards. In the arboriculture industry, the current standard approved by the ISA and the NAA is *The American National Standards Institute* (ANSI) A300 issued in 1995. Davey Residential Operations adheres to the National Arborist Association (NAA) *Pruning Standards for Shade Trees* (revised 1988) where four classes of pruning are defined. The NAA classes appear in a condensed version on the back of the Davey Plant Health Care quote/work order forms printed before 1996.

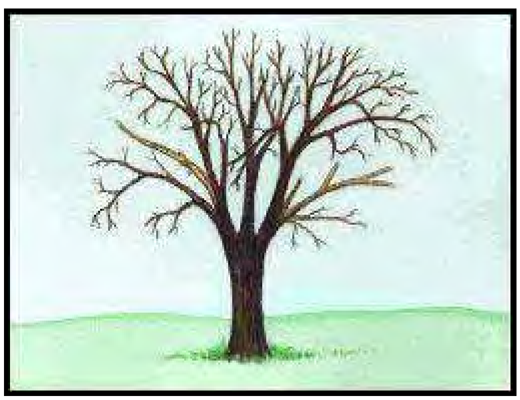
Reasons for Pruning

The first rule in pruning is **do not cut without a reason**. Too often arborists tend to over prune to meet client expectations. Proper pruning is an effort to *direct* new growth rather than 'control' growth.

Most pruning cuts are of a *preventive* or a *corrective* nature to be beneficial to woody plant health.

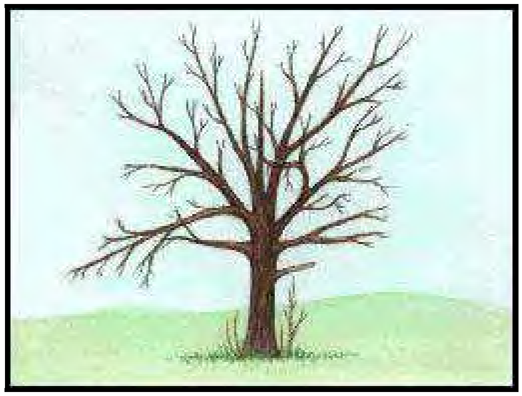
Health

- *Sanitation* by removing dead, broken, decayed, diseased or insect-infested wood (crown cleaning).
- *Thinning* to improve penetration of light and air, and to reduce wind resistance and potential storm damage.
- Reduction of the number of poorly attached *epicormic branches.*
- *Girdling root* removal.
- Correct and/or redirect *structural growth* that may cause future problems (weak crotches, branches growing out of proportion, etc.).



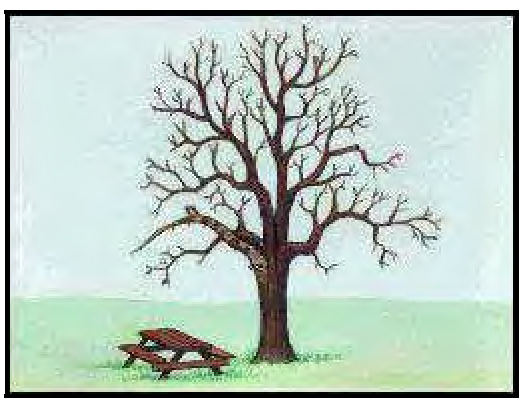
Appearance

- Shape for aesthetic purpose, natural forms, growth habit (training).
- Influence flowering, fruiting, promotion of shoots, canes, bark color.
- Direct new growth and/or correct improper prior pruning (crown restoration).



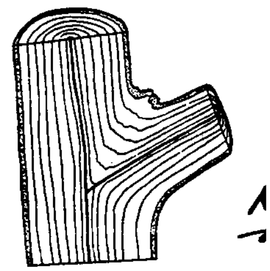
Convenience or Safety of Property and People

- Correct or modify storm-damaged, neglected, or poorly pruned woody plants.
- Identify and remove potential hazard limbs, stems, and deadwood (hazard reduction pruning).
- Line clearance (directional pruning).
- Raise or lower obstructive canopies over or near roads, sidewalks, playgrounds, buildings, pools, satellite dishes, etc. by removing interfering limbs (crown reduction and/or crown raising).
- Provide access to more light for understory plants and turf (crown thinning).
- Vista pruning (alter crowns to allow views of something beyond tree screens).



Pruning Methods and Techniques

Branch Attachment to Stems



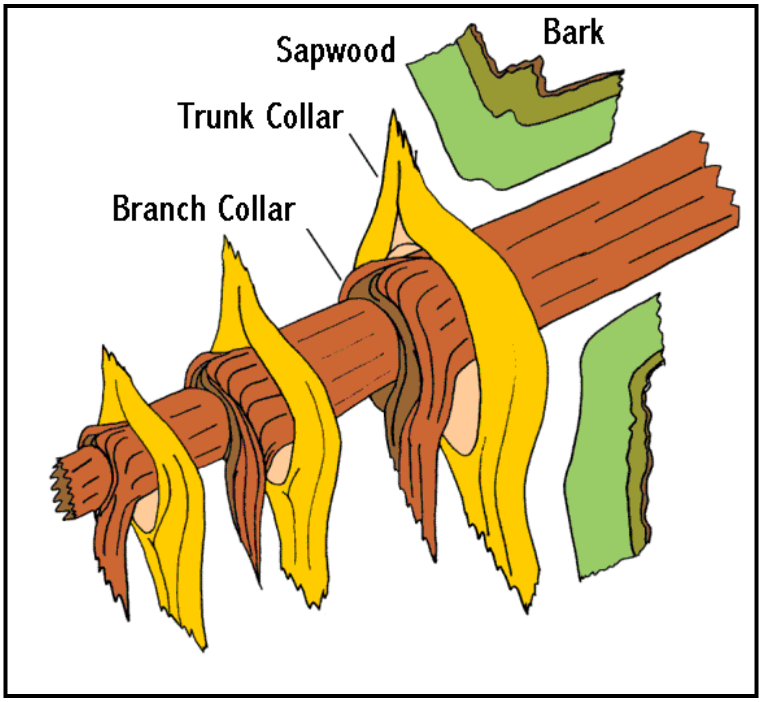
New branch tissues generated by the vascular cambium usually start growth before trunk tissues. As current-year branch tissue develops from branch ends toward the trunk, it turns abruptly downward at the branch base to form a *collar*.

Trunk branch tissues grow later and form a trunk collar over the branch collar (trunk collars and branch collars are collectively called the *branch collar*).

The collar is where wood and bark of the branch and the trunk come together, like an overlapping tissue 'switching zone'. All true branches on woody plants have branch collars.

The *branch bark ridge* (BBR) is raised bark developing in the branch crotch and shows the angle of the branch core in the tree.

If a branch dies or is removed, the trunk collar continues to grow over the thin belt of branch tissue below the collar junction. The wood core of the branch is walled off (compartmentalized) in the trunk.



Proper Pruning Cuts (Natural Target Pruning)

Location of *branch bark ridges* and *branch collars* determines the location of a pruning cut. Cuts must be made *outside* of the branch bark ridge, angling away from the trunk outward as close as possible to the collar.

- There is no set or standard angle for a proper collar cut.
- The proper angle depends on the shape of the collar.
- Conifers often have flat collars where a straight cut close to the collar is correct.
- Sometimes the angle of the cut will necessitate an *upstroke* cut with a handsaw or chainsaw.

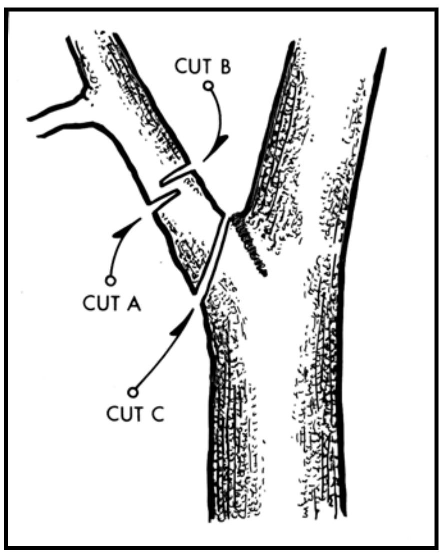
Do not cut into the collar to stimulate callus production and rapid closure. Although closure is desirable for appearance, such a cut promotes decay and future hazards. Never put a pruning tool behind the branch bark ridge.

Whether a branch collar is obvious or not, the position of the final or finish cut should:

- Minimize the branch stub that is an entryway for decay fungi.
- Retain the natural decay protection present in the branch core. The intact branch collar is the first line of defense in preventing decay within the trunk.
- Minimize the overall size of the pruning wound and direct damage to the stem.

Always **stub cut** the branch first. Limbs that cannot be controlled must be removed using at least **three** cuts. Roping of limbs may be necessary to prevent damage to other parts of the tree if they cannot be controlled by hand.

1. The first cut (Cut A) **undercuts** the limb one or two feet out from the parent branch or trunk. A properly made undercut will eliminate the chance of the branch 'peeling' or tearing bark as it is removed.
2. The second cut (Cut B) is the **top cut** which is usually made slightly further out on the limb than the undercut. This allows the limb to drop smoothly when the weight is released.
3. The third cut (Cut C) or **finish cut** is to remove the stub.



Each finish cut should be made carefully, outside of the branch bark ridge and the evident collar, leaving a smooth surface with no jagged edges or torn bark.

There are some situations where the cambium dies back beneath a branch collar after a correct cut:

- The trunk collar did not join the branch collar directly below the branch. Sunken spots under branches are a sign of this condition.
- Winter cuts may result in undercollar dieback.
- Problem tends to increase with size of branches removed.

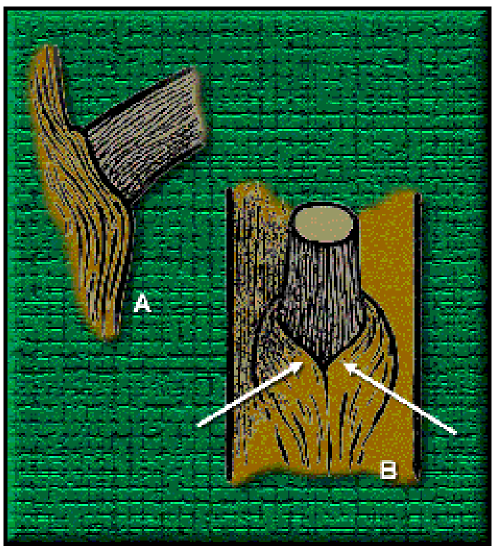
Callus and Woundwood

Callus is undifferentiated meristematic tissue that forms at wound margins from the cambium.

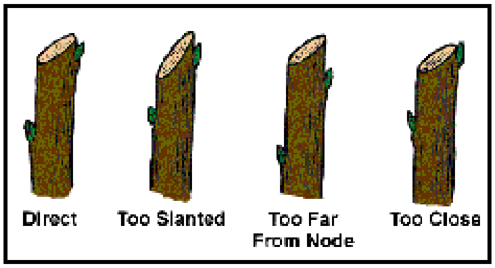
Callus differentiates into *woundwood* over time. Woundwood is 'new wood' and has the different cell components of periderm, cambium, phloem, and xylem.

A *complete* ring of callus and subsequent woundwood will develop around and eventually over proper cuts. Woundwood forms only to the sides of improper cuts (flush cuts), which means the collar and branch protection zone is damaged and the trunk is wounded.

A proper pruning cut results in a smaller wound area, and more rapid callus and woundwood movement over the wound. Cuts on dead limbs that have trunk collars moving up the dead branch wood must also be made just outside of the evident collar.



- Appropriate only for small woody plants or one- to two-year-old branches (twigs, branchlets) on trees.
- Cut back to a bud (lateral bud) or lateral branchlet, slanting at a 45° angle above the bud *node* on alternately arranged branches and stems.
- Two or more buds at a node (opposite, whorled) require a *transverse* cut just above the bud tips or a 45° angle cut, removing one of the buds and leaving the other(s) to elongate in a desired direction.
- Cut 1/8" higher above the bud tips when pruning in cold weather to prevent winter injury to the bud (tissue around a winter cut is more vulnerable to desiccation).



- Leaving a majority of *inward* facing buds produces growth towards center.
- Leaving a majority of *outward* facing buds results in more open growth.

Pruning Tools

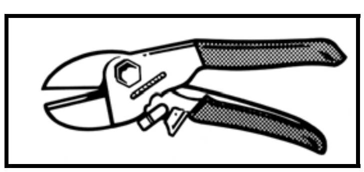
Use **well-sharpened** tools for both your safety and to help reduce tearing of wood and cambial tissues. Wear specified protective equipment.

Pruning Shears

Hand shears, secateurs, hand pruners, one-hand shears:

- Remove branches, stems up to 1/2" diameter.
- By-pass (hook and blade, scissors, drop-forge, curve blade): make closer cuts than anvil-type.

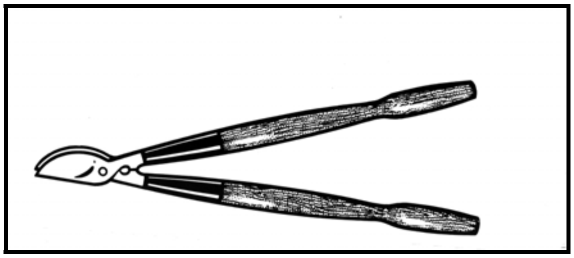
- Anvil (straight-blade): good for only soft-tissued wood; will crush harder wood (inappropriate per A300 standards).



Lopping shears

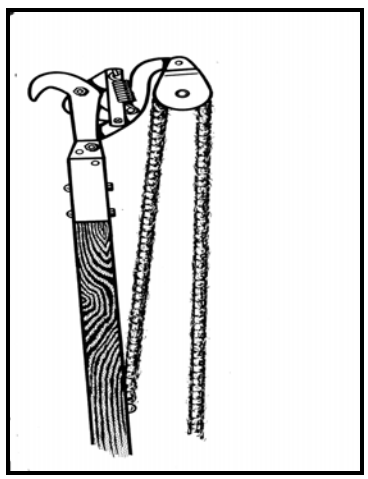
Two-hand shears:

- Remove branches, stems up to 1-3/4" diameter.
- Most useful in rejuvenation.
- By-pass, hook and blade, etc.
- Anvil, straight-blade.
- Ratcheting.



Pole Pruners

- Wood and insulated poles (round and squared).
- Cut like by-pass shears.
- Important to keep blade side in toward the cut.



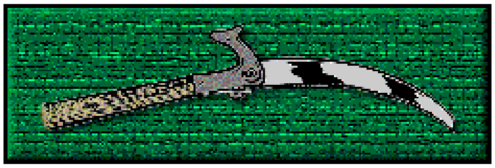
Cut at the outer side of the branch bark ridge at a slightly outward angle so as not to injure or remove the branch collar. Hook the pruner head around the limb to be cut with the blade side against the lateral branch or stem to remain. The arborist must be in a safe working position and the pruner handle positioned so the blade will not jam in the wood. You should not cut off a limb directly above yourself if there is any chance that it could fall and hit you.

Change your working position before completing the cut; place the hook so you have a straight pull on the rope and the lever arm can move far enough to complete the cut. An experienced tree surgeon can give a limb a flip with the side of the pruner head, just as the cut is completed, so that the limb will fall in the desired direction.

Saws

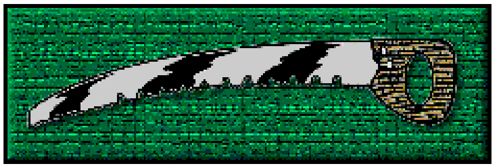
Pole saws:

- Hook cast onto pole-head.
- Wood poles (round and squared).
- Insulated poles (foam core).
- Difficult to make clean, accurate cuts.



Fine-tooth saw blades (more points per inch):

- On folding, rigid, and grip handles.
- *Needlepoint* teeth.
- Razor-tooth, Japanese, or *tri-edge*-style teeth (*Fanno*™ 1311, *Felco*™, *Corona*™); narrow, curved blades facilitate getting into tight spots.



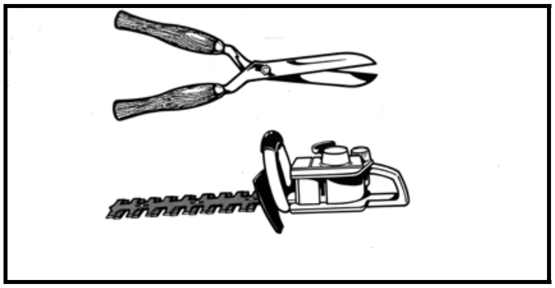
Arborist saws cut on the *pull* stroke:

- Davey-issue speed saw.
- Raker and gullet saws.
- Needle-tooth saws Fanno™ series.
- Scabbards, blade lengths.
- Pole saw blades now available with tri-edge teeth.

Hedge Shears

Clippers/trimmers:

- Manual (sometimes called 'pruning' shears)



- Powered (electric, gasoline)
- Cut off growth ‘in line’ with no regard for node locations or branch bark ridges.
- Provide time and labor savings at expense of overall plant health.
- Dull blades compound problems and make you work harder!

Crown Thinning and Cleaning

A proper thinning cut removes a branch at its point of attachment, or back to a lateral branch large enough to assume a terminal role.

Learn to foresee the need for removing live branches while they are small. Avoid large cuts. Direction can be influenced by removal of short portions of growth or even by removal of individual buds.

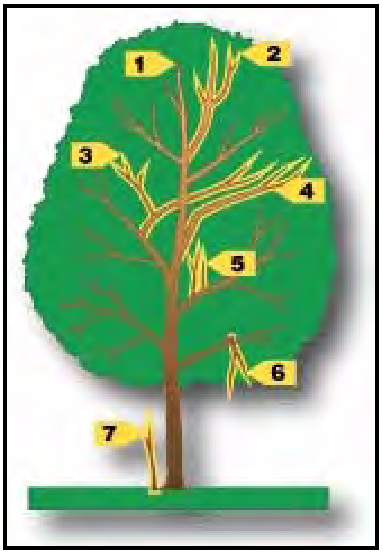
Thinning of lower branches can ‘raise’ a limb. If, after crown raising, the remaining leaf material is insufficient for limb size, consider complete removal. The client's opinion is important.

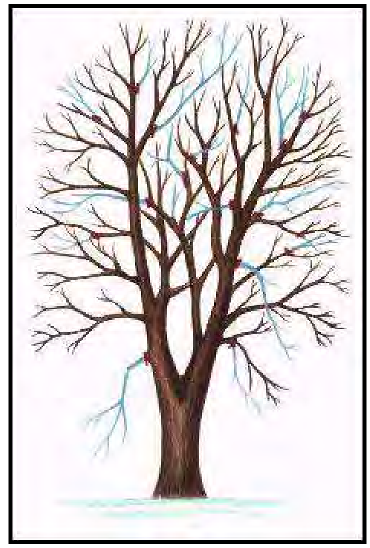
Never perform excessive thinning, which is stressful, especially on thin-barked or young trees prone to sunscald.

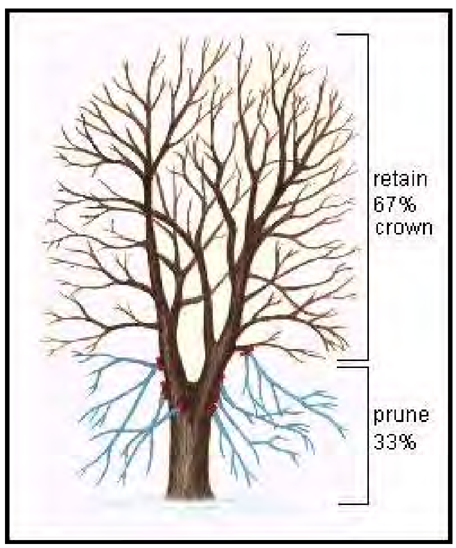
Avoid removing more than 1/4 of the live branches on a tree. Older or overmature trees should have an absolute minimum of living branches removed.

Always avoid ‘skinning’ or ‘hollowing' out the center of a tree's canopy. The majority of thinning cuts should be made along the outer crown. Proper thinning requires a good deal of limb-walking and deft use of a pole-pruner when and where aerial lifts are not used.

When thinning laterals from a limb, maintain well-spaced inner branches to achieve more distribution of foliage along the branch.

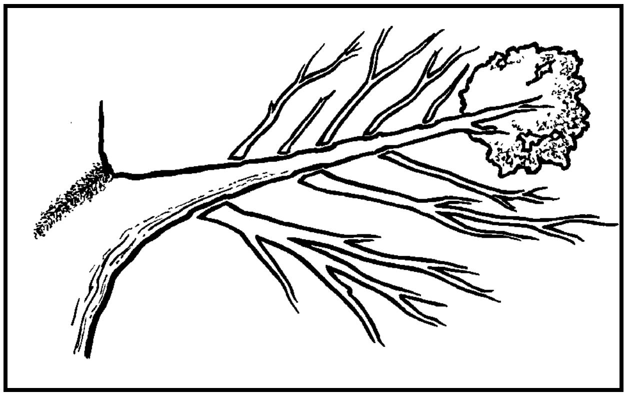






Caution must be taken to avoid creating an effect known as *lion-tailing*:

- Caused by removing all of the inner laterals and foliage.
- Displaces foliar weight to the ends of the branches.
- May result in sunburned bark tissue, renewed and excessive epicormic branches, weakened branch structure and breakage.
- Wind whippage.



Lion-tailing

Removal of Diseased or Insect-Infested Branches

Sanitation or 'eradicative' pruning (crown cleaning):

- Cut out diseased limbs back to collars, appropriate lateral branches, or a scaffold branch at least one foot below infected portion.
- Disinfect tools *during or after* pruning diseased branches with bleach solution (1 part bleach to 10 parts water) or Lysol.
- Do not use any form of alcohol to sterilize pruning tools *during* the work. Use alcohol to disinfect auger-bits, injection tees, or pruning tools *after* the job, especially plants with wetwood or fireblight bacterial infections.

Removal of Weak, Rubbing, or Competing Stems

Remove, if possible, but avoid large holes in the canopy.

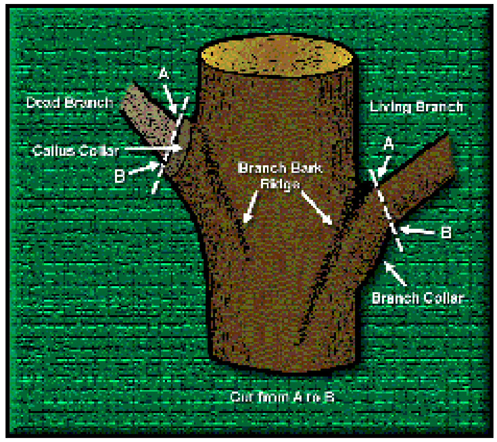
The life of large limbs, weakened by decay or cracks, can often be extended by "shortening" or weight removal using highly selective thinning cuts. Cabling and/or rigid bracing may be required to secure limbs or codominant stems if removal is not possible.

Deadwood Removal

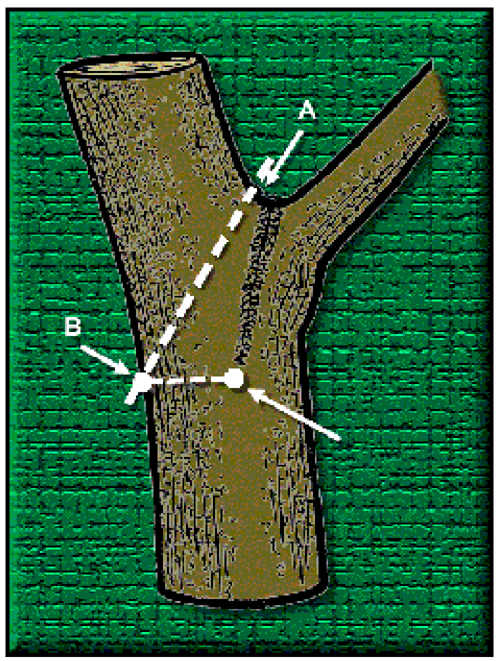
Sanitation and hazard reduction pruning:

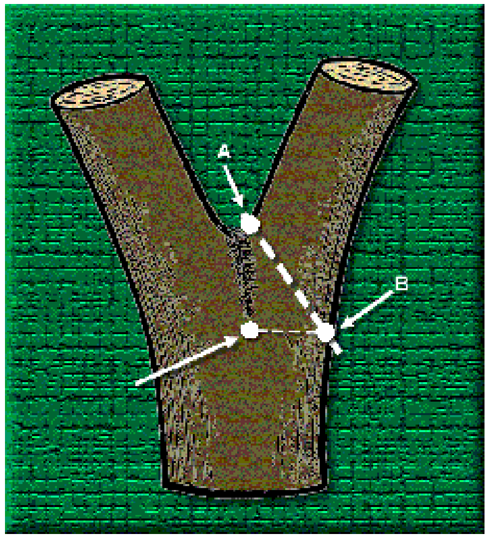
- Dead branches and stubs are an energy source (cellulose, glucose).
- Decay fungi.
- Boring insects.

Again, do not remove the branch collar around dead branches. Cut as close as possible to the collar of good wood surrounding the branch base.



Locate Target Points





Codominant Stem or Branch Removal

Always *stub cut* the stem to be removed, and then make the *finish* cut with care.

Some defect (discoloration) will develop in the remnant stem 'core' in the main stem:

- Usually not attached like a true branch with protective collar.
- Barrier zone should develop and confine defect if correct cut is performed.

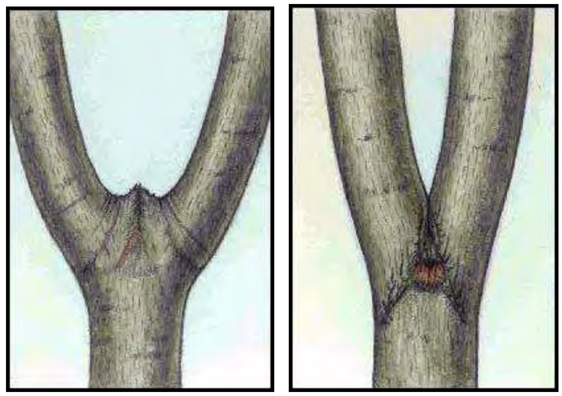
Never remove both stems!

When the bark plates on the stem bark ridge turn upward, the union of the stems is usually *strong.*

When the bark between the stems turns inward, the union of the stems is *weak.*

It is the *union* of the stems or upright branches more than the *angle* that determines whether attachment is weak or strong.

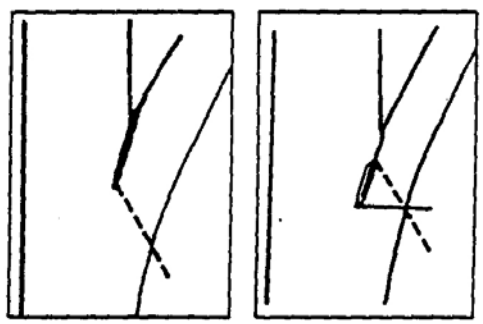
The stems have *included bark* squeezed or embedded *between* them.



Remedies:

To *remove*, stub cut the stem first and then cut where the dotted line is with care; avoid cutting into the remaining stem.

If the saw cannot complete this cut, tap a small wedge into the kerf and cut the remainder of the wood with a flat chisel and mallet.



To *strengthen* stem on older trees, a cable can be attached; place at a point approximately two-thirds of the distance from the crotch to the ends of the stems.

When a cable is used to strengthen stems, the cable and hardware must be checked regularly. When the risk of stem fracture becomes high, the weaker stem should be removed.

Davey Residential Operations employs four general classes of pruning. Classes 1, 2, and 3 are classified as maintenance pruning, which is recommended when the primary objective is to maintain or improve tree health and structure, including hazard reduction pruning:

- Class #1 - *Fine Pruning*: consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches (crown cleaning), as well as selective thinning to lessen wind resistance. Some deadwood up to ½ inch in diameter may remain within the main leaf area where it is not practical to remove such. Girdling roots will be monitored and removed where possible.

- Class #2 - *Medium Pruning*: consists of the removal of dead, dying, diseased, interfering, objectionable, and weak branches (crown cleaning). Some deadwood up to one inch in diameter may remain within the leaf canopy.
- Class #3 - *Hazard reduction*: pruning is recommended when the primary objective is to reduce the danger to a specific target, caused by visibly defined hazards in a tree, by removing dead, diseased, or obviously weak branches two inches in diameter or greater.
- Class #4 - *Crown Reduction Pruning*: consists of reducing canopy tops, sides, under branches, or individual limbs at appropriate lateral limbs and stems for purposes of clearance of storm damage repair. Some crown reduction pruning incorporates hazard reduction pruning.

Epicormic Branches

Epicormic branches may be needed to fill in the canopy where trees have been excessively thinned or storm damage has occurred (crown restoration).

Epicormic branches (shoots, watersprouts, suckers) arise from two types of "buds":

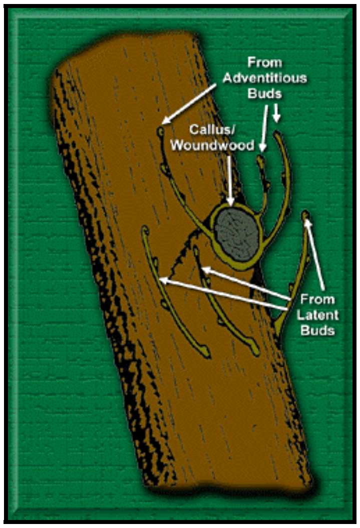
- Adventitious buds.
- Latent (dormant) buds or meristematic points.

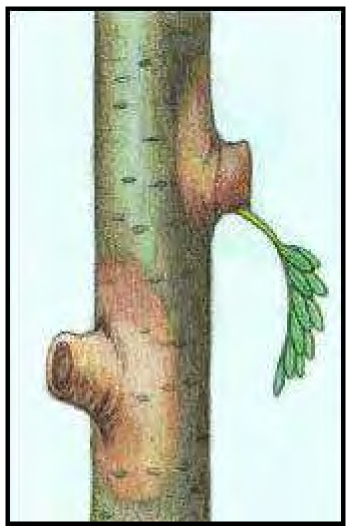
Adventitious epicormics come from meristematic tissue generated anew by the cambium. Most adventitious buds develop from callus tissues moving over a wound, or from root tissue.

Latent (dormant) buds or *meristematic points* are formed at an earlier time in the life of a woody plant but do not 'release' or grow. Latent buds are 'carried along' in rays in the cambial zone year after year, as the tree increases girth, and are usually released upon injury or stress. Epicormic sprouts from latent meristematic points are often found in the vicinity of pruning cuts, usually below the wound.

Epicormic branches are *stimulated* on a much larger scale by winter or early spring pruning rather than by late spring-summer pruning (desirable in shrub renewal or rejuvenation).

A *watersprout* is an epicormic branch growing from branch and stem parts, or above a graft union.





A *sucker* is an epicormic branch growing from root tissue or <u>below</u> a graft union.

Apical Dominance and Control

Woody plant natural shapes, forms, or habits are governed by species' inherent (genetic) determination of:

- Leaf and flower bud locations.
- Bud-break patterns along stems.
- Branching angles.
- How buds and branches elongate.

Apical dominance = terminal bud(s) suppress lateral buds along an elongating shoot

Excurrent and *decurrent* branching patterns:

- Decurrent woody plants have overall weak apical control, but strong apical dominance while shoots are elongating.
- Random-branching excurrent plants have weak apical dominance and overall strong apical control.
- Whorl-branching excurrent trees have both strong apical dominance and control.

Excurrent

Decurrent

Plant growth regulators are substances that enhance or alter the growth and development process of a plant. In most cases, these chemicals either increase or decrease normal growth, flowering, and/or fruiting of plants.

Selective growth control and/or branch release by natural growth regulators:

- Auxins
- Abscisic acid (ABA)
- Cytokinins
- Gibberellins (gibberellic acid = GA)
- Ethylene

Branch terminals – auxin source
Roots – cytokinin source

Low auxin = axillary bud release,
High cytokinin energy storage drain

High auxin = bud suppression,
Low cytokinin initiate new roots

Plant growth regulators are substances that enhance or alter the growth and development process of a plant. In most cases, these chemicals either increase or decrease normal growth, flowering, and/or fruiting of plants.

Utility arborists use synthetic growth regulators to *control* the growth of trees and other vegetation beneath utility lines. Growth *inhibitors* can be:

- Sprayed on the foliage.
- Painted on pruning wounds.
- Banded on the bark.
- Soil applied.
- Injected into trees.

Antigibberellins are growth regulators that counter the effects of naturally occurring *cell-elongation* hormones (gibberellin). Ideal formulations are being sought that would minimize phytotoxicity while reducing utilities' pruning expenses.

Another use of growth inhibitors is to suppress epicormic branch production on trees:

- Not yet widely used by arborists.
- Must be applied annually.
- Client concern over the use of chemicals.
- Applicator safety concerns.
- Epicormic branch growth can be minimized with proper cuts.
- Retarded woundwood development.

Painting of Cuts

Proper cuts negate the "need" for wound dressings. Wound dressings will not *prevent* decay; wound dressings have been evaluated to often *promote* wood decay or cause cambium damage.

Cuts or wounds in certain species during the growing season may attract insects that carry diseases or allow fungus invasion. Native oaks or elms and European elms should be pruned during dormant periods in regions where wilt disease conditions are known to exist.

If pruned in summer, pruning wounds on wilt-susceptible oaks and elms should be treated with the current wound dressing recommended by The Davey Institute.

Pruning Phenology

The ideal or optimal times to prune most woody plants are:

- Late in the dormant season.
- After leaves are fully formed and expanded.

Client concerns with excessive *sap flow* (birches, maples):

- Avoid pruning during height of sap flow (just before growing season) if possible.
- Sap flow may be unsightly but does not cause definite injury.
- Prune immediately after leaves are fully expanded if client cannot be convinced.

Avoid pruning birches after leaf expansion, as the wounds may be attractive to boring insects.

Dead, broken, or weak limbs may be removed at any time with little effect, except in wilt-susceptible oaks and elms.

Pruning before the spring leaf bud-break period can enhance stimulated growth and rapid wound closure. Pruning during the period after leaf expansion will result in suppressed growth and maximum ‘dwarfing’.

Avoid pruning those woody plants undergoing bud break and early leaf expansion, especially in the period where bark ‘slips’ (cambial development of unlignified wood).

Flowering can be reduced or enhanced by pruning at the appropriate time of the year. Woody plants that bloom on current season's growth (‘summer-flowering’ such as crapemyrtle or butterfly-bush) are best pruned to enhance flowering:

- During the dormant season.
- Just prior to or immediately after leaf expansion.
- In late summer (post-bloom).

Plants that bloom on last season's wood ('spring-flowering') should be pruned *just after bloom.*

- Fruit trees are often pruned during the dormant season to enhance structure and distribute fruiting wood, and after bloom to thin fruit-load.

Pruning Selection

Ideal pruning technique begins with planting the right tree in the right place (PHC selection).

Maintaining tree size or allowing for limited crown growth is possible with a regular pruning schedule begun early in the tree's life.

- Consider the extent of mature branches and crown.
- Select good stock with proper growth form.
- Imagine how form will continue to develop; there is no way to turn a large tree back into a small tree.
- Don't expect to improve form with future prunings.

Avoid obtaining saplings with included bark; the stem union becomes weaker rather than stronger as the plant grows. Failure of one or both stems of the fork frequently occurs when the tree is mature, especially during snow and ice storms (loading events).

Structural Pruning

Structural pruning principles are used when training young woody plants or working with a tree that has not been pruned in many years. Properly trained shrubs and young trees will develop into structurally strong plants that should require little corrective pruning as they mature.

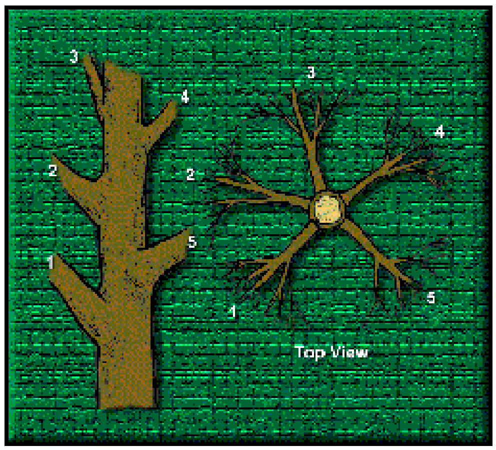
Trees that will be large at maturity should have a sturdy, tapered trunk, with well-spaced branches smaller in diameter than the trunk.

If two branches develop from apical buds at the tip of the same stem, they will form *codominant* branches or, eventually, codominant stems. Each codominant branch is a direct extension of the stem. It is best if one is removed when the tree is young.

Branches with narrow angles of attachment and codominant branches may tend to break if there is *included bark* that gets enclosed inside the crotch as the two branches develop girth and length.

The relative *size* of a branch in relation to the trunk is usually more important for strength of branch attachment than is the *angle* of attachment. Scaffold branches' diameters should not be more than 1/2 the stem or trunk diameter.

Select main branches to give *radial distribution*. Discourage branches growing directly over another unless spaced well apart.



On large-growing trees, except whorl-branching conifers, branches that are more than 1/3 the diameter of the trunk in size should be well spaced along the trunk (at least 18 inches apart).

Maintain one-half the foliage on branches arising in the lower 2/3 of younger trees.

- Increases trunk taper.
- More uniformly distributes weight and wind stress along the trunk.

This rule of thumb also holds true for an individual limb:

- Leave lower and inside branches along the limb.
- Limb can develop taper and strength.
- Stress and weight can be evenly distributed along the length.

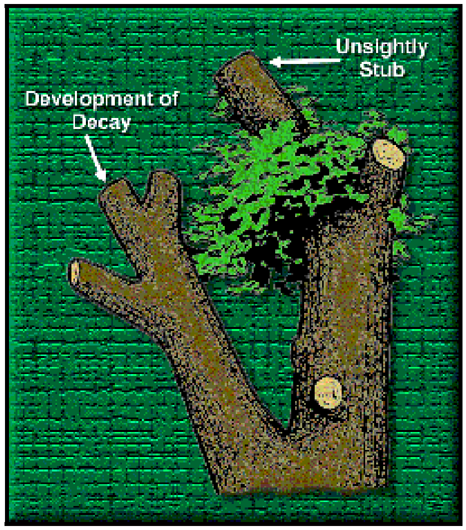
The height of the lowest scaffold branch will depend on the intended function of the tree: screen an unsightly view, provide a windbreak, shade a patio, installed as a walkway or street tree.

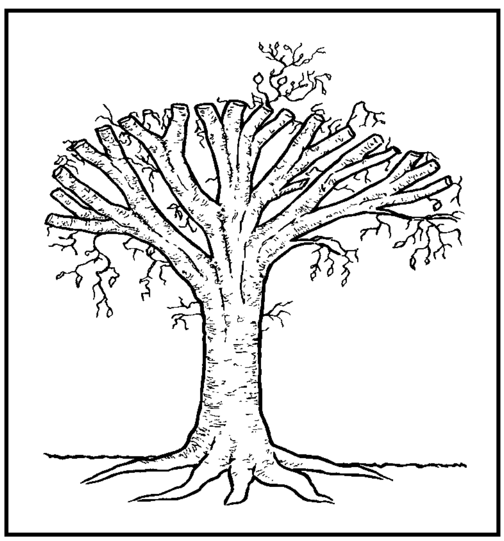
Pruning at Planting

For years, the conventional wisdom was that trees should be severely pruned at time of transplant to compensate for root loss and to "balance" the crown with the root system (especially bareroot trees). This practice has since been discovered to prolong *transplant shock.*

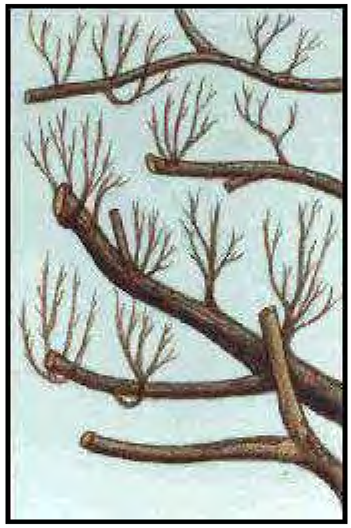
- Transplant pruning should be limited to removal of dead, broken, diseased, or interfering branches.
- Leave small shoots along the trunk for later removal.
- Protect the trunk from ‘sunburn’.
- Aid in development of proper trunk taper.
- Leave as many terminal buds as possible.
- Stimulate root growth triggered by hormones in these buds.

Topping, Tipping, and Roundover

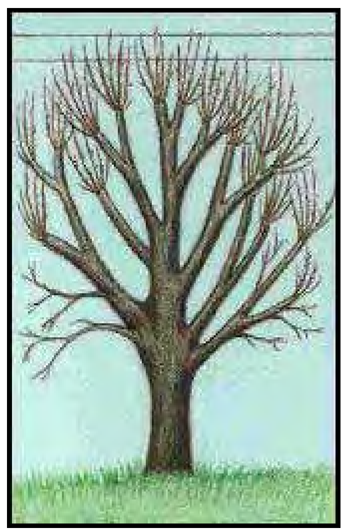




Topping: cutting vertical branches and stems back to inadequate nodes (heading) or to internodes (stubbing).



Tipping: heading side or horizontal branches to stubs or weak laterals.



Roundover: topping + tipping.

Many people have the misconception that cutting or heading the main branches of a tree back to stubs to 'reduce the height' is the proper way to prune.

Apparently, a short tree is thought to be safer and healthier than a tall tree regardless of how the result is attained. Heading back to stubs or inadequate laterals permanently disfigures and weakens a tree. Topping is one of the worst things humans do to trees.

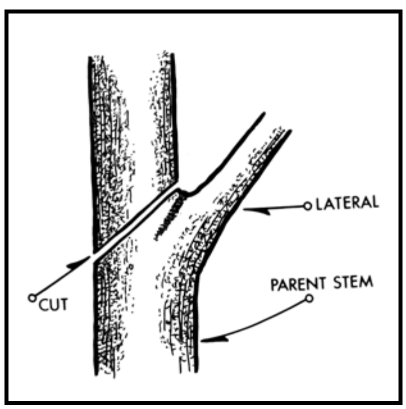
The International Society of Arboriculture (ISA) and the National Arborist Association (NAA) consider heading-back to stubs an unacceptable arboricultural practice. Modern pruning standards do not include heading-back as any sort of a recommended technique.

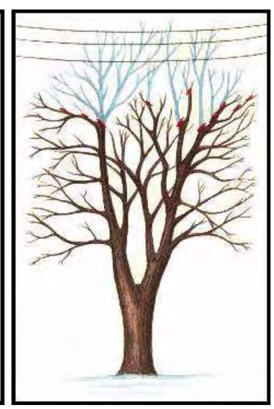
- Topping removes a major portion of a tree's leaves that are necessary for the production of carbohydrates.
- Stimulation of epicormic branches at or just below an internodal stub cut causes a topped tree to grow back to its original height faster and denser than a properly pruned tree. The sprouts are weakly attached and easily broken off in storms.
- Bark within the canopy can become scalded by sudden exposure to direct sunlight.
- Stubs attract wood-boring insects and sustain wood decay organisms.
- Topping, tipping, and roundover cuts permanently disfigure a tree.

Crown Reduction, Restoration, and Raising

If the height or width of a tree has to be reduced because of storm damage or interference with structures or utility lines, it is performed correctly by a method called *crown reduction* or *drop-crotch* pruning (NAA Class IV Crown Reduction). This procedure involves the removal of a main leader, scaffold, or branch at its point of attachment with a lateral branch large enough to assume a terminal or leader role.

The final cut should begin or end somewhat *parallel* to the remaining lateral branch and offset slightly above the branch bark ridge (without cutting into the bark ridge). The remaining lateral branch must be at least one-half to one-third the diameter of the branch or leader that is being removed.





If a tree has been topped previously and now has epicormic sprouts, *crown restoration* can improve its structure and appearance. Decayed, rotting stubs and tipped branches are cut back to appropriate laterals or entirely removed. One to three sprouts on main branch stubs are retained to become permanent branches and reform a more natural appearing crown. Selected epicormic branches may need to be thinned to a lateral to control length and ensure adequate attachment for the size of the sprout. Restoration usually requires several prunings over a number of years.

Trees in urban and landscape settings may need to have lower limbs removed. *Crown raising* or elevating removes the lower branches of a tree in order to provide clearance for buildings, vehicles, pedestrians, and vistas. Excessive removal of lower limbs should be avoided so that the development of trunk taper is not affected and structural stability is maintained.

Definitions of Arboricultural Terms

Anvil-Type Pruning Tool – Pruning tool that has a straight sharp blade that cuts against a flat metal cutting surface (see *hook and blade-type pruning tool*).

Arborist – A professional who possesses the technical competence through experience and related training to provide for or supervise the management of trees and other woody plants in the residential, commercial, and public landscape.

Boundary Reaction Zone – A separating boundary between wood present at the time of wounding and wood that continues to form after wounding.

Branch – A secondary shoot or stem arising from one of the main axes (i.e. trunk or leader) of a tree or woody plant.

Branch Collar – Trunk tissue that forms around the base of a branch between the main stem and the branch or a branch and a lateral. As a branch decreases in vigor or begins to die, the branch collar becomes more pronounced.

Branch Bark Ridge – Raised area of bark in the branch crotch that marks where the branch wood and trunk wood meet.

Callus – Undifferentiated tissue formed by the cambium layer around a wound.

Cambium – Dividing layer of cells that forms sapwood (xylem) to the inside and bark (phloem) to the outside.

Climbing Spurs – Sharp, pointed devices affixed to the climber's leg used to assist in climbing trees (also known as *gaffs, hooks, spurs, spikes, climbers).*

Closure – The process of woundwood covering a cut or other tree injury.

Crotch – The angle formed at the attachment between a branch and another branch, leader, or trunk of a woody plant.

Crown – The leaves and branches of a tree or shrub; the upper portion of a tree from the lowest branch on the trunk to the top.

Crown Cleaning – The removal of dead, dying, diseased, crowded, weakly attached, low-vigor branches, and watersprouts from a tree's crown.

Crown Raising – The removal of the lower branches of a tree in order to provide clearance.

Crown Reduction – The reduction of the top, sides, or individual limbs by the means of removal of the leader or longest portion of a limb to a lateral no less than one-third of the total diameter of the original limb removing no more than one-quarter of the leaf surface.

Crown Thinning – The selective removal of branches to increase light penetration and air movement, and to reduce weight.

Cut – The exposed wood area resulting from the removal of a branch or portion thereof.

Decay – Degradation of woody tissue caused by biological organisms.

Espalier Pruning – A combination of cutting and training branches that are oriented in one plane, formally or informally arranged, and usually supported on a wall, fence, or trellis. The patterns can be simple or complex, but the cutting and training is precise. Ties should be replaced every few years to prevent girdling the branches at the attachment site.

Facility – Equipment or structure used to deliver or provide protection for the delivery of an essential service such as electricity.

Girdling Roots – Roots located above or below ground whose circular growth around the base of the trunk or over individual roots applies pressure to the bark area, ultimately restricting sap flow and trunk/root growth. Frequently results in reduced vitality or stability of the plant.

Heading – Cutting a currently growing or one-year-old shoot back to a bud, or cutting an older branch or stem back to a stub or lateral branch not sufficiently large enough to assume the terminal role. Heading should rarely be used on mature trees.

Heartwood – The inactive xylem (wood) toward the center of a stem or root that provides structural support.

Hook and Blade Pruning Tool – A hand pruner that has a curved, sharpened blade that overlaps a supporting hook (in contrast to *an anvil-type pruning tool*).

Horizontal Plane (palms) – An imaginary level line that begins at the base of live frond petioles.

Lateral – A branch or twig growing from a parent branch or stem.

Leader – A dominant upright stem, usually the main trunk. There can be several leaders in one tree.

Limb – Same as *Branch,* but larger and more prominent.

Lopping – See *Heading.*

Mycellum – Growth mass of fungus tissue found under bark or in rotted wood.

Obstructing – To hinder, block, close off, or be in the way of; to hinder or retard a desired effect or shape.

Parent Branch or Stem – The tree trunk or a large limb from which lateral branches grow.

Petiole – The stalk of a leaf.

Phloem – Inner bark tissue through which primarily carbohydrates and other organic compounds move from regions of high concentration to low.

Pollarding – Pollarding is a training system used on some large-growing deciduous trees that are severely headed annually or every few years to hold them to modest size or to give them and the landscape a formal appearance. Pollarding is not synonymous with topping, lopping, or stubbing. Pollarding is severely heading some and removing other vigorous water sprouts back to a definite head or knob of latent buds at the branch ends.

Precut or Precutting – The two-step process to remove a branch before the finished cut is made so as to prevent splitting or bark tearing into the parent stem. The branch is first undercut, and then cut from the top before the final cut.

Pruning – Removal of plant parts.

Qualified Line Clearance Tree Trimmer – A tree worker who, through related training and on-the-job experience, is familiar with the techniques in line clearance and has demonstrated his/her ability in the performance of the special techniques involved. This qualified person may or may not be currently employed by a line clearance contractor.

Qualified Line Clearance Tree Trimmer Trainee – Any worker undergoing line-clearance tree trimming training, who, in the course of such training, is familiar with the techniques in line clearance and has demonstrated his/her ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Qualified Person or Personnel – Workers who, through related training or on-the-job experience, or both, are familiar with the techniques and hazards of arboriculture work including training, trimming, maintaining, repairing, or removing trees, and the equipment used in such operations.

Qualified Tree Worker, Person, or Personnel – A person who, through related training and on-the-job experience, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees and with the equipment used in such operations and has demonstrated ability in the performance of the special techniques involved.

Qualified Tree Worker Trainee – Any worker undergoing on-the-job training who, in the course of such training, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees, with the equipment used in such operations and has demonstrated ability in the performance of the special techniques involved. Such trainees shall be under the direct supervision of qualified personnel.

Remote/Rural – Areas associated with very little human activity, land improvement, or development.

Sapwood – The active xylem (wood) that stores water and carbohydrates, and transports water and nutrients; a wood layer of variable thickness found immediately inside the cambium, comprised of water-conducting vessels or tracheids and living plant cells.

Shall – As used in this standard, denotes a mandatory requirement.

Should – As used in this standard, denotes an advisory recommendation.

Stub – An undesirable short length of a branch remaining after a break or incorrect pruning cut is made.

Stubbing – See *Heading.*

Target – A person, structure, or object that could sustain damage from the failure of a tree or portion of a tree.

Terminal Role – Branch that assumes the dominant vertical position on the top of a tree.

Thinning – The removal of a lateral branch at its point of origin or the shortening of a branch or stem by cutting to a lateral large enough to assume the terminal role.

Throwline – A small, lightweight line with a weighted end used to position a climber's rope in a tree.

Topping – See *Heading.*

Tracing – Shaping a wound by removing loose bark from in and around a wound.

Urban/Residential – Locations normally associated with human activity such as populated areas including public and private property.

Utility – An entity that delivers a public service such as electricity or communication.

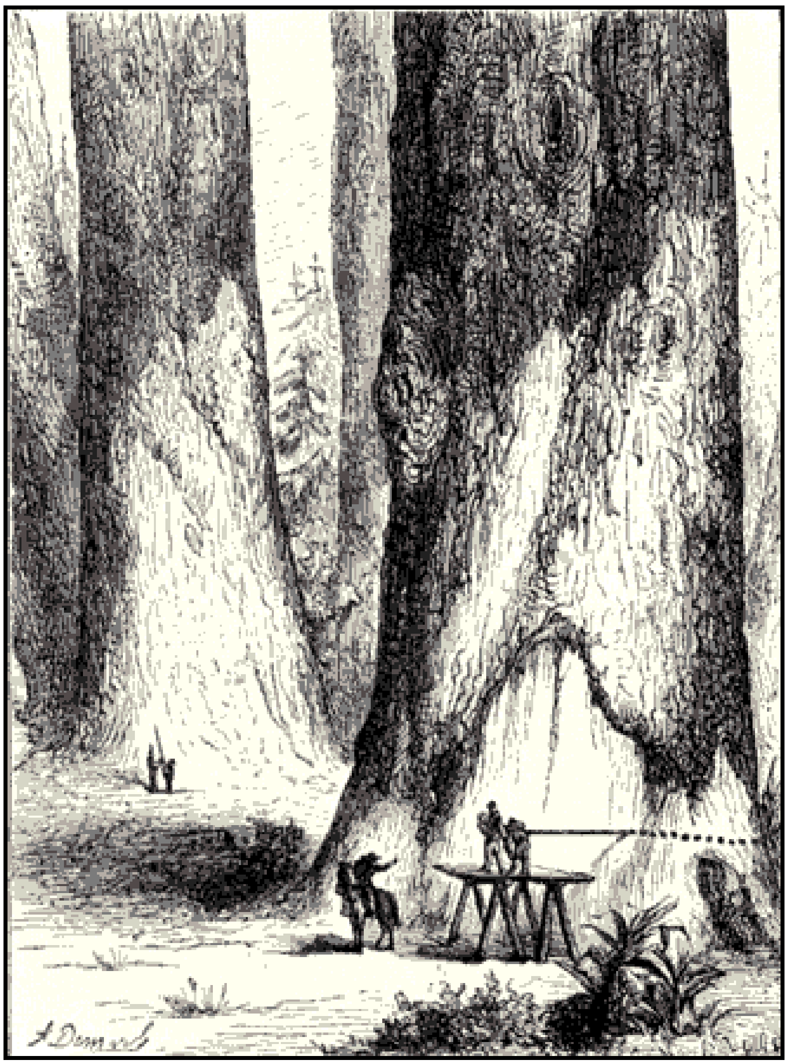
Utility Space – The physical area occupied by the utility's facilities and the additional space required ensuring its operation.

Wound – An opening that is created any time the tree's protective bark covering is penetrated, cut, or removed, injuring or destroying living tissue. Pruning a live branch creates a wound, even when the cut is properly made.

Woundwood – Differentiated woody tissue that forms after the initial callus has formed around the margins of a wound. Wounds are closed primarily by woundwood.

Xylem – Wood tissue; active xylem is called *sapwood* and inactive xylem is called *heartwood.*

Young Tree – A tree young in age or a newly installed tree.



Appendix K
Davey® Planting Guidelines

Planting Guidelines

The following guidelines to tree planting will help reduce transplanting shock and ensure that trees adapt to the new site. Keep in mind that spring and fall are the best times of the year to plant trees, but some trees do better when transplanted in spring rather than fall, and vice versa. Check with your nursery when planning tree-planting operations.

Site Conditions

A frequent cause of new tree failure is poor acclimation to site conditions. This includes not only the planting site, but also the climate conditions at the nursery and the similarity in the new tree location. For example, a tree raised in a nursery farther south than the planting site may have more difficulty in adapting than a tree grown in more similar climate conditions. Furthermore, the soil conditions of the site (pH, moisture, oxygen, and nutrient availability) should be sufficient to meet the specific requirements of the tree. It is more cost-effective to choose the right tree for a site than to modify the site after the tree has been planted or to have high maintenance costs because a poorly established tree is unhealthy.

Tree Selection

In addition to selecting trees that are tolerant of existing site conditions, select trees that show normal growth and are free of serious insect and disease problems. The trees should exhibit good vitality, appearing undamaged with a healthy root mass. Trees should have good leaf color, annual twig growth, and bud appearance. Careful nursery selection is essential.

Single-stemmed trees should not have the appearance of clumped foliage arising from the same point on the stem. Such a condition, while providing an initial tree form, will ultimately cause branching problems, such as weak crotches, and should be avoided. Trees with good potential for lower maintenance when mature will have a scaffold or ladder appearance with branch angles greater than forty-five degrees. Some trees have this form naturally, while others need to be pruned when young to encourage such form.

Stock Type

Trees are delivered from the nursery in one of three states of preparation: balled-and-burlapped trees, with soil surrounding the root system; bare-root trees, without soil; and containerized trees, generally grown in the container in which they are delivered.

Bare-root is the least expensive and allows roots to be in contact with the native soil. However, care must be taken to keep the roots protected and moist before planting, as the fine roots can dry rapidly.

Balled-and-burlapped tree roots are slower to dry out than bare-root trees, as the roots are inside a soil ball. However, the burlap may cover dead or poorly pruned roots and should be inspected before planting. The type of soil surrounding the roots should not be too different from the soil on the site or the tree roots may not extend sufficiently into the surrounding soil from the root ball. In such a case, the backfill soil should be amended to provide a transition between the two types of soil.

Container-grown trees have an undisturbed root system and can be planted with the intact root system. If the tree has been in the container for too long; however, the tree may be pot-bound with the roots encircling the inside perimeter of the pot. The roots should be sliced or partially separated in order to improve the ability of the tree to extend the roots into the surrounding soil.

Tree Planting

The tree should be planted to the same depth or slightly higher than it was growing at the nursery. A high mound should be avoided as the soil can dry out quickly in the summer and freeze in the winter.

The hole should be dug shallow and wide. It should not be any deeper than the root ball but should be a wide hole, allowing for amendments, if necessary, or for loosening heavy clay soil to allow for improved oxygen availability and root penetration.

The backfill soil should be added gradually and watered carefully to settle the soil but not to saturate it. Balled-and-burlapped trees should have any untreated burlap pulled away from the top of the root ball and cut away—not buried—so that none of the burlap is exposed at the soil surface. Otherwise, the burlap can wick moisture away from the roots of the freshly planted tree.

Tree Staking

Stakes should only be used to support trees on windy sites or for smaller trees with weak trunks. The stakes should be placed before the backfill is added to avoid damaging any large roots. A stake is meant to provide a temporary support and should be removed within a year to allow the tree to develop trunk strength and to limit the potential for physical damage from the stakes and support ties.

Wooden stakes, metal pipe, fence stakes, and metal reinforcing bars may all be used for support. Anything used for a tie should have a flat, smooth surface and be somewhat elastic to allow for slight movement for the tree. Suitable materials include rubber strips or webbing and belting. Wire covered with hose or tubing **should not** be used.

Tree Irrigation

Because a newly transplanted tree may have lost much of its root system, watering is critical for successful establishment. Initial watering at planting should be followed with weekly watering, particularly during dry periods. A newly planted tree will benefit from at least an inch of water a week.

Mulching

Newly planted trees respond well to mulch placed around the tree. This reduces initial root competition with turf and limits the possibility of physical damage by mowers. These factors contribute to the health of the trees and increase the likelihood of survival.

The mulch should **not** be piled (mulch 'volcanoes') around the tree and should not actually touch the tree trunk. No more than a 2- to 3-inch depth of mulch should be added, with it being no more than ½ inch deep closest to the tree.

Pruning

When planting a tree, only dead or broken branches should be removed. All living branches should be left on the tree to help promote tree establishment. Once the tree has been established on the site, training pruning can be done to promote good branching patterns, but no more than 1/4 of the branches should be removed at any one time.

Fertilizing

Fertilizer is not generally necessary at the time of planting and, indeed, if placed improperly in the planting hole can injure roots. The addition of nitrogen, in a slow-release form, however, can benefit a newly planted tree, and it may be efficient to apply at the time of planting.

Appendix L
Street Tree Fertilization, Planting, Pruning, and Removal Specifications

CITY-WIDE STREET TREE PLANTING SPECIFICATIONS
CITY OF ___________________, ___________________

I. Scope of Work

To provide all supervision, material, labor, equipment, service operations, and expertise required to deliver, locate, plant, and guarantee for one year, street trees in the City of ___________ as specified herein. Contractor has responsibility to:

A) Furnish, transport, and plant trees;

B) Reserve workspace along streets;

C) Excavate in-place soil, plant, and backfill with topsoil approved by City Administrator;

D) Furnish and place mulch;

E) Remove excess material and clean up site;

F) Guarantee trees for one year and make appropriate replacement planting;

G) Keep work site safe at all times; and

H) Any work incidental to above.

II. Definitions

A) Reference is any other specifications or standards means the latest revision in effect on date of invitation to bid. This set of specifications governs when disagreement with a reference specification occurs.

B) Specified means specified in the invitation to bid and/or order or contract.

C) ANSI Z60.1-Standards are American Standard for Nursery Stock.

D) City Administrator is the city's representative that will administer the technical aspects of this tree planting contract. The City Administrator for this contract is: ________________________

E) Contractor is a company that earns the majority of its annual revenue from planting or maintaining trees and/or shrubbery. Contractor must possess an I.S.A. Certified Arborist License or Certified Landscapers License or Certificate.

III. Materials Specifications

Mention of any product name neither constitutes an endorsement of that product nor excludes the use of similar products meeting specifications.

A) Nursery Stock - All trees healthy, vigorous, and well-grown, showing evidence of proper root and top pruning, single-trunked, high-branched specimens suitable for use along streets. All trees 1-3/4 inch caliper unless otherwise noted. All trees grown at least one year in a currently active nursery having same climatic conditions as the City of ______________. All trees meet ANSI Z60.1-standards for top grade. Label attached to each tree at nursery indicating botanical name and common name. City Administrator will mark trees in the nursery and has final approval of species or variety used and nursery from which trees are obtained.

B) Root balls and burlap - All trees balled and burlapped with ball shape and size conforming to ANSI Z60.1 standards. Root flare will be easily visible on root balls. Only rottable burlap and rottable rope permitted. Root balls adequately protected at all times from sun, heat, freezing, and drying. City Administrator will reject any cracked or manufactured root balls.

C) Mulch - Year-old rough wood chips created by local tree service companies during brush chipping operations.

IV. Work Procedures

A) Source of supply - Contractor submits to City Administrator, within ten (10) days after receipt of notice of award of contract, complete and detailed information concerning the source of supply for each item of plant material specified in the planting list.

B) Tree location - All planting sites will be identified and marked by the City Administrator before planting begins. The appropriate utilities services will be notified of planting site locations by Contractor immediately after contract has been awarded. Contractor will also be responsible for notifying the appropriate utility authority prior to digging. Contractor will be responsible for any damage to utilities during the planting process. Sites will be marked by a white flag in the grass area and also with a white mark painted on the curb. All trees will be centered between curb and sidewalk, at least two feet from curb line unless otherwise specified by the City Administrator.

C) Delivery - Trees shall be transported and handled with adequate protection. Trees shall be covered with burlap or tarpaulin during transit or transported in a closed truck to prevent drying out of the tree. Trees in leaf shall be sprayed before shipping with "Wiltpruf" or other anti-desiccant approved by the City Administrator.

D) Temporary storage - Root balls of trees not immediately planted after delivery must be adequately protected by mulch or heeling-in and watering until planting occurs. Contractor assumes all risk and expense of temporary storage.

E) Planting holes - Holes may be dug by hand, backhoe, tree spade, or other approved equipment at specified location. An auger is not considered approved equipment. Walls of the planting hole shall be dug so that they are properly sloped and sufficiently loosened to remove the glazing effects of the digging. The planting hole shall be elliptical in shape with the top diameter two times that of the ball. The bottom of the hole shall be rough, flat, and deep enough to have the plant at its original planting depth or slightly higher. Holes shall be ground only on the day the tree is planted. Contractor is responsible to ensure all holes are safe until planted and covered with mulch.

F) Precautions during digging - When underground utilities are encountered, Contractor immediately calls the controlling agency or company and the City of ____________. The Contractor, at his expense, restores to original condition all structures, facilities, and other property damaged by his company's work.

G) Surplus excavation - Removed and disposed of by Contractor at his own expense.

H) Planting - Allowed only between the dates of ______________ and _______________. Planting is only allowed when the soil is not frozen. Balled and burlapped trees are set on tamped backfill, placing tree at same depth as in nursery or up to two (2) inches higher than that level. Planting height may be adjusted if unusual site situations are encountered after approval by City Administrator. Burlap should be pulled back one-third the depth of the root ball and rope or twine should be cut from trunk. Trees with forked top oriented with forked limbs shall be pointed parallel to street and not toward street. Planting is not allowed on days when temperatures fall below 30° F.

I) Root pruning - Ends of broken or damaged roots more than 1/4 inch in diameter should be pruned with a clean cut, removing only injured portion.

J) Backfilling - Planting holes shall be backfilled with approved topsoil. Mix soil amendments in mixture prior to filling the hole to prevent stratification. Incorporate a transplant inoculant that contains water-absorbing material such as polymers, root stimulants, and endo- and ecto-mycorrhizal fungi into the backfill. Backfill sides of the tree hole halfway with soil mixture and tamp as the hole is being filled. Cut and remove all rope, twine, burlap, and wires from the top half of the soil ball. Wire baskets should be cut and removed to a two-inch depth below the soil line. Burlap should be pulled back with one-half of the soil ball exposed after plants are properly placed in the planting hole. Shape backfill and mulch in a water ring to facilitate watering.

K) Top pruning and wound treatment - Pruning to make trees shapely and typical of species shall be done according to recognized horticultural standards and instructions of the City Administrator. Accidental damage during planting not great enough to warrant branch removal or tree replacement should be promptly traced according to recognized horticultural practices. Pruning paint is not necessary.

L) Mulching - Place rough wood chips loosely around trees within 24 hours after planting to uniform depth of no more than four (4) inches and to a diameter of three (3) feet where possible.

M) Extra holes - Excess or improperly located planting holes are to be immediately backfilled and seeded with Kentucky Bluegrass, and covered with two (2) inches of straw, at Contractor's expense.

N) Watering - Thoroughly water to settle backfill when one-half of backfill is in place and again after all backfill is placed. It is highly recommended that watering continue through the first growing season to increase chances of survival after planting.

O) Wrapping - Trees are not wrapped unless specified by the City Administrator. If wrapping is required, trunk and wrapping shall be treated with a 20 percent Lindane and water spray. Wrapping is crinkle-draft tree wrapping paper tied with rottable twine.

P) Productivity - Production schedule beginning and ending dates will be agreed upon in writing between the Contractor and the City Administrator.

Q) Supervision - Contractor is required to consult with the City Administrator concerning details and scheduling of all work. Contractor shall have a competent person in charge of work at all times to whom the City Administrator may issue directions and who is authorized to accept and act upon such directives. Supervisor calls the City Administrator before each day's work begins to provide work locations by street.

R) Public relations - An information sheet shall be supplied by the City Administrator to Contractor for distribution to property owner.

V. *Substitutions*

If a species or variety is used as a substitute with the approval of the City Administrator, the per tree price paid by the City is the lowest of:

A) The per tree price of the species or variety originally bid on; or

B) The lowest bid price for the substitute species or variety if it is specified elsewhere in this contract.

VI. *Inspections*

A) Nursery inspection - The City Administrator, at its discretion, will inspect and mark nursery stock purchased under this contract before digging.

B) Agency inspection - Federal, state, and other authorities inspect all trees before removal from nursery, as required by local law. Required certificates declaring trees free of all diseases and insects shall accompany each order or shipment of trees.

C) Planting inspection - The City Administrator, at its discretion, inspects progress of planting or temporarily stored trees to review the progress of the work and condition of trees.

D) Guarantee period inspection - The City Administrator inspects planting work to verify completion and begin guarantee period. Contractor requests this inspection in writing at least ten (10) days before its scheduled date. After inspection, the City Administrator notifies Contractor in writing of date of beginning of guarantee period or of deficiencies to correct before guarantee period begins.

E) Correction inspection - Two months before end of guarantee period, the City Administrator inspects work and notifies Contractor of replacement and other corrections required to make work acceptable.

F) Final inspection - At end of guarantee period, City Administrator inspects trees to determine final acceptance. Contractor requests this inspection in writing at least ten (10) days before the scheduled date.

G) Stock inspections - The City Administrator reserves right to inspect trees before they are removed from delivery truck at work site. Delivery truck driver or other agent or Contractor should call the City Administrator's office before leaving for work site each day to facilitate these on-truck inspections.

H) Other inspections - City Administrator reserves right to inspect on-site work at any time without notice. Contractor calls City Administrator on morning of each working day to provide work location.

VII. Guarantee

Contractor guarantees that all trees remain alive and healthy until the end of a one- (1) year guarantee period. Contractor replaces, as specified, and at his expense, any dead trees and any trees, that in the opinion of the City Administrator, have become unhealthy or unsightly or have lost their natural shape due to dead branches, improper pruning or maintenance, or any other cause due to the Contractor's negligence, or weather conditions. Contractor straightens any leaning trees, bearing the entire cost.

VIII. Rejection

Contractor disposes of any tree rejected by the City Administrator at the Contractor's expense.

IX. Items

Each entry (Street name, estimated number of trees and species) within each section is considered a separate item. The City Administrator reserves the right to delete any item or items because of an inability to obtain specified trees or other reasonable cause.

TREE REMOVAL AND PRUNING SPECIFICATIONS CITY OF_____________, _____________

I. Scope of Work

To provide all labor, supervision, equipment, services, and expertise necessary to perform urban forestry maintenance work in the City of ____________ as specified herein. Since this work is of a potentially dangerous nature, and requires special expertise, it is to be performed by a contractor that derives a majority of its annual income from arboricultural work and whose employees are highly trained and skilled in all phases of tree service work. Contractors must have been in business for at least five years. The City will require proof of Contractor's involvement in tree service work. The contractor has the responsibility to:

A. Remove or prune designated trees.

B. Reserve work space along streets.

C. Grind out stump when tree is to be removed.

D. Remove excess material and clean up site.

E. Guarantee that specifications be met.

F. Keep work site safe at all times.

II. Definitions

A. **Reference:** Reference to any other specifications or standards means the latest revision in effect on date of invitation to bid. This set of specifications governs when disagreement with a reference specification occurs.

B. **Specified:** Means specified in the invitation to bid

C. **ANSI Z-133:** American Standard of Tree Worker Safety.

D. **ANSI A300:** Standard Practices for Trees, Shrubs, and Other Woody Plant Maintenance

E. **City Administrator:** The City's representative that will administer the technical aspects of this tree pruning and removal contract. The City administrator for this contract is: ________________________

F. **Contractor:** A company that earns the majority of its annual revenue for pruning, removing, or maintaining trees and/or shrubbery. Contractor must possess an I.S.A. Certified Arborist License.

III. Work Procedures

A. **Equipment:** All bidders must have in their possession or available to them by formal agreement at the time of bidding: trucks, devices, chippers, hand tools, aerial and other equipment and supplies which are necessary to perform the work as outlined in these specifications. The City may inspect such equipment or agreements prior to the awarding of a contract.

B. **Tree Location:** Work limited to trees located on all public rights-of-way and City-owned property. All work under this contract shall be assigned by supplying the Contractor with a list of trees that have been marked with blue paint for priority pruning or red paint if tree is to be removed. All other trees on list are to be pruned for vehicular and pedestrian traffic. The City reserves the right to change, add, or delete areas or quantities to be pruned or removed as it deems to be in its best interest. Pruning and removal operations will commence no later than thirty (30) days after the contract has been awarded and will be completed no later than 90 days after work has begun. The Contractor will be responsible for notifying the appropriate utility authority before removing trees growing in the utility wires. Contractor will be responsible for any damage to utilities during the removal or pruning process.

C. **Public Relations:** An information sheet will be sent by the City Administrator to the property owners.

D. **Supervision:** Contractor consults with the City concerning details of scheduling of all work. Contractor has a competent person in charge of his work at all times to whom the City may issue directives and who shall accept and act upon such directives, and who reads, speaks, and writes English competently. Failure for the supervisor to act on said directives shall be sufficient cause to give notice that the Contractor is in default of contract unless such directives would create potential personal injury of safety hazards. The City requires a certified arborist on the job site, and requires the arborist's certification number in this bid.

E. **Inspections:** The City is called at #___________ before 8:30 a.m. on mornings of each working day and told exact location of that day's work. The City inspects work at its discretion and is requested by letter, five days in advance of the completion of this contract, to provide a final inspection.

F. **Tree Damage:** Climbing irons, spurs, or spikes are not used on trees to be pruned. Any tree damage caused by contractor is repaired immediately at no additional expense to the satisfaction of the City Administrator. Trees damaged beyond repair, as judged by the City Administrator, are removed at no expense to the City and replaced by a tree of size and species designated by the City Administrator at no additional expense to the City or the dollar value of such damaged trees, as determined by the City Administrator, is deducted from the monies owed the Contractor.

G: **Pruning Specifications:** Conforms to latest revision of standards of National Arborist Association, ANSI A300. All cuts shall be made as close as possible to the trunk or parent limb, without cutting into the branch collar or leaving a protruding stub. Bark at the edge of all pruning cuts should remain firmly attached. All branches too large to support with one hand shall be precut to avoid splitting or tearing of the bark. Where necessary, ropes or other equipment should be used to lower large branches or stubs to the ground. Treatment of cuts and wounds with wound dressing or paints has not been shown to be effective in preventing or reducing decay and is not generally recommended for this reason. Wound dressing over infected wood may stimulate the decay process. If wounds are painted for cosmetic or other reasons, then material non-toxic to the cambium layer of meristematic tissue must be used.

Care must be taken to apply a thin coating of material only to exposed wood.

Old injuries are to be inspected. Those not closing properly and where the callus growth is not already completely established should be bark traced if the bark appears loose or damaged. Such tracing shall not penetrate the xylem (sapwood), and margins shall be kept rounded.

Equipment that will damage the bark and cambium layer should not be used on or in the trees. For example, the use of climbing spurs (hooks or irons) is not an acceptable work practice for pruning operations on live trees. Sharp tools shall be used so that clean cuts will be made at all times.

All cut limbs shall be removed from the crown upon completion of the pruning. Clean-up of branches, logs, or any other debris resulting from any tree pruning shall be promptly and properly accomplished. The work area shall be kept safe at all times until the clean-up operation is completed. Under no condition shall the accumulation of brush, branches, logs, or other debris be allowed upon a public property in such a manner as to result in a public hazard.

Trees impeding vehicle or pedestrian traffic should be raised up a least 13 feet over streets and 8 feet over sidewalks. Trees obstructing control devices (stop signs, yield signs, and traffic lights) should be trimmed to allow for adequate visibility.

H. **Removal Specifications:** Removals will include topping and other operations necessary to safely remove the assigned trees. No trees or trunks are felled onto pavement. Work includes removal of basal sprout and brush and weeds within three feet of the trunk. The tree stump will be ground out to a depth of six (6) inches below the normal surface level including all surface roots. Immediately after grinding each stump, the grindings must be removed from the work area. Adjacent sidewalks, lawns, streets, and gutters will be cleaned. Backfill consisting of clean earthen soil should be used to fill the cavity, free of debris, to normal ground level and seeded with an approved seeding mix. Do not backfill with wood chips. All labor, supervision, equipment, materials, and supplies necessary for the execution of this work must be provided for by the contractor at no additional cost to the city. All debris disposal must be provided by the contractor at no additional cost to the city. The chosen contractor will be required to follow the ANSI Z-133 Standards for tree worker safety. If a contractor is not aware of these standards, copies can be provided by the City of ____________.

I. **Traffic Control:** Is total responsibility of Contractor and is coordinated with the proper department of the City of _____________.

The contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall provide the necessary warning devices, barricades, and personnel needed to give safety, protection, and warning to persons and vehicular traffic within the area.

Blocking of public streets shall not be permitted unless prior arrangements have been made with the City and is coordinated with the appropriate departments. Traffic control is the responsibility of the Contractor and shall be accomplished in conformance with State, County, and Local highway construction codes.

J. **Utility Agencies:** Are contacted by Contractor any time assistance is needed to work safely around overhead or underground installations. The City provides a list of principal contacts and telephone numbers for public and private utility organizations.

Tree trimming and removal operations may be conducted in areas where overhead electric, telephone, and cable television facilities exist. The Contractor shall protect all utilities from damage, shall immediately contact the appropriate utility if damage should occur, and shall be responsible for all claims for damage due to his operations.

The Contractor shall make arrangements with the utility for removal of all necessary limbs and branches that may conflict with or create a personal injury hazard in conducting the operations of this contract. If the Contractor has properly contacted the utility in sufficient time to arrange for the required work by the utility, delays encountered by the Contractor in waiting for the utility to complete its work will not be the responsibility of the Contractor.

K. **Safety:** Work conforms to the latest revision of American National Standards Institute Standard Z-133.1 (Safety Requirement for Pruning, Trimming, Repairing, Maintaining, Removing Trees, and for Cutting Brush).

At the time a contract is entered into, the Contractor shall certify in writing to the City that all Contractor's employees working on this job are either 'Qualified Line Clearance Tree Trimmers' or 'Qualified Line Clearance Tree Trimmer Trainees', as defined in the above ANSI Z-133.1 Standards.

L. **Clean Up:** Clean-up procedures are completed within two hours after debris have been placed around the site of each tree requiring pruning or removal. The work site is left equal to or cleaner than pre-work conditions. Tree parts dropped or lowered from trees are kept off private property.

It shall be the responsibility of the Contractor to remove and dispose in a proper and acceptable manner all logs, brush, and debris resulting from the tree maintenance operations. Wood may be left for residents, but that not taken must be disposed.

M. **Damages:** Done by the Contractor to any person or property, public or private, are the total responsibility of the Contractor and are repaired or compensated for by the Contractor to the satisfaction of both injured party and the City at no cost to the City.

N. **Insurance:** Contractor shall be fully insured as specified and shall be completely covered by State Workers' Compensation during the life of this contract. The Contractor shall have liability insurance in the amount of $1,000,000.00 for each occurrence and shall name the City as an additional insured on its policy for the work being performed in the City of ____________.

O. **Payments:** Partial billings are acceptable, but not more frequently than every two weeks. Payment is made according to actual number of stumps removed. Ten percent (10%) of each invoice is withheld until Contractor's work is completed to the satisfaction of the City. Billing for work along any street may not be made until Contractor completes all work on that street. At the discretion of the city, one-half of the ten percent (10%) retainer may be held until spring if enough snow is on the ground that a proper inspection of sites cannot be conducted. When an inspection is done and the Contractor, as directed by the City, corrects any problem that may occur, the remainder of the retainer will be paid.

P. **Working Hours:** The Contractor will schedule work between the hours of 7:00 a.m. and 6:00 p.m. Monday through Friday unless authorized by the City to do otherwise.

Q. **Subcontracts:** The Contractor will not be allowed to subcontract work under this contract unless written approval is granted by the City. The Subcontractor, as approved, shall be bound by the conditions of the contract between the City and the Contractor. The authorization of a Subcontractor is to perform in accordance with all terms of the contract and specifications. All directions given to the Subcontractor in the field shall bind the Contractors as if the notice had been given directly to the Contractor.

R. **Execution of Contract:** The successful Bidder shall, within five (5) calendar days of the mailing of written notice of selection as the successful bidder, enter into contract with the City on forms included within the bidding documents for the performance of work awarded him and shall simultaneously provide the appropriate bonds, indemnities, and insurance required hereunder.

The contract, when executed, shall be deemed to include the entire agreement between the parties; the Contractor shall not base any claim for modification of the contract upon any prior representation or promises made by representatives of the City, or other persons.

S. **Discontinuance of Work:** Any practice obviously hazardous as determined by the City shall be immediately discontinued by the Contractor upon receipt of either written or oral notice to discontinue such practice.

T. **Observance of Laws, Ordinances, and Regulations:** The Contractor, at all times during the term of this contract, shall observe and abide by all Federal, State, and Local laws which in any way affect the conduct of the work and shall comply with all decrees and orders of courts and competent jurisdiction. The Contractor shall comply fully and completely with any and all applicable State and Federal Statutes, rules, and regulations as they relate to hiring, wages, and other applicable conditions of employment.

U. **Supervision:** This contract will be under the direct supervision of the City or its authorized representatives. Any alteration or modifications of the work performed under this contract shall be made only in written agreement between the Contractor and the City-authorized representative and shall be made prior to commencement of the altered or modified work. No claims for extra work or materials shall be allowed unless covered by written agreement.

V. **Bidding Specification and Contractual Terms:** Tree maintenance work done under the direction of this contract shall be bid on forms as provided by the City.

W. **References:** Municipal tree pruning and removal experience is required. The bidder will provide a list of municipal governments that it has serviced in the past five years with a contact person listed.

X. **Award:** For a bid to be considered, prices must be quoted for the entire pruning and removal project.

Y. **Contract Termination:** The City shall have the right to terminate a contract or a part thereof before the work is completed in the event:

i. Previous unknown circumstances arise making it desirable in the public interest to void the contract;

ii. The Contractor is not adequately complying with the specifications;

iii. Proper arboricultural techniques are not being followed after warning notification by the City or its authorized representatives;

iv. The Contractor refuses, neglects, or fails to supply properly trained or skilled supervisory personnel and/or workers or proper equipment of the specified quality and quantity;

v. The Contractor in the judgment of the City is unnecessarily or willfully delaying the performance and completion of the work;

vi. The Contractor refuses to proceed with work when as directed by the City; or

vii. The Contractor abandons the work.

Z. **Indemnification:** I, the Contractor, agree to indemnify, hold harmless, and defend the City from and against any and all loss, damage, or expense which the City may suffer or for which the City may be liable by reason of any injury (including death) or damage to any property arising out of negligence on the part of the Contractor in the execution of the work to be performed hereunder.

This indemnity provision shall not apply in cases where the Contractor has not been provided with timely notice, nor shall the Contractor be liable to the City for any settlement of any complaint affected without the prior written consent of the Contractor. This indemnity provision also specifically does not apply to loss, damage, or expense arising out of contact with the City's trees by persons (other than employees of the Contractor engaged in the work contemplated by this agreement) who are around such trees.

STUMP REMOVAL SPECIFICATIONS
FOR DEPARTMENT OF PUBLIC SERVICE
CITY OF ________________, _________________

I. Scope of Work

To provide all labor, supervision, equipment, services, and expertise necessary for grinding of stumps, disposal of grindings and debris, and backfilling of stump holes in the City of ____________ as specified herein. Since the work is potentially dangerous, and requires special expertise, it is to be performed by a Contractor that derives a majority of its annual income from arboricultural work and whose employees are highly trained and skilled in all phases of tree service work. Contractors must have been in business for at least five years. The City may require proof of the Contractor's involvement in tree service work.

The Contractor has the responsibility to:

A. Reserve work space along streets;

B. Grind out designated stumps;

C. Remove excess material and clean up the work site;

D. Guarantee the specifications will be met; and

E. Keep work site safe at all times.

All bidders must have in their possession or available to them by formal agreement at the time of bidding: trucks, stump grinders, hand tools, and other equipment and supplies that are necessary to perform the work as outlined in these specifications.

II. Location

Work is limited to stumps located on all public rights-of-way and City-owned property. All work under this contract shall be assigned by supplying the Contractor with a list of stumps that have been marked with the diameter of the stump.

The City reserves the right to change, add, or delete areas or quantities of stumps to be removed as it deems necessary. Stumping operations will commence no later than five (5) days after the contract has been awarded and will be completed no later than _____________.

III. Supervision

Contractor consults with the City concerning details of scheduling of all work. Contractor has a competent person in charge of his work at all times to whom the City may issue directives and who shall accept and act upon such directives, and who reads, speaks, and writes English competently.

Failure for the supervisor to act on said directives shall be sufficient cause to give notice that the Contractor is in default of contract unless such directives would create potential personal injury of safety hazards. The City requires a certified arborist on the job site, and requires the arborist's certification number in this bid.

IV. Inspections

The City is called at #______________ before 8:30 a.m. on mornings of each working day and told exact location of that day’s work. The City inspects work at its discretion and is requested by letter, five days in advance of the completion of this contract, to provide a final inspection.

V. Stump Grinding

The tree stumps will be ground out to a depth of six (6) inches below the normal surface level including all surface roots. Immediately after grinding each stump, the grindings must be removed from the work area. Adjacent sidewalks, lawns, streets, and gutters will be cleaned. Holes are not to be left open overnight. Backfill consisting of clean earthen soil should be used to fill in the cavity, free of debris, to four (4) inches above the existing lawn grade surrounding the stump site (to allow for settling) and seeded with an approved seeding mix. Do not backfill with wood chips.

All labor, supervision, equipment, material, and supplies necessary for the execution of the work must be provided for by the Contractor at no additional cost to the City. All debris disposal must be provided by the Contractor at no additional cost to the City.

The chosen Contractor will be required to follow the ANSI Z-133 Standards for tree worker safety. If a Contractor is not aware of these standards, copies can be provided by the City of _____________.

VI. Traffic Control

Is total responsibility of Contractor and is coordinated with the proper department of the City of _____________.

The Contractor shall be solely responsible for pedestrian and vehicular safety and control within the work site and shall provide the necessary warning devices, barricades, and personnel needed to give safety, protection, and warning to persons and vehicular traffic within the area.

Blocking of public streets shall not be permitted unless prior arrangements have been made with the City and is coordinated with the appropriate departments. Traffic control is the responsibility of the Contractor and shall be accomplished in conformance with State, County, and Local highway construction codes.

VII. Utility Agencies

Are contacted by Contractor any time assistance is needed to work safely around overhead or underground installations. The City provides list of principal contacts and telephone numbers for public and private utility organizations.

The Contractor shall protect all utilities from damage, shall immediately contact the appropriate utility if damage should occur, and shall be responsible for all claims for damage due to his operations. It is left to the Contractor's discretion to notify the appropriate utility authority before stump removal begins. If the Contractor has properly contacted the utility in sufficient time to arrange for the required work by the utility, delays encountered by the Contractor in waiting for the utility to complete its work will not be the responsibility of the Contractor.

VIII. Damages

Done by the Contractor to any person or property, public or private, are the total responsibility of the Contractor and are repaired or compensated for by the Contractor to the satisfaction of both injured party and the City at no cost to the City.

IX. Insurance

Contractor shall be fully insured as specified and shall be completely covered by State Workers' Compensation during the life of this contract. The Contractor shall have liability insurance in the amount of $1,000,000.00 for each occurrence and shall name the City as an additional insured on its policy for the work being performed in the City of ____________.

X. Payments

Partial billings are acceptable, not more frequently than every two weeks. Payment is made according to actual number of stumps removed. Ten percent (10%) of each invoice is withheld until Contractor's work is completed to the satisfaction of the City. Billing for work along any street may not be made until Contractor completes all work on that street. At the discretion of the city, one-half of the ten percent (10%) retainer may be held until spring if enough snow is on the ground that a proper inspection of sites cannot be conducted. When an inspection is done and the Contractor, as directed by the City, corrects any problem that may occur, the remainder of the retainer will be paid.

XI. Working Hours

The Contractor will schedule work between the hours of 7:00 a.m. and 6:00 p.m. Monday through Friday unless authorized by the City to do otherwise.

XII. Subcontracts

The Contractor will not be allowed to subcontract work under this contract unless written approval is granted by the City. The Subcontractor, as approved, shall be bound by the conditions of the contract between the City and the Contractor. The authorization of a Subcontractor is to perform in accordance with all terms of the contract and specifications. All directions given to the Subcontractor in the field shall bind the Contractors as if the notice had been given directly to the Contractor.

XIII. *Execution of Contract*

The successful Bidder shall, within five (5) calendar days of the mailing of written notice of selection as the successful bidder, enter into contract with the City on forms included within the bidding documents for the performance of work awarded him and shall simultaneously provide the appropriate bonds, indemnities, and insurance required hereunder. The contract, when executed, shall be deemed to include the entire agreement between the parties; the Contractor shall not base any claim for modification of the contract upon any prior representation or promises made by representatives of the City, or other persons.

XIV. *Discontinuance of Work*

Any practice obviously hazardous as determined by the City shall be immediately discontinued by the Contractor upon receipt of either written or oral notice to discontinue such practice.

XV. *Observance of Laws, Ordinances, and Regulations*

The Contractor, at all times during the term of this contract, shall observe and abide by all Federal, State, and Local laws which in any way affect the conduct of the work and shall comply with all decrees and orders of courts and competent jurisdiction. The Contractor shall comply fully and completely with any and all applicable State and Federal Statutes, rules, and regulations as they relate to hiring, wages, and other applicable conditions of employment.

XVI. *Supervision*

This contract will be under the direct supervision of the City or its authorized representatives. Any alteration or modifications of the work performed under this contract shall be made only in written agreement between the Contractor and the City-authorized representative and shall be made prior to commencement of the altered or modified work. No claims for extra work or materials shall be allowed unless covered by written agreement.

XVII. *Bidding Specification and Contractual Terms*

Stump work done under the direction of this contract shall be bid on forms as provided by the City.

XVIII. *Award*

For a bid to be considered, prices must be quoted for the entire stump removal project.

XIX. Contract Termination

The City shall have the right to terminate a contract or a part thereof before the work is completed in the event:

A. Previous unknown circumstances arise making it desirable in the public interest to void the contract;

B. The Contractor is not adequately complying with the specifications;

C. Proper arboricultural techniques are not being followed after warning notification by the City or its authorized representatives;

D. The Contractor refuses, neglects, or fails to supply properly trained or skilled supervisory personnel and/or workers or proper equipment of the specified quality and quantity;

E. The Contractor in the judgment of the City is unnecessarily or willfully delaying the performance and completion of the work;

F. The Contractor refuses to proceed with work when as directed by the City; or

G. The Contractor abandons the work.

XX. Indemnification

I, the Contractor, agree to indemnify, hold harmless, and defend the City from and against any and all loss, damage, or expense which the City may suffer or for which the City may be liable by reason of any injury (including death) or damage to any property arising out of negligence on the part of the Contractor in the execution of the work to be performed hereunder.

This indemnity provision shall not apply in cases where the Contractor has not been provided with timely notice, nor shall the Contractor be liable to the City for any settlement of any complaint affected without the prior written consent of the Contractor. This indemnity provision also specifically does not apply to loss, damage, or expense arising out of contact with the City's stumps by persons (other than employees of the Contractor engaged in the work contemplated by this agreement) who are around such stumps.

CITY WIDE STREET TREE FERTILIZATION SPECIFICATIONS
CITY OF ______________, ______________

I. Scope of Work

To provide all supervision, material, labor, equipment, service operations, and expertise required to fertilize street trees in the City of ____________ as specified herein. Contractor has responsibility to:

A) Furnish, transport, and apply water-soluble fertilizer;

B) Reserve work space along streets;

C) Use hydraulic sprayer and soil probe or lance at 100-200 PSI;

D) Remove excess material and clean up site;

E) Keep work site safe at all times; and

F) Any work incidental to above.

II. Material Specifications

Section A: Types of Fertilizer to be Used

1. Inorganic Fertilizer (Chemical) - Is that derived from chemical sources. These nutrients are readily available in the soil and are rapidly soluble, with a short residual period.
2. Soluble Fertilizer - Is mixed with water and applied in liquid form. Soluble fertilizers may be applied via the deep root feeding method. Soluble fertilizers are usually inorganic and readily available. Materials with a limited solubility that dissolve slowly are often listed on fertilizer labels as water-insoluble nitrogen (WIN).

Section B: Fertilizer Analysis

1. Established Plantings - use fertilizers with N-P-K ratios of 3-1-2 or 3-1-1 for best response. These formulations may have slight variations.
2. Inorganic (water-soluble) nitrogen should be supplemented with synthetic or organic nitrogen (WIN) for the slow availability characteristics of the insoluble form of the material.

Section C: Rates of Application

1. For optimum plant growth, apply 4-6 lbs. of actual nitrogen per 1,000 sq. ft. every two years.
2. Diameter at Breast Height (DBH) - Measure the trunk diameter at 4.5 feet above grade. Generally for optimum growth, apply 1/4 lb. actual nitrogen per inch DBH to trees under 6 inches in diameter. The rate can be increased to 1/2 lb. N per inch DBH for most trees over 6 inches DBH. The majority of the trees to be fertilized in this project will be 2 - 4 inch DBH. Using a 3-inch DBH tree and fertilizing with 1/4 lb. actual N per inch DBH would require 4.2 lbs of an 18-5-11 complete fertilizer:

   3 inches (dia) x 0.25 lb/inch (rate) = 0.75 lb. (amount of N).

   0.75 lb. (amount of N) / 0.18 (%N in 18-5-11) = 4.166 lbs of 18-5-11.

3. Liquid application - Diluted fertilizer solutions should be applied at the rate recommended by the manufacturer according to operating pressure and flow rate of the equipment to be used. Apply sufficient liquid mixture to supply the required rate of fertilizer as determined by the surface area of DBH method. It is suggested that one apply 150 gallons to each 2,000 sq. ft. of surface area. Inject approximately 1/2 gallon of fertilizer solution per injection at 2.5 ft. spacings.

Section D: Timing of Fertilizer Applications

Early spring before bud break is the recommended time for fertilizing. Fertilizing should not be done after leaves have fully expanded.

Section E: Method of Fertilizer Application

Liquid Injection - Injections using a soil probe or lance should be 2.5 feet apart, and 6-12 inches deep for trees. Begin lance injection 2-3 feet from the tree trunk and work out about 8 feet beyond the trunk or to the sidewalk or other hardscape obstacle, which ever is farthest. Use a hydraulic sprayer at 100-200 lbs. pressure and soil lance designed for liquid fertilizer with a manual shut-off valve and three or four horizontal discharge holes at 90 degrees in its point. Inject one-half a gallon of fertilizer solution into each hole. The addition of water to dry soil as occurs during the liquid injection process is an excellent side-benefit.

Section F: Additional Guidelines

1. Undesirable tree species that could be found on tree lawns or on public rights-of-way should not be fertilized. These are: silver maple, boxelder, alder, birch, catalpa, redbud, Russian-olive, osage-orange, apple, mulberry, poplar, cottonwood, cherry plum, black cherry, black locust, sassafras, willow, and elm.

2. Be aware that overfertilizing small trees such as flowering crabapple can result in excessive succulent growth. Succulent growth is more prone to fireblight symptoms on susceptible plants such as pear, crabapple, and mountain ash.

3. Fertilize in moist soils - Fertilizer should always be applied in moist soils to enhance fertilizer uptake and reduce fertilizer injury to plants and aid in soil injection treatment. If soils are not moist, irrigation should precede fertilization to moisten the plant root zone area. The liquid injection method of fertilizing trees will help moisten the soil in the root zone while applying desired nutrients.

4. Fertilizing Excessively Wet Soils - Avoid fertilizing trees growing in soil that is excessively wet. The roots in wet soil are often damaged from lack of oxygen caused by the accumulation of toxic gases. Adding fertilizer in any form may contribute to root injury.

5. Read the Label - Read the entire label of any fertilizer product before application and apply per label recommendations.

Appendix M
Contracting Tree Work

Contracting Tree Work

Tree care companies can be utilized to perform work beyond the capabilities of municipal manpower and equipment. Some of the advantages of using contracted crews to do tree work are:

- Does not require an increase in municipality personnel or re-training of existing personnel.
- Does not require large capital expenditures on equipment.
- Allows for greater flexibility in scheduling tree care operations.
- Allows the amount of work performed on an annual basis to be adjusted based on available municipality budget, without laying off municipality personnel.

A municipality can most cost-effectively contract tree work by:

- Scheduling work in the winter months, since this is traditionally the slow season for tree care companies. Companies may offer reduced rates (10% to 20%) for off-season work to keep their employees on the payroll.
- Performing work on a project basis. In this way, the tree care company is guaranteed a certain dollar volume of work, and the municipality is guaranteed specific work rates. Tree companies may offer a reduced rate (5% to 15%) for fixed-volume business.

Contracting of Tree Care on a Project Basis

To secure the best possible prices, Davey Resource Group recommends contracting on a project-by-project basis. Projects can include work on an individual tree or work on a group of trees, based on either the type of maintenance to be performed or by location of work. In the first example, all of the removals can be identified as a project, and bids can be solicited for the performance of the removals alone within a specific time frame. Ideally, bids for work should be on a per tree basis by diameter class. In the second example, the maintenance for all trees on several streets can be identified as a single project and bids solicited for the entire project. There are many variations of this concept for contracting tree care, and the Municipality can select the method that best suits its requirements. Project planning should focus on the efficient use of workers and equipment by the selected contractor. This will aid the Municipality in obtaining the best pricing for tree care projects.

It is important to consider more than just pricing when selecting a tree care contractor. Contractors should be required to post performance bonds on projects over a certain dollar amount; should show proof of adequate general liability and workers' compensation insurance; should be able to demonstrate sufficient ability to perform the work as specified; should hold all necessary licenses, such as pesticide application certification; and should be able to provide references to past work that is similar to the work specified for the project. In addition, the Municipality should maintain awareness of any public relations problems involving the contractor's work procedures, equipment, and personnel appearance. Such problems or potential problems should be remedied as soon as possible.

Recommendations for Contractor Crew Inspection

When inspecting contractor tree crew operations, the Municipality should make sure the crews follow the guidelines set forth in contract specifications for the work being performed. These specifications should be developed and approved by the Municipality to ensure quality performance by contractors. Following these guidelines should result in improved pruning procedures and safe work practices. The inspection process should ensure that the contractual procedures are followed. Examples include:

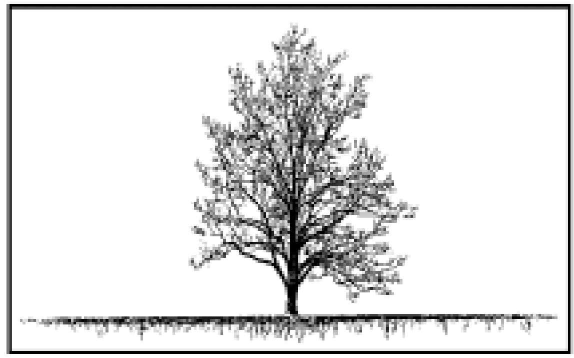
- Climbing crews do not use climbing spikes except for tree removals.
- All pruning cuts are made according to specifications. Pollarding, framing, or rounding over is not acceptable practice.
- Work operations are properly protected with traffic cones, pedestrian barriers, and flaggers to prevent injury to crew personnel and the general public, and to prevent damage to adjacent property.

Appendix N
Construction Damage and Tree Preservation

Construction Damage and Tree Preservation

Trees are valuable assets. They clean the air, provide shade and wind protection, add aesthetic benefits, decrease cooling and heating costs, provide pollution control, provide stormwater management benefits, and increase property value.

Unfortunately, when expansion occurs in the name of progress, trees are often compromised in the process. Attempts to save trees during the construction process are often doomed unless protective measures are carefully implemented prior to and strictly enforced during construction.

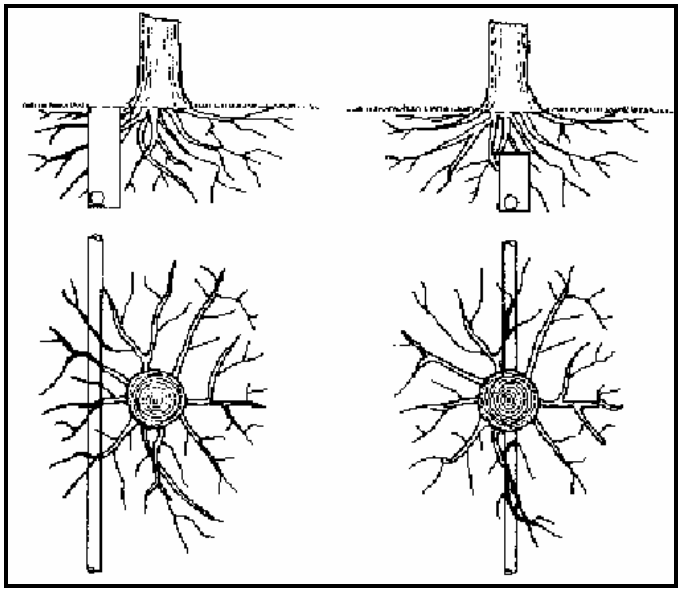


Scientists and arborists agree that the greatest percentage of tree roots are in the upper 12 to 18 inches of soil and extend well beyond the spread of the canopy. Trees are adversely affected both above and below ground by construction activities. To preserve trees during construction activities, every possible preservation technique must be implemented to minimize damage.

The following activities damage trees during construction:

1. **Trenching:** Construction equipment can injure a tree by tearing or breaking limbs and/or roots and by damaging the bark and wounding the trunk. Wounds created from these actions are permanent and can be fatal if extensive.

Whenever possible, trenching should be restricted to areas that will disturb the least amount of root systems. Where this cannot be achieved because of other site restrictions, tunneling or directional boring should be considered. These practices minimize tree damage by keeping root injury to a minimum.

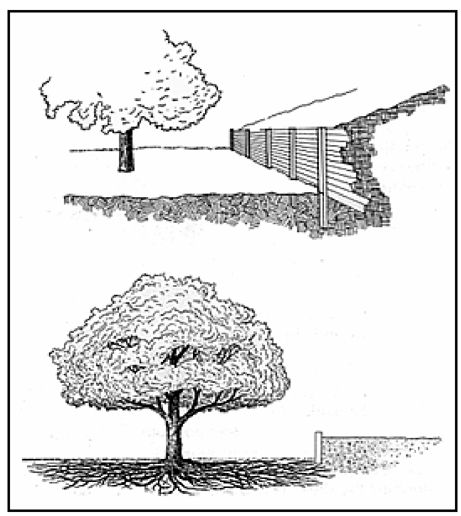


2. **Soil Compaction:** The most damaging effect of construction activity is soil compaction. Species tolerance to compaction varies, but most trees will suffer when the surrounding soil is compacted extensively.

Soil compaction during construction is usually due to equipment and vehicles continually driving over the root zone and from construction supplies and materials being stored for long periods of time near trees. Compaction happens very quickly and is difficult, if not impossible, to correct. Only seven passes of a small tractor over the same area is enough to change a porous soil consistency to one similar to concrete.

To remedy this, fencing and 'off-limits' areas should be established. If this cannot be accomplished, then a thick layer of unrefined (coarse) wood chips (12 to 18 inches deep) or sturdy geotextile materials can be temporarily laid over the driving area to reduce compaction.

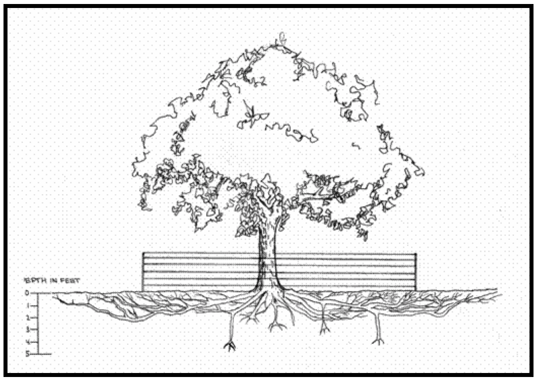
3. **Soil Clearing and Grading:**



Mechanical damage, soil compaction, and stripping of soil nutrients can all be avoided by preserving a tree's root zone. Restricting construction activity in and near the root zone by erecting metal, plastic, or wood fencing is the most effective means of avoiding damage to roots, trunks, and crowns.

Also, site design solutions are available to achieve required grade changes and to retain trees. The project architect and/or engineer, working in conjunction with a qualified arborist, can help develop innovative solutions to construction activities and tree preservation.

Branches directly interfering with construction work should be properly pruned back. If a tree is severely injured, it should be removed.



Ultimately, a *Tree Preservation Plan* should be developed specifically for all construction projects in the City that will affect trees. A preservation plan must note that protective tree fencing shall be installed prior to any site work and that it be placed at or outside of the dripline to ensure survivability of existing trees. It must also state that no site disturbing activities (cut, fill, parking, or material storage) shall take place inside the fenced area. It is also a very good idea to post signs on the fencing that display all pertinent information such as potential penalties, City forester's name and phone, etc.

Trees that are only slightly damaged may be restored to a healthy condition by pruning, watering, fertilizing, core aeration, and/or radial trenching.

While trees that have been disrupted by construction activities may not be showing signs of damage or stress now, they may show signs of decline in the near future. Trees in construction zones can be damaged or killed by root severance, soil compaction, soil grading, and/or construction materials (toxic leaks and spills).

Tables 1 and 2 list symptoms of construction damage and methods to minimize damage to trees. More information about construction damage and protecting trees during construction is included in Appendix O.

Table 1. Symptoms and Signs of Construction Activity Damage

Tree Part	Symptoms and Signs of Damage
Crown	Slow growth rate, staghorns, and/or dieback
Leaves	Wilted, scorched, sparse, undersized, distorted, chlorotic, browning margins, premature autumn color, and/or premature drop
Trunk	Wounds, absent bark, crown rot, absence of buttress (root) flares, adventitious sprouting, suckering, and/or severe insect damage and disease
Branches	Dieback, slow growth rate, wounds, adventitious sprouting, and/or suckering
Fruits and flowers	Abnormally large crop, absence of fruit, and/or flowering out of season

Table 2. Major Construction Impacts and Methods to Minimize Damage

Impact to Tree	Construction Activity	Methods/Treatments to Minimize Damage
Root Loss	Stripping site of organic surface soil during mass grading	Restrict stripping of topsoil around trees. Any woody vegetation (slated for removal and adjacent to preserved trees) should be cut at ground level and not pulled out by equipment. This will prevent tree root injury.
	Lowering grade; scarifying; preparing subgrade for fills and/or structures	Use retaining walls with discontinuous footings to maintain natural grade as far as possible from trees. Excavate to finish grade by hand and cut exposed roots with a saw to avoid root wrenching and shattering by equipment, or cut with root pruning equipment. Spoil beyond cut face can be removed by equipment sitting outside the dripline of the tree.
	Subgrade preparation for pavement	Use paving materials requiring a minimum amount of excavation (e.g., reinforced concrete instead of asphalt). Design traffic patterns to avoid heavy loads adjacent to trees (heavy load bearing pavement requires thicker base material and subgrade compaction). Specify minimum subgrade compaction under pavement within dripline (extra reinforcement in concrete or geotextile under asphalt may be needed).
	Excavation for footings, walls, and/or foundations	Design walls/structures with discontinuous footings/pier foundations. Excavate by hand. Avoid slab foundations/post and beam footings.
	Trenching for utilities and/or drainage	Coordinate utility trench locations with installation contractors. Consolidate utility trenches. Excavate trenches by hand in areas with roots larger than 2 in. in diameter. Tunnel under woody roots rather than cutting them.
Wounding Top of Tree	Injury from equipment	Fence trees to enclose low branches and protect trunk. Report all damage promptly so arborists can treat appropriately.
	Pruning for vertical clearance for buildings, traffic, and/or construction equipment	Prune to minimum height required prior to construction. Consider minimum height requirements of construction equipment and emergency vehicles over roads. An arborist, not construction personnel, should perform all pruning.
Unfavorable Conditions for Root Growth; Chronic Stress from Reduced Root Systems	Compacted soils	Fence-off trees to keep traffic and storage out of root area. In areas of engineered fills, specify minimum compaction (usually 85%) if fill will not support a structure. Provide a storage yard and traffic areas for construction activity well away from trees. Protect soil surface from traffic compaction with thick mulch. Following construction, vertical mulch compacted areas. Install aeration vents.

Table 2. Major Construction Impacts and Methods to Minimize Damage (Continued)

Impact to Tree	Construction Activity	Methods/Treatments to Minimize Damage
Unfavorable Conditions for Root Growth; Chronic Stress from Reduced Root Systems (Continued)	Spills and/or waste disposal (e.g., paint, oil, fuel)	Post notices on fences prohibiting dumping and disposal of waste around trees. Require immediate cleanup of accidental spills.
	Soil sterilants (herbicides) applied under pavement	Use herbicides safe for use around existing vegetation and follow label directions.
	Impervious pavement over soil surface	Utilize pervious paving materials (e.g., interlocking blocks set on sand). Install aeration vents in impervious paving.
Inadequate Soil Moisture	Rechannelization of stream flow, redirecting runoff, lowering water table, and/or lowering grade	In some cases, it may be possible to design systems to allow low flows through normal stream alignments and provide bypass into storm drains for peak flow conditions. (Usually flood control and engineering specifications are not flexible where the possibility of flooding occurs). Provide supplemental irrigation in similar volumes and seasonal distribution as would normally occur.
Excess Soil Moisture	Underground flow backup; raising water table	Fills placed across drainage courses must have culverts placed at the bottom of the low flow so that water is not backed up before rising to the elevation of the culvert. Study the geotechnical report for groundwater characteristics to see that walls and fills will not intercept underground flow.
	Lack of surface drainage away from tree	Where surface grades are to be modified, make sure that water will flow away from the trunk; i.e., that the trunk is not at the lowest point. If the tree is placed in a well, drainage must be provided from the bottom of the well.
	Compacted soils; irrigation of exotic landscapes	Compacted soils have few macropores and many micropores. Core vent to improve drainage. Some species cannot tolerate frequent irrigation required to maintain lawns, flowers, and other shallow-rooted plants. Avoid landscaping under those trees, or utilize plants that do not require irrigation.
Increased Exposure	Thinning stands; removal of undergrowth	Preserve species that perform poorly in single stands as groups or clusters of trees. Maintain the natural undergrowth.
	Reflected heat from surrounding hard surfaces	Minimize use of hard surfaces around trees. Monitor soil moisture needs where water use is expected to increase.
	Pruning	Avoid severe pruning where previously shaded bark would be exposed to sun. Where pruning is unavoidable, provide protection to bark from sun.

Appendix O
Sample Street Tree and Tree Preservation Ordinance

A PROPOSED STREET TREE ORDINANCE FOR

___________________, ___________________

BE IT ORDAINED BY THE COUNCIL OF THE CITY OF ___________, ____________.

Section 1. Short Title

This ordinance shall be known and may be cited as the STREET TREE ORDINANCE OF THE CITY OF ___________, ____________.

Section 2. Definitions

For the purposes of this Ordinance the following terms, phrases, words, and their derivations shall have the meaning herein given.

1. The word "shall" is always mandatory and not merely suggested.
2. The "City" means the City of ____________.
3. When not inconsistent with the context, words of the masculine gender shall include the feminine and words of the feminine gender shall include the masculine; words used in the plural number shall include the singular number and words used in the singular number shall include the plural number; words used in the future tense shall include the present and words in the present tense shall include the future.
4. The term "Superintendent of Public Works" means the person authorized to exercise the powers granted to him by this Ordinance.
5. The word "person" means any person, firm, partnership, association, corporation, company, or organization of any kind.
6. The words "tree" or "street tree" include any tree or other plant in a public place or on private property as indicated by subsequent provisions of this Ordinance.
7. The words "public place" mean any public street, public highway, public park, and any property owned or held by the City of __________ within the boundaries of said City.
8. The words "arboriculture, "management" or "preservation" mean the treating, spraying, pruning, and any other tree care work intended for the preservation of trees and the removal and prevention of tree pests, blights, and diseases of any and all kinds.

Section 3. The Street Tree Director

The Superintendent of Public Works shall by virtue of his office, be the Street Tree Director.

(Alternate) Section 3-A. Establishment of a Street Tree Committee

An administrative committee called the "Street Tree Committee" is hereby established. This five member committee shall consist of four citizen members and the Street Tree Director who shall serve as chairman and represent the City Board.

1. Term of Office

   The four citizen members of the committee shall be appointed by the Mayor for a term as hereinafter provided or until their successors are appointed. The first two elector members shall be appointed for a term of one year, and the second two elector members shall be appointed for a term of two years, respectively.

2. Authority of the Street Tree Committee

   The committee shall have the authority to elect a secretary, establish subcommittees, adopt rules and regulations as may be necessary for the purpose of carrying out the intent of this Ordinance. Such regulations for the planting, care, pruning, and removal of trees shall not only be aimed at the elimination of economic waste by reason of damage to public property and/or the property of others in the interest of public health, safety, and welfare, but also for the aesthetic appearance of streets, avenues, highways, parks, and other public areas in the city.

Section 4. Powers and Duties of the Street Tree Director

1. General Authority

   The Street Tree Director is hereby given complete authority, control, and supervision of all trees which now or which may hereafter exist upon any public place in this City and over all trees which exist upon any private property in this City when such trees are in such a hazardous condition as to affect adversely the public health, safety, and welfare.

2. Specific Powers and Duties

   A. Preservation and Removal of Trees on Public Property

      The Street Tree Director shall have the right and duty to prune, preserve, or remove any tree or other plant existing upon any public place when such tree, or part thereof, is so infected with any injury, fungus, insect, or other plant disease or when such tree, or part thereof, constitutes an interference with travel. Said Director is further authorized to take such measures with regard to such trees or plants as he deems necessary to preserve the function and to preserve or enhance the beauty of such public place.

   B. Order to Preserve or Remove Trees on Private Property

      The Street Tree Director shall have the authority and it shall be his duty to order the pruning, preservation or removal of trees or plants upon private property when such trees constitute a public nuisance or when he shall find such action necessary to preserve the public health, safety and welfare.

i) Dead, Dangerous, or Diseased Tree

Any dead, dangerous, or diseased tree in so far as it affects the public health, comfort, safety, and welfare is hereby declared a public nuisance dangerous to life and limb. For the purposes of this ordinance, a dead tree is any tree with respect thereto the Street Tree Director or his designated agent has determined that no part thereof is living; a dangerous tree is any tree, or part thereof, living or dead, which the said Street Tree Director or his designated agent shall find is in such a condition and is so located as to constitute a danger to persons or property on public space in the vicinity of the said tree; a diseased tree shall be any tree on private property in such a condition of infection from a major pathogenic disease as to constitute, in the opinion of the said Street Tree Director or his designated agent, a threat to the health of any other tree.

ii) Specific Species as a Public Nuisance

Any trees, such as ailanthus, silver maple, poplar, boxelder, catalpa, or willow whose roots penetrate through or under the surface of any public place in the City, is hereby declared to be an undesirable species of tree for street planting.

iii) Obstructions as a Public Nuisance

Any hedge, tree, shrub, or other growth situated at the intersection of two or more streets, alleys, or driveways in the City is hereby declared to be a public nuisance to the extent that such hedge, tree, shrub, or other growth obstructs the view of the operator of any motor vehicle with regard to other vehicles or pedestrians approaching or crossing the said intersection.

C. Authority of Street Tree Director to Enter on Private Premises

The Street Tree Director or any designated member of his staff shall have the authority to enter upon private premises at any and all reasonable times to examine any tree or shrub located upon or over such premises and to carry out the provisions of this Ordinance.

D. Desirable and Undesirable Plant Lists

The Street Tree Director shall provide lists of trees undesirable for planting in public places in the City so as to ensure the public safety and welfare. These shall not be recommended for general planting, and their use, if any, shall be restricted to special locations where, because of certain characteristics of adaptability or landscape effect, can be used to advantage. The Street Tree Director shall provide lists of trees desirable for planting in public spaces. Other species and varieties may be added or deleted as experience proves their value. These lists are from the Street Tree Inventory provided by Davey Resource Group, a division of The Davey Tree Expert Company.

E. Issuance of Permits for Trimming, Removal and Planting

The Street Tree Director is given full authority and control in connection with the issuance of permits hereinafter provided for.

F. Issuance of Conditional Permits

The Street Tree Director shall have the authority to affix reasonable conditions to the grant of a permit issued in accordance with Section 6 of this Ordinance.

G. Delegation of Duties and Authority

In the exercise of all or any of the powers herein granted, the Street Tree Director shall have the authority to delegate all or part of his powers and duties with respect to supervision and control to his subordinates and assistants in the employ of the City, as he may from time to time determine. Such subordinates or assistants may be appointed by the Street Tree Director as he deems expedient. He may, at any time, remove them from office.

H. Supervision

The Street Tree Director or his appointed officer shall have the authority and it shall be his duty to supervise all work done under a permit issued in accordance with terms of this Ordinance.

Section 5. Street Tree Inventory Plan Adopted

This is hereby adopted for the City of ________, a Street Inventory Plan Public Document showing species of all trees existing or to be planted in the public right-of-way of all streets within the City. Said Street Tree Inventory Plan is attached to this Ordinance and is hereby incorporated by reference. No person shall hereafter plant, transplant, or remove any public tree on or to any street of the City except on a location where it will be in conformation to the Street Tree Inventory Plan and the species and variety therein designated.

Section 6. Required Permit and Conditions for Granting Relief

1. General Requirements

No tree shall be planted or removed in or upon any public place without a written permit from the Street Tree Director. Such permit shall designate the type of tree and place where such tree is to be planted or removed. The Street Tree Director shall have the authority to designate the species and variety of tree to be planted and the required spacing and required minimum planting size.

2. Application Data

The application for a permit herein required shall state the number, species, and variety of trees to be pruned, preserved, removed, or planted, the kind of treatment to be administered, and such other information as the Street Tree Director shall find reasonably necessary to a fair determination of whether a permit should issue hereunder.

3. Standards for Issuance

The Street Tree Director shall issue the permit provided for herein when he finds that the desired action or treatment is satisfactory and that the proposed method and workmanship are satisfactory.

4. Exemptions

No permit shall be required to cultivate or water public trees or shrubs. The Street Tree Director may authorize any tree expert company or other professional to do the work or act described in Subsection 1 of this section without a written permit for each tree whenever he determines that such work or act will not be detrimental to the public interest and will be in accord with the spirit and other requirements of this Ordinance.

Section 7. General Tree Regulations

1. Injury to Trees Prohibited

No person shall, without the written permission from the Street Tree Director in the case of a public tree, do or cause to be done to others, any of the following acts:

A. Secure, fasten, or run any rope, wire, sign, or other device or material to, around, or through a tree.

B. Break, injure, mutilate, deface, kill or destroy, or permit any fire to burn where it will injure any tree.

C. Permit any toxic chemical, gas, smoke, brine, oil, or other injurious substance to seep, drain, or to be emptied upon or about any tree.

D. Excavate any ditch or trench in such a manner as to adversely affect the health of a tree or damage the root system.

E. Erect, alter, repair, or raze any building or structure without placing suitable guards around all nearby trees which may be injured or defaced by or where said injury or defacement may arise out of, in connection with, or by reason of such operation. Quality of said guard shall be determined by the Street Tree Director.

F. Knowingly permit any uninsulated electric transmission or distribution wires to come in prolonged contact with any public tree.

G. Remove any guard, stake, or other device or material intended for the protection of any public tree or close or obstruct any open space about the base of a public tree designed to permit access of air, water and fertilizer.

2. Moving Trees

All moving of trees upon any public place in this City made necessary by the moving, construction, or razing of a building or structure by any other private enterprise shall be done under the supervision of the Street Tree Director at the expense of the applicant. Such applicant, as one of the conditions of obtaining such permission, shall deposit with the City such sum in cash as the Street Tree Director may determine and specify to cover all the costs of moving and replacement thereof: provided, however, that in lieu of such cash deposit the Street Tree Director may, at his discretion, accept a good and sufficient bond in like amount conditioned upon the payment of all the costs of such moving and replacing.

Section 8. Procedure Upon Order to Preserve or Remove

When the Street Tree Director shall find it necessary to order the pruning, preservation, or removal of trees or plants upon private property as authorized in Section 4, (2), (b) herein, he shall serve a written order to correct the dangerous condition upon the owner, occupant or other person responsible for its existence.

1. Method of Service

   The order herein shall be served in one of the following ways:

   A. By making personal delivery of the order to the person responsible.

   B. By leaving the order with some person of suitable age and discretion upon the premises.

   C. By affixing a copy of the order to the door at the entrance of the premises in violation.

   D. By mailing a copy of the order to the last known address of the owner of the premises by registered mail.

   E. By publishing a copy of the order in the local paper once a week for three consecutive weeks.

2. Time for Compliance

   The order required herein shall set forth a time limit for compliance, dependent upon the hazard and danger created by the violation. In cases of extreme danger to person or public property, the Street Tree Director shall have the authority to require compliance immediately upon service of the order.

3. Appeal From Order

   A person to whom an order hereunder is directed shall have the right, within 24 hours of service of such order, to appeal to the Mayor, who shall review such order within five working days and file his decision thereon. Unless the order is revoked or modified, it shall remain in full force and be obeyed by the person to whom directed. A person to whom such order is directed must comply with said order within 20 working days after an appeal shall have been determined. When a person to whom an order is directed fails to comply within the specified time period, the Street Tree Director may take such steps as he finds necessary to remedy the condition.

4. Special Assessment

   If the cost of remedying a condition is not paid within 30 days after receipt of a statement therefore from the Street Tree Director, such cost shall be levied against the property upon which said hazard exists as a special assessment. The levying of such assessment shall not affect the liability of the person to whom the order is directed to fine and imprisonment as provided in Section 11. Such special assessment shall be collected with a forfeiture of 5% and interest for failure to pay at the time fixed by the assessing Ordinance.

5. (OPTIONAL) Assessment Ordinance

Those costs incurred by the City which constitute a special assessment as authorized by the Code of the City of __________, shall become a lien upon the property as of the date of the filing of the certificate of expenditure within the City Council. If such lien shall remain unpaid at the expiration of two years from the date of the filing of the certificate, the property may be sold for taxes in the same manner as property sold for general real estate taxes.

Section 9. Regulations Governing Residential and Apartment House Subdivisions

1. Street trees shall be planted by the property owner in all new residential and apartment house subdivisions, including single-family dwellings, stores, offices, and industry within the City, including land abutting any street previously opened as well as those opened for the subdivision. Installation shall be made under the guidance of the Street Tree Director.
2. The number, size, species, and location of the street trees planted at all new residences, offices, apartments, etc. shall be as specified by the Street Tree Director.
3. The Department of Licenses and Inspections shall not grant a building permit unless a street tree planting permit has been issued and a bond has been filed or cash deposited with the Street Tree Director to ensure compliance with this Ordinance and regulations adopted hereunder.
4. The bond or cash deposit shall equal the cost, as determined by the Street Tree Director, of purchasing and planting the required number of street trees.
5. The subdivider may comply with the street tree regulations or request the Street Tree Director to contract the work on public bid.
6. If a bond or cash deposit exceeds or is less than an accepted bid, the subdivider, in the case of the bond, may decrease or shall increase the bond and, in the case of a cash deposit, be reimbursed or increase the deposit in the amount of the difference.
7. Street trees shall be planted by the subdivider or contractor within two years from the issuance of a permit. Failure to plant the trees shall be a default and the bond or cash deposit shall be forfeited. Any funds derived from a default shall be expended by the Street Tree Director to plant the required trees.

Section 10. Regulations Pertaining to Persons Engaged in the Handling and Care of Street Trees

No person, firm or corporation shall advertise, solicit, or contract as a tree expert to improve the condition of fruit, forest, shade or ornamental trees by feeding, fertilizing, trimming, bracing, or other methods of improving or protecting trees without first obtaining a yearly permit from the Street Tree Director.

1. Anyone interested in obtaining such a permit shall make applications to the Street Tree Director. The Street Tree Director shall review the qualifications of the applicant and determine whether a permit will be issued.

2. Said permit shall be a prerequisite to the performance of any work connected with the planting, removing, spraying, pruning, bark tracing, and root pruning or any other acts necessary to obtain such work.

3. He shall obtain and maintain in full force and effect, covering the performance of the work covered by the permit issued under these Regulations, comprehensive property damage and public liability insurance. Said policy of insurance to have a minimum limit of $100,000 and $300,000 for injury to any person or persons and $50,000 for damages to any property. A certificate of said insurance policy with a 30-day cancellation notification shall be placed on file with the Street Tree Director. Additionally, they must provide workers' compensation insurance for all employees.

4. He shall perform the work described above in a professional manner and, in addition, shall comply with the specifications (written and drawn) furnished by the Street Tree Director. He shall further comply with regulations governing work to be done as directed upon the permit to cover such work.

5. A party who fails to obtain such as permit violates this section of the Ordinance and may be subject to a fine of not more than $100 per day. The imposition of this penalty shall not affect the liability of the person to fine and imprisonment as provided in Section 11 of this Ordinance.

Section 11. Penalty

Any person violating any of the provisions of this Ordinance shall be deemed and held guilty of a misdemeanor and upon conviction, shall be fined in any sum not to exceed $100 for each such offense and each day during which the violation shall continue, shall be held and deemed to be a separate offense.

Section 12. Constitutionality

If any of the provisions of this Ordinance shall be declared invalid or unconstitutional by any court of competent jurisdiction, such declaration shall not invalidate any other provisions of this Ordinance. The council of the City of __________ hereby declares that they would have adopted each and every portion of this Ordinance separately regardless of the possible invalidity of any part thereof.

Section 13. Adoption

This ordinance shall take effect from and after _____.

(Alternate) Section 13-A. Adoption

This Ordinance is hereby declared to be an emergency measure for the reason that its immediate passage is necessary for the preservation of the public peace, health, and safety of the City of __________, and it shall take effect and be in force immediately from and after the date of its passage and approval.

Section 14. Repealer

Any Ordinance of part thereof heretofore adopted which in any manner conflicts with any provisions of this Ordinance is hereby repealed to the extent of such conflict.

SAMPLE TREE PRESERVATION ORDINANCE

1.0 Intent

The City of ___________ finds that:

- ___________ has an abundance of trees that have benefited its citizens for many years, providing protection, cool shade, food, and rest;

- ___________'s trees have played an important role in the quality of life and the economic value of homes and property in the City;

- ___________'s trees have acted as purifying systems for the air, and their roots have held the soil to minimize erosion and flooding;

- ___________'s trees have been an invaluable physical and psychological counter-balance to the urban setting, making life more comfortable by providing shade and cooling the air, reducing noise level and glare, and providing an essential counter-point to man's impact on the land;

- As the population of the City has expanded, so have the needs for housing and services. To meet those needs, development has occurred, but sometimes those needs have been met at very great expense to the City's natural environment;

- The City's trees, which have been so invaluable, are easily damaged and destroyed during the activities associated with development, even when these trees are not in the direct way of said development;

- While homeowners commonly preserve, plant, and replace their trees, the process of development itself has often resulted in the clearing or inadvertent damage to trees and shrubs on large tracts of land, that results in a net loss of trees to the City;

- The intent of this ordinance is to ensure the protection of the maximum number of City trees possible and to preserve and perpetuate these natural assets for future generations.

1.1 Purpose

City of ___________ finds that the interests of the public health, safety, and welfare of its citizens require the establishment of standards limiting the destruction of and ensuring the survival of as many trees as possible in the City and the replacement of trees sufficient to promote the value of property and the quality of life of its citizens; to safeguard the ecosystem necessary to ensure the stabilization of soil by the prevention of erosion and sedimentation; to reduce stormwater run-off and the costs associated therewith; to replenish groundwater supplies; to prevent the destruction of carbon dioxide and to replenish oxygen in the atmosphere; and to provide greenbelts and buffers to screen against noise pollution, artificial light, and glare.

Toward those ends, and for the benefit of all of the citizens of ___________, it is intended that this ordinance will prohibit the unnecessary clearing of trees and to provide for the reforestation of cleared land so as to achieve no net loss of trees and to preserve, as much as possible, the existing tree composition.

2.0 Definitions

1. Basal area (BA) is the cross-sectional area at breast height (4.5 feet), usually expressed in square inches or square feet of all of the trees in the stand.
2. Diameter breast height (dbh) is the diameter of any tree, 4.5 feet above the natural ground line. Wherever the word diameter is used in this ordinance, it shall be taken to mean dbh, unless otherwise specified. The related term, circumference, is the diameter multiplied by 3.1416 (π), and is also a measurement around the tree at the 4.5 feet standard.
3. Dripline is the outside diameter of a tree crown.
4. Historic Tree is a tree which has been found by the City to be of notable historic interest to the City based on its age, species, size, or historic association with the City.
5. Official Master Tree Protection Map is a map identifying tree protection areas, specimen trees, and historic trees, and shall mean those official maps on file with the City.
6. Person is any public or private individual, group, company, firm, corporation, partnership, association, society, or other combination of human beings whether legal or natural.
7. Protected Tree is any tree growing within tree protection areas.
8. Shrub - is any woody plant of low height with several stems.
9. Specimen Tree is a tree determined by the City to be of high value to the community because of its type, size, age, or other significant tree characteristic.

10. Urban Forester(s) is the individual, or individuals, responsible for administering and enforcing this ordinance.
11. City Tree Board is the board responsible for overseeing this ordinance.
12. Tree is a woody plant having at least one well-defined stem and a more or less definitely formed crown, usually attaining a height of at least eight feet.
13. Tree Destruction Permit is the permit which must be obtained before any tree may be removed, as specified in this ordinance.
14. Tree Protection Area is any undeveloped area which contains a significant number of trees, and which should have an on-site inspection by the Urban Forester before any tree destruction permit is issued for that area, notwithstanding any exemptions which otherwise apply. Such areas are identified on the Official Master Tree Protection Map.

3.0 Tree Destruction Permit

It shall be unlawful to cut or remove or otherwise cause the death of any tree having a dbh of over eight (8) inches, except as otherwise provided by the City Tree Board, pursuant to Section _____, in ____________, as covered in this ordinance, without first having obtained a permit, except as otherwise herein provided. It shall be unlawful to remove any tree from a Tree Protection Area without having first obtained a Tree Destruction Permit. Certain trees, designated as specimen or historic trees, because of their size, age, rarity, historic, or ecological value shall be protected from cutting or destruction regardless of their location within the City.

3.1 Exceptions

The requirement of a permit in the above section is modified in the following situations:

3.1.1 Homeowners shall not be required to obtain a permit to cut a tree from the parcel of land upon which they reside, unless that parcel exceeds 100,000 square feet or unless the tree is identified as a specimen or historic tree pursuant to the terms of this ordinance.

3.1.2 This ordinance is not intended to regulate commercial nurseries, Christmas tree farms, orchards, horticultural operations, or the destruction of dead trees or the destruction of a tree that has become, or threatens to become, an immediate danger to human life or property. This exception shall not be construed to include the harvesting of lumber.

3.1.3 Cutting down, killing, or otherwise destroying trees by state or county agencies, public service companies, and natural gas companies performing normal construction and maintenance pursuant to applicable state or federal safety construction laws and regulations do not fall within the purview of this ordinance.

4.0 *Enforcement Authority*

The City Forester shall have the responsibility to identify and designate tree protection areas, specimen and historic trees, issue tree destruction permits, and supervise all work performed under any permit issued pursuant to this ordinance.

4.1 Any person residing in the City may request that the City Forester examine any tree to determine if that tree should be protected as a specimen or historic tree.

4.2 The City Forester shall survey the City for specimen, historic, and other important trees. Upon identifying a specimen or historic tree, the City Forester shall place a notice in the land records of property upon which any such tree is located, stating that such tree is protected by the provisions of this ordinance. Such notice shall also be added to the City official Tree Protection Map. When a tree destruction permit application is received, the Forester shall make an on-site inspection, if necessary, to ascertain the presence or absence of such protected trees.

4.3 The City Forester shall consult with the applicant for a tree destruction permit so as to ensure the survival of any trees not removed from the site.

4.4 The City Forester may make reasonable entry upon any lands within the City for the purpose of making any investigation, survey, or study contemplated by this ordinance.

4.5 The City Forester shall make all approvals or denials of tree destruction permits and all designations of specimen or historic tree status in writing.

4.6 The City Forester shall prepare the Official Master Tree Protection Map.

4.7 The City Forester shall coordinate with the entities identified in 3.1.3 of this ordinance so as to meet the purposes of this ordinance.

5.0 *City Tree Board*

There is hereby created a City Tree Board, consisting of no less than five individuals to oversee the activities of this ordinance and to serve in an advisory role to the City Forester in setting policy guidelines for enforcement of this ordinance. They shall be residents of the City, no less than 18 years of age, and shall be individuals who are actively interested in the improvement of the natural environment of ___________. Their terms shall be for ____ years, following usual procedures for new boards.

5.1 The City Tree Board shall have the authority to change the minimum size requirement for a tree destruction permit for some species of trees, when appropriate.

6.0 *Application for Tree Destruction Permits*

A tree destruction permit shall be obtained for the destruction of any tree protected by this ordinance by submitting a written application to the City Forester, together with such filing fee as shall be set by the Board of Trustees. The application shall be a sworn statement which shall include the applicant's name and address; the consent of the owner of the land upon which the trees are located; the location of the property upon which the trees to be removed are located; and tree size, age, and species, if known, of the trees to be removed.

6.1 If the application for tree destruction involves more than three trees, or if the property whereon the trees are located has been the subject of three previous tree destructions during the year preceding the current application, or if the tree to be removed is in a tree protection area, the application shall additionally contain the following information: a diagram of the 100-foot radius surrounding each tree to be removed, or a diagram to the property line, whichever is closer, that indicates the location of trees to be removed; and the locations of surrounding trees within that radius, together with their diameter and a tree restoration plan that meets the requirements of Section 9.0.

6.2 In addition to the previous permit requirements, if the proposed destruction is pursuant to construction or on-site improvements such as roads or utilities, in order to provide the City Forester enough information to evaluate the applicant's proposed restoration plan, and to also allow the City Forester to make recommendations that would facilitate the preservation of on-site trees, the applicant must also provide: the location of all diseased or damaged trees; the location of any trees interfering with any roadway, pavement, or utility line; any proposed grade changes; all trees to be removed identified on the site for the Forester's inspection; and a plan showing location of future buildings and improvements.

7.0 *Approval of the Tree Destruction Permit*

Upon receipt of an application for the destruction of more than three trees, or upon the receipt of an application for any tree destruction in a Tree Protection Area, the City Forester shall visit and inspect the site and shall approve the destruction permit for those trees that meet the following criteria: the destruction of the tree or trees is necessary to allow reasonable use of the property; the destruction of the trees will not adversely affect soil erosion, soil moisture retention, flow of surface waters, and the destruction of the trees is not inconsistent with the master drainage plan of the City; the trees to be removed are not specimen or historic trees as defined in this ordinance; and the applicant's tree restoration plan is adequate, pursuant to the standards described in Section 9.0.

7.1 The City Forester shall review the application for tree destruction to confirm that all the trees that will be destroyed are, in fact, included in the plan.

7.2 For purposes of this ordinance, it shall be presumed that trees within fifteen (15) feet of buildings and improvements will be irreparably damaged.

7.3 No tree destruction permit shall be valid for a period longer than one (1) year.

8.0 Appeal Procedures

Any person may appeal in writing, within 14 days, the City Forester's written decision approving or denying a tree destruction permit, or approving or denying specimen or historic tree status to the City Tree Board.

8.1 Any person may appeal any decision of the City Tree Board to the Board of Trustees in writing within fourteen days.

9.0 Tree Restoration Plan and Mitigation Standards

The restoration plan shall provide for the preservation or the restoration of a minimum of 75% of the original basal area of all of the trees in the stand, except as otherwise allowed in this ordinance's mitigation sections.

9.1 If the tree restoration plan calls for the replacement of trees, the trees should be replaced in kind, if feasible. If not, the replacement trees will be selected from an approved list of preferred trees prepared by the City Forester and posted in a prominent place in the City and also provided to the applicant at the time of original application.

9.2 The applicant may, as mitigation to the restoration plan requirements, deposit with the City Tree Board, a cash payment in lieu of the preservation of some or all of the trees on the site necessary to meet the basal area requirements. Such deposit shall be placed in a fund to be established by the City Tree Board. Such fund shall be used only for tree planting and maintenance projects within the City that have been approved by the City Tree Board. The City Tree Board shall determine the amount of the deposit based upon the value of the trees removed from the applicant’s property, including replacement cost, using procedures established by the International Society of Arboriculture.

9.3 Any of the aforementioned alternatives may be utilized in combination as deemed appropriate by the City Tree Board.

10.0 Timeliness

Before a preliminary plat plan, application for a special use permit, grading permit, or a building permit may be approved by the City, the site must be inspected by the City Forester to determine if a tree destruction permit is necessary and to determine if specimen and historic trees are present on the site.

11.0 Tree Protection During Development

During any building, renovating, or razing operations on any site which has been the subject of an approved tree restoration plan, the builder must erect and maintain suitable protective barriers around all trees, so as to prevent damage to said trees and so as to prevent a change in grade within the dripline of the tree.

11.1 Protective posts of nominal two inches by four inches or larger, or equivalent, shall be implanted deep enough in the ground to be stable, with at least three feet of post visible above ground, and linked together by approved fencing or other approved material and shall be clearly flagged with bright plastic tape so as to be readily visible.

11.2 The protective barrier described in 11.1 shall be established at a distance from the trunk of the protected tree to be at least six inches for each one inch of trunk diameter at 4.5 feet above natural grade line, or at minimum of two-thirds (2/3) of the distance to the dripline, whichever is greater.

11.3 The City Forester or the Tree Board may from time to time provide further protective standards or instructions so as to increase the likelihood of protected tree survival after development.

12.0 Bonding Procedure and Re-inspection Process

The City Forester has the authority, subject to appeal in writing within 14 days by the applicant to the Township Board of Trustees, to require the applicant to post a bond sufficient to guarantee the survival of specimen and historic trees and the completion of the approved restoration plan. The bond shall not be discharged until the City Forester shall visit and inspect the site to determine compliance. The inspection shall take place one year after planting, thereby allowing the City Forester to confirm the survival of the trees.

13.0 Penalties

Any person who violates any of the provisions of this ordinance, or permits any such violation, or who fails to comply with any of the requirements hereof, or who uses any land in violation of any detailed statement or plan submitted by him and approved by the City Forester, shall be subject to punishment as provided by law. Each tree unlawfully removed or otherwise destroyed shall be a separate violation. Each violation shall be punished by a $500 fine, in addition to the value of the tree. The value of such tree(s) shall be determined using procedures established by the International Society of Arboriculture and in accordance with section 9.0 of this ordinance.

13.1 Any violation of this ordinance shall also constitute a public nuisance that may be enjoined and abated as provided by law.

13.2 No building permit, plat plan, grading permit, or special use permit shall be issued for any parcel of land that has been cleared of trees without meeting the requirements of this ordinance for a period of six years after the offense.

14.0 Severability

This ordinance is not a substitute for landscaping requirements which may be imposed pursuant to other sections of the City ordinances, although other landscaping requirements may be used to satisfy the requirements of an applicant's restoration plan. Should any part or provision of this ordinance be declared invalid by a court of competent jurisdiction, the same shall not affect the validity of the ordinance as a whole, or any part thereof, other than the part declared to be invalid.

15.0 Effective Date

This ordinance is declared to be an emergency ordinance which is immediately necessary for the preservation of the public health, safety and general welfare, and is therefore made immediately effective.

Appendix P
Davey® Technical Bulletins

TECHNICAL BULLETIN

Prepared by The Davey Institute

ANTHRACNOSE DISEASES OF DECIDUOUS TREES

Gleosporium spp. *and Apiognomonia* spp.

Figure 1. Damage by ash anthracnose causes brown lesions. Leaves and leaflets drop early in the spring.

Figure 2. Symptoms of sycamore anthracnose disease are evident on newly expanding leaves.

Anthracnose diseases are caused by a common and destructive group of fungal pathogens that can attack various shade trees. Extended periods of cool, wet weather can make these diseases devastating and difficult to control with foliar applications of fungicides.

SYMPTOMS: Symptoms vary and are listed below by host.

Ash (*Fraxinum* spp.) – Brown areas with irregular shapes occur along the new leaves; brown blotches occur on leaf tips, veins and margins. Infected leaves drop prematurely in the spring (Figure 1). Twigs may be girdled and die, especially during cool, wet weather.

Maple (*Acer* spp.) – There are several fungi that cause anthracnose-type leaf spotting on maples. Foliar symptoms include brown vein lesions originating at the veins, to irregular browning of margins that extend inward.

Oak (*Quercus* spp.) – White oak is severely affected when new leaves are expanding and cool, moist weather occurs for a prolonged period. Leaves have large dead areas between the leaf veins, usually on lower branches. These leaves become twisted and droop with downward cupping. Twig and branch dieback may be evident the following spring.

Sycamore (*Platanus* spp.) – Areas along leaf veins turn tan to brown (Figure 2). As the fungus invades the leaf tissue it moves into petioles and stems. Buds turn gray-brown and wilt. Twigs and branches show discoloration around infected buds or exhibit dead sunken areas in the stems (cankers). Continuous years of infection cause severe canopy reduction and a witches'-broom stunting of branches.

CAUSE: The fungus generally overwinters in infected, dead leaves on the ground. With the sycamore disease, it also winters in the infected buds or twig and branch cankers. During cool wet springs, minute blister-like swelling in the infected tissues releases thousands of spores that are wind-dispersed to new leaves. These new infections cause death of the leaf tissues, which results in tan-to-brown dead areas. Varying amounts of leaf drop take place, depending upon the severity of the disease that season. The inoculum is present to repeat the cycle the following year.

SOLUTIONS: Current recommendations for preventing or correcting anthracnose diseases of shade trees include the following:

1. Fertilize trees that have become infected, and water during dry periods. This will help the tree overcome the stress brought on by the disease and the resulting defoliation.
2. Rake up and destroy infected leaves, and prune off cankered branches to reduce the potential for infection.
3. Usually, a fungicide applied to tree foliage during leaf expansion will aid in minimizing leaf infection and defoliation. However, if the weather is cool and wet for prolonged periods of time, foliar applications may not provide satisfactory results.

For management of sycamore anthracnose disease on trees greater than 2 feet in diameter, trunk injections of Arbotect® fungicide are recommended. This treatment provides two years of disease suppression from one application. The trunk injections are effective even when there is cool, wet weather that favors disease development.

Printed in the U.S.A.

T15065-9/2000

TECHNICAL BULLETIN

DAVEY

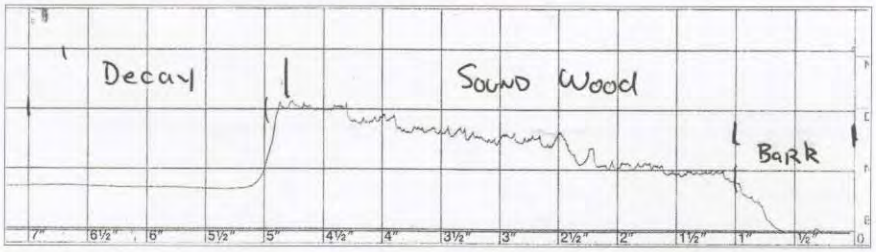
Prepared by The Davey Institute

ADVANCED DECAY DETECTION USING THE RESISTOGRAPH

WHY TEST FOR DECAY?

Wood decay in shade and ornamental trees is the most common disease in the urban forest. Decay and other tree defects can result in failure of branches, large stems or the entire tree. Importantly, not all trees with decay require treatment. The presence of decay does not necessarily mean that the tree is hazardous or requires treatment. More important than the presence of decay is the location and amount of decay.

In many cases, visual assessment of decay, simply sounding with a hammer, or probing with a sharp tool can provide adequate information to judge the amount of decay in a tree. However, because decay is often hidden internally by the bark, more advanced tools may be needed to make better judgments on how much decay is present.



Labeled Resistograph chart.

SYMPTOMS OF DECAY: There are many symptoms or indicators of decay in trees. A few examples include cavities; decayed branch stubs; loose or missing bark; fruiting bodies of wood decay fungi on roots, the trunk, or stems; or the presence of carpenter ants. These indicators do not tell how much decay might be present in a tree.

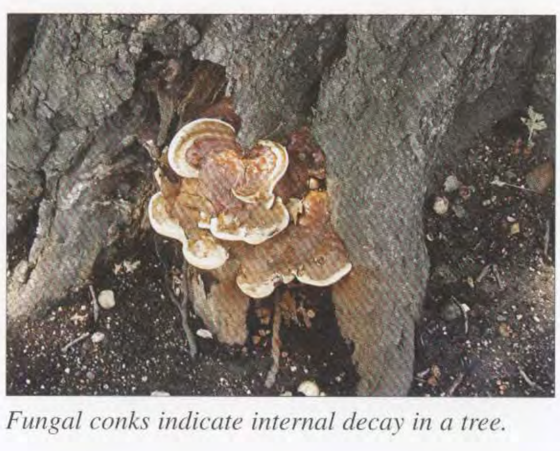
CAUSE: Wood decay in trees is caused by a closely related group of basidiomycete fungi that can digest the cellulose and lignin components of wood. These fungi may fruit on a tree in the area where the decay is present.

SOLUTION: The first step in the treatment of trees with indicators or symptoms of decay is to make an assessment of the amount of decay. If visual observation, sounding or probing techniques cannot adequately provide enough information, more advanced techniques may be needed.

The Resistograph is a relatively new tool in arboriculture that provides a means to assess and document hidden decay in a tree. This tool has a very small (3 mm), non-spiraled bit that can probe areas in the tree where decay is suspected. The distance the bit has traveled and the resistance to the bit are recorded on graphs. Reading these charts allows your Davey arborist to determine the presence and amount of decay in a particular location.

Once an evaluation of the amount of decay in a tree is made, treatment options can be developed. Unfortunately, there are no treatments to stop decay once it starts inside a tree. Treatments such as removal, pruning, cabling, bracing or moving of the target (what the tree might hit if it or a part of it fails) are potential options that can be developed with your Davey arborist.


Drilling into a sycamore with a Resistograph.


Fungal conks indicate internal decay in a tree.

Prepared by The Davey Institute

APPLE SCAB DISEASE OF CRABAPPLES

Venturia inaequalis

Figure 1. *Leaf spots from infection by the apple scab fungus.*

Figure 2. *The 'Hopa' crabapple tree on the left was not treated the previous year. Due to defoliation caused by scab disease, it has very poor flowering. The tree on the right was treated and is contributing to the beauty of the landscape.*

SYMPTOMS: Olive-green or brown spots develop on leaves in May through early June. On older leaves the spots are slightly raised, velvety and dark colored (Figure 1). As the disease develops, the leaves turn yellow and drop prematurely. The symptoms on the blossoms and fruit are similar to those on the leaves. Fruit may be deformed if heavily infected. Typical fruit lesions are circular brown spots with black margins and a corky appearance.

CAUSE: Apple scab, caused by the fungus *Venturia inaequalis,* is one of the most devastating diseases of ornamental crabapples. It also can be a problem on cotoneaster, firethorn and mountainash. This fungus overwinters on infected fallen leaves, or, rarely, on twigs of the tree. Spores, which infect the new leaves in the spring, are produced on the fallen leaves during warm rains in April and May.

Trees can be defoliated by late June with only a few leaves remaining for the rest of the summer. Not only does this alter the aesthetic appeal of the property, but it also reduces the vigor of the tree making it more susceptible to other disorders. Flowering may be reduced the next season because of this year's defoliation. Defoliation minimizes carbohydrates available for flower bud production. Some varieties exhibit flower decline more than others (Figure 2).

SOLUTION: Fungicide treatments in the spring will help minimize infection. During prolonged, wet spring conditions, which favor fungal growth, some infections will occur but fungicide treatments will help keep leaves on the trees. Additional applications may be purchased if there is an unusually wet growing season.

Rake and remove infected fallen leaves in autumn to reduce the potential for infection the following spring. Also, many cultivars of crabapple are resistant to apple scab and should be planted whenever possible. Check with your local extension service or call your Davey technical advisor for a current listing.

Printed in the U.S.A.

T15071-498

TECHNICAL BULLETIN

DAVEY

Prepared By The Davey Institute

Armillaria Root Rot

Armillaria melea

Hundreds of plant species, growing in sub-tropical to boreal forests, are affected by this disease. It is also a common problem in landscapes, gardens, and orchards in the Western part of the country. Armillaria root rot actually refers to a disease complex involving at least 11 species of fungi.

Armillaria root rot on root flares and base of trunk.

SYMPTOMS: Aboveground symptoms of Armillaria root rot include a reduction in growth, chlorotic undersized foliage, premature defoliation, and branch dieback in the upper crown. Wind throw of large trees has also been associated with Armillaria infection. Infection in coniferous trees stimulates heavy resin flow, which may saturate the bark.

The mushroom stage of the fungi develops annually in the fall. These mushrooms are called "honey mushrooms" and appear on or near decaying wood.

Below the ground, fanlike, veined white fans (mycelial sheets) can be seen under the bark of the roots. Black-brown fungal strands spread along root surfaces and also up the trunk of dead trees under the bark. The interior of the strand is white. These thick strands resemble shoestrings, leading to the name "shoestring root rot."

CAUSE: The fungus invades the bark and cambial regions of roots and root collars. Roots and trees of all sizes can be killed. Armillaria is a decay fungus and depends on woody material as a food source. Fungal infection progresses from the cambium into the sapwood.

SOLUTION: In general, plant susceptibility decreases as trees get older. Therefore, it is most important to keep trees healthy when they are younger. Even plants susceptible to Armillaria may survive infection if they are otherwise healthy and vigorous.

In orchards where the summers are hot and dry, some infected trees have been saved by excavating the soil away from the base of the trunk and root collar. Armillaria cannot survive the increased temperatures.

The most important strategies for the protection of shade and ornamental plants are to promote vigor, minimize stress, and to remove infected stump and roots. Armillaria can remain active in the soil for decades if sufficient woody material is available for growth.

DAVEY

Botryosphaeria Canker and Dieback

(Botryosphaeria dothidea, B. obtusa, B. rhodina)

SYMPTOMS: Symptoms vary with the type of plant infected, but generally begin as small lesions on the bark or as dead leaf buds. Lesions on the bark develop as sunken areas or 'cankers' until the stem is completely encircled. At this time, smaller twigs wilt and die from the tip downward, while larger twigs or wood appear mottled. Trees may lose individual twigs and branches, while smaller shrubs may appear as though whole sections have died. Plants more commonly affected include rhododendron, azalea, camellia, giant sequoia, sweetgum, oak, Leyland cypress, mountain laurel, madrone, sycamore, redbud and wax myrtle.

CAUSE: *Botryospaeria* fungi enter the plant through cracks in the bark or buds soon after a freeze, during extreme hot, dry weather, or through pruning cuts when plants are under stress. Thus, any environmental condition that weakens shrubs or trees encourages infection by *Botryosphaeria* fungi.

SOLUTION: Plants that have experienced sudden cold temperatures should be inspected for bark cracks along exposed stems and at the soil line. Prune out cracked or split stems at least 6 inches below discolored areas during the dry season. A registered fungicide applied after pruning may protect wood until wounds begin to close. Be sure to water trees and shrubs deeply whenever the soil is dry, but ensure irrigation heads do not deposit water directly against the tree trunk.

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T15076-3/00

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

CABLING OF TREES

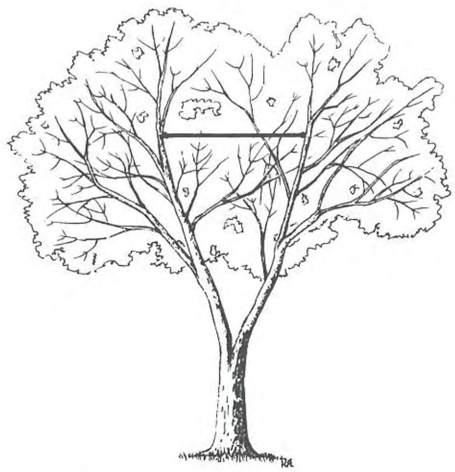


Figure 1.

Cabling is the installation of flexible steel strand cables in trees to reduce stress damage from high winds, the weight of ice or snow, and heavy foliage. Multi-stemmed trees or those with narrow V-shaped forks are especially susceptible to this type of damage (Figure 1). This procedure is used by arborists to improve your tree's chances to survive storms and minimize property damage when branches fail (Figure 2).

BENEFITS: The usefulness of a cable lies in its ability to transfer part of the weight of a weak branch or limb to a stronger one. In addition, a cable may provide mutual support to limbs that are joined by a narrow V-shaped fork. It is intended to prolong the life of the tree. Branches or trees that pose a potential threat to property or people are candidates for cabling.

EVALUATION: In determining whether cabling is warranted, the condition of the tree must first be assessed. The arborist and customer must then determine if cables will help to make the tree reasonably safe. If the root system is not structurally sound, or if the tree contains excessive decay, removal of the tree may be the better choice.

PROCEDURE: Before cables are installed, a tree should be pruned to remove hazardous branches, reduce foliage weight, and help improve the structure. This pruning will help reduce the weight of limbs to be cabled.

Figure 2. This damage was due to poor tree structure. Cabling would have minimized or avoided the damage.

After installation, cables should be inspected periodically for deterioration of materials and changes in the tree that may make adjustments necessary. In addition to pruning on a regular basis, the tree should be fertilized to help improve its health and vigor.

Our arborists adhere strictly to procedural and safety guidelines for cabling.

Printed in the U.S.A.

T15085-9/2000

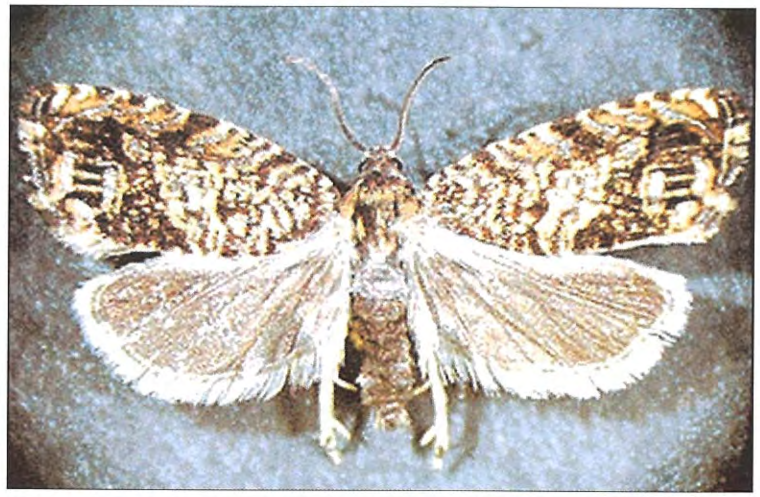
TECHNICAL BULLETIN

Prepared by The Davey Institute

CHERRY BARK TORTRIX

(Enarmonia formosana)

The cherry bark tortrix (CBT) is an introduced insect species from Eurasia that was first discovered in North America in 1990. Since then, this moth has become an important Pacific Northwest pest of rosaceous trees and shrubs, affecting plants such as apple, crabapple, hawthorn, Mountain ash, pear and *Photinia* species. *Prunus* species are the preferred hosts.



Adult moths have a wingspan of just over ½ inch.

SYMPTOMS: Initial larval feeding stimulates exudation of gum-like resin that is often mixed with silk and fecal material. Other signs of infestation include reddish-orange "frass tubes" that protrude from the bark, cracking and curling of bark, cankers and large swellings. Serious infestation results in branch dieback, followed by tree death.

LIFE CYCLE: CBT larvae overwinter under the bark of host trees, where they feed on living tissue. Mature larvae pupate in the frass tubes in spring, emerging as adult mothers from late April to early May (with flight activity in June). Less mature larvae pupate later, creating more flying activity in August. Females lay eggs on bark, in crevices and at graft and other wound sites. Upon hatching, the larvae feed in all directions just beneath the outer bark, then move into the cambium layer (but do not attack the wood). CBT has one generation per year.

Fully grown larvae are just under ½ inch in length with pale-gray to slightly pink bodies and dark heads. The pupae are about ½ inch in length, light brown and protrude from the bark or are found in bark cracks. The adult moths have a wingspan of just over ½ inch and are mottled-brown with coppery wing spots.

SOLUTIONS: Severely infested plants should be removed and destroyed. Monitor host species for the presence of pupal chambers. Remove chambers and loose bark. Set pheromone traps between May and September to trap adult moths. Invigorate trees with fertilization and watering during drought periods. Practice good pruning techniques, and prune during the dormant season. Cover injured bark and pruning wounds with pruning seal. Dormant oil and insecticide applications to trunk and branches may help reduce the populations of overwintering larvae.

Research for an effective biological control is being conducted.

Printed in the U.S.A.

Construction Damage and Tree Protection

Preventing damage to trees is much more economical than trying to save a tree injured by careless activity.

Mature trees are valuable assets - they provide shade, wind protection, and enhance property value. Most construction damage impacts the root systems of native trees on new home sites. Tree roots systems are quite extensive, and vulnerable to disruption of the soil profile and mechanical injury.

A construction project accounts for existing trees on the drawing board. Trees that face serious impact may be removed or carefully transplanted. Trees that require special protection with barriers can be determined. The best approach for tree preservation is to have all trees properly fertilized with Arbor Green® before construction begins.

On very large projects, consulting arborists can be directly involved. They may post signs for protected zones, designate parking and storage areas away from trees and help supervise construction activity to minimize tree damage.

SOIL DISRUPTION: A common problem associated with construction is lack of soil aeration, often resulting from compaction. A few species withstand such conditions, but most will suffer. A barrier placed at the perimeter of the tree canopy (dripline) will direct construction workers away. If this is not feasible, construction workers should be advised not to lay equipment or materials under the tree or to trample the soil underneath.

Soil compaction can also be reduced by laying down a 12 -inch layer of wood chip mulch under the tree. If soil needs to be removed to lower the grade beyond the dripline of the tree, mulching with organic materials can retain moisture and stimulate root production. If extensive soil removal is needed, a retaining wall creating a terrace or the formation of a tree well will keep much of the original soil beneath the tree intact. Soil should never be added within the dripline of the tree. Even 1 -inch of additional soil can suffocate the root system.

(over)

ROOT DAMAGE: At a minimum, the root zone diameter is 1-1/2 times the height of the tree. This area normally extends passed the tree canopy. Any piles of sand, gravel, or excavated soil should be stored outside this zone. Lime or limestone should be kept away from roots to avoid raising soil alkalinity and caustic materials such as paint thinner should not be discarded over the root zone.

Utility trenching should be done as far away from tree roots as possible. Installation of driveways should be planned so as to minimize tree root damage. In the event of root damage, the tree should be mulched and watered.

MECHANICAL INJURY: Some type of fencing should be erected around the tree to protect its trunk and lower branches. At very least, trunks and large exposed roots should be covered with protective materials to prevent mechanical injury. Branches directly interfering with construction work should be properly pruned back.

If a tree is severely injured it should be removed. Trees that are only slightly damaged may be restored to healthy condition by pruning out dead or dying portions, watering and fertilizing.

TECHNICAL BULLETIN DAVEY

Prepared by The Davey Institute

CORE AERIFICATION

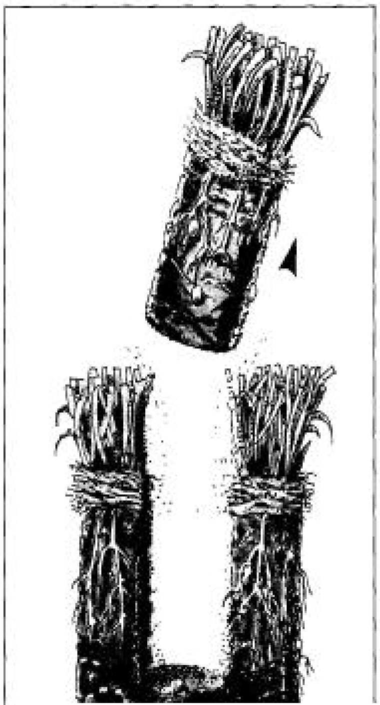
Aerification is the mechanical means of removing small plugs of thatch and soil from a lawn to allow the exchange of air between soil and the atmosphere to occur. This process is recommended for most home lawns to:

1. relieve soil compaction
2. "knit" soil interfaces
3. reduce excessive thatch layers

Many turfgrass areas suffer from soil compaction due to rainfall and foot or vehicular traffic. Although compaction is most often associated with athletic fields, home lawns can also suffer from compacted soil layers. Reasons for home lawn compaction include: construction activity prior to lawn establishment and traffic on high clay content soils especially when wet.

1. **Compaction** causes individual soil particles to press together tightly. This decreases the pore space where air and water are held. A compacted layer of soil forms a physical barrier which limits infiltration of water into the soil and availability of soil oxygen. Aerification will improve the penetration of air and water into the soil, which encourages deeper root growth and better turf quality.

2. Aerification is also useful where a **soil interface** exists. Soil interfaces another distinctly different soil type, in many instances, the sod used to establish a lawn is grown on soil which is organic in nature and is distinctly different from the soil over which it is placed. The interface that develops between these two layers resists uniform movement of water, air, and nutrients, resulting in irregular turf response. Aerifying breaks up the interface and promotes better conditions for turfgrass growth and development.



Aerification improves penetration of air and water into the soil.

3. Another benefit of aerification is **the modification of excess thatch layers** (1/2 inch or more). Thatch is a layer of dead and living stems and roots of grass which accumulate between the green grass blades and the soil surface. Multiple aerifications that leave the cores on the lawn surface to break down will incorporate native soil into the thatch layer, thereby improving the water and nutrient holding capacities of the thatch. Microorganisms in the soil cores will also help decompose the thatch. Aerification is particularly useful on large turf areas where dethatching is impractical.

Annual aerification is beneficial for most lawns; however, lawns growing on heavy clay soils or lawns exposed to intense use may need more than one aerification per year. It should be performed during the period of most active root growth for a particular grass species. Spring and fall are ideal times to aerify most lawns.

TECHNICAL BULLETIN

Prepared by The Davey Institute

COTTONY MAPLE SCALE

The cottony maple scale is a large, flat, brown scale insect found on the twigs and branches of various trees. The white, cottony egg masses, which resemble popcorn, are the most distinguishing feature of this scale. A favored host is silver maple, but it will attack other species of maple as well. Other host preferences are: honeylocust, black locust, white ash, euonymus, oak, boxelder, dogwood, hackberry, sycamore, beech, elm, willow, basswood and poplar.

SYMPTOMS: Injury to trees is caused by the scale insect sucking juices from the twigs and branches. Small twigs begin to die first, followed by leaves becoming stunted and a black, sooty mold becoming evident on the tree itself and on objects beneath the tree. This mold grows on honeydew excreted from the scale. A heavy infestation for two or three years may result in the death of large branches.

CAUSES: The fertilized, immature females spend the winter on the twigs and small branches of the host. In the spring, they resume their feeding and development. In late May, the females begin producing eggs that are deposited in masses covered with white, silken fibers. The young scales, called "crawlers," begin hatching in mid-June through early July. The crawlers move up and down twigs and out onto leaves before settling down to suck juices and secrete a waxy coating over themselves. In late summer, adult males emerge, mate with females, and die. Just before leaf drop in the fall, the mated females migrate back to the branches, where they settle and overwinter.

During about the third year after cottony maple scales infest a tree, a population of small lady beetles may be found devouring the egg masses. If these larvae are found in over half of the egg masses, natural control is taking place and additional treatment may not be necessary.

SOLUTION: A horticultural oil treatment may be applied before growth starts in the spring or after leaf drop in the fall. An additional treatment may be applied in mid-August or September after all the crawlers have hatched and settled on the leaves. However, do not treat sugar maples with oil; this species reacts adversely to oil, and branches may die.

It is extremely important to restore plant vitality, because trees weakened by the scale are more susceptible to other insects, diseases and environmental stress. Fertilizing, mulching, and watering, especially during dry periods, are recommended to help maintain tree health.

Printed in the U.S.A.

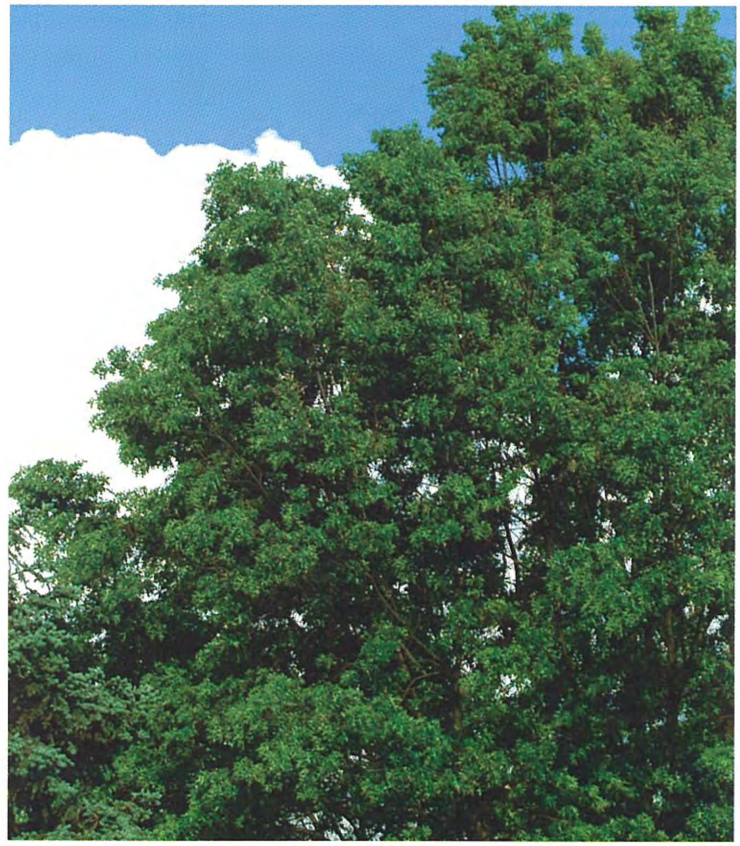
T15051-9/03

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

DAVEY KNOWS...SPIKING TREES IS *NOT* THE WAY TO GO



It is very important when pruning trees that the correct procedures be followed, in order to keep them looking healthy and strong. Spiking damages a tree, making it more susceptible to disease, insects and other stresses. Davey Tree wants to make you aware that spiking may *seem* to be an easy way for a tree trimmer to enter the tree and get the job done quickly, but in the long run, it will do much more harm than good.

The practice of using climbing spikes when pruning trees injures them, leaving entry sites for wood-rotting fungi. Climbing spurs (spikes) are steel gaffs attached to shanks that are strapped to the inside of a worker's leg. Workers secure their footing by driving the spurs into the trunk of the tree. With their spurs in the wood, workers are able to stand or walk along the vertical trunk or limb.

Spurs should only be used on trees that are dead or being removed. If necessary, spurs can be used on trees in an emergency rescue situation. According to the ANSI A300, which sets the proper pruning standards, a tree should not be pruned using spikes. Open wounds in the wood will be more likely to become infected with fungi (types of micro-organisms that can completely overwhelm a tree).

For more information on how to keep the trees on your property healthy and strong, contact Davey Tree today.

DAVEY

Prepared by The Davey Institute

DOGWOOD ANTHRACNOSE

Discula destructiva

Figure 1. *Trees infected with dogwood anthracnose develop tan, blotchy leaf spots on lower branches that progress up the tree.*

Figure 2. *Dead leaves often remain attached to the tree infected with dogwood anthracnose.*

Also referred to as lower branch dieback, dogwood anthracnose usually attacks flowering and pacific dogwood trees, which grow naturally in woodlands and home landscapes.

SYMPTOMS: This disease attacks twigs, branches and trunks as well as leaves, usually appearing during cool, wet weather in the spring. Initially, infected trees develop tan, blotchy leaf spots (Figure 1) on lower branches that progress up the tree. This fungus invades the main leaf vein causing total leaf and twig death. Dead leaves often remain attached to the tree (Figure 2). Eventually, the fungus moves into one and two year wood and forms elliptic cankers at the base of dead branches. In advanced stages of the disease, multiple shoots arise below dead branches along the main trunk.

CAUSE: Dogwood anthracnose is caused by the fungus Discula destructiva and is found naturally occurring on forested dogwood at higher elevations. Spores are spread through rain splash, primarily in cool, wet spring and fall weather. Hot, dry conditions will slow disease development. Drought, winter injury, and construction damage weaken trees and increase disease severity. Consecutive years of heavy infection have resulted in extensive destruction of both woodland and ornamental dogwoods.

SOLUTION: Selective pruning, preventive fungicide treatments, fertilization and watering are important preventive measures for controlling dogwood anthracnose. Effective management is possible if the disease is detected *before* extensive dieback occurs. Prune to improve air circulation and to dispose of diseased twigs and branches that are potential sources of inoculum. Do not transplant wild dogwoods into the landscape. Purchase healthy trees from reliable nurseries and consider borer applications to protect stressed trees.

Maintain healthy dogwood trees by improving water availability with mulch, avoid trunk injury, and fertilize with a slow release fertilizer such as Arbor Green.® Foliar fungicide treatments for dogwood anthracnose and other leafspot fungi should be applied in the spring during leaf expansion to keep disease incidence low.

Printed in the U.S.A.

L15093-299

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

DUTCH ELM DISEASE

Ophiostoma ulmi (syn. Ceratocystis ulmi)

Dutch elm disease is one of the most destructive shade tree diseases in the United States and Canada, and has killed millions of elm trees since its introduction from Europe in 1930. Despite this loss, many elms still remain as street trees or specimen shade trees providing grace and beauty to our landscapes.

SYMPTOMS: Infected elm trees display wilted leaves on one or a few branches in the crown of the tree – called flagging. The wilted leaves may turn yellow, curl, and/or turn brown. Leaves can remain attached to the stem or prematurely fall off. Stems exhibiting flagging typically die back.

If bark is peeled away from stems exhibiting yellow, brown or wilted leaves, brown streaking may be visible in the sapwood just under the bark. Sometimes streaking is embedded deeper in the wood, which indicates that the infection occurred in previous years.

CAUSE: The disease is caused by the fungus *Ophiostoma ulmi*. Both the smaller European elm bark beetle and native elm bark beetle can transfer fungal spores of the disease from infected elms to healthy elms. The fungus is transmitted to healthy trees when beetles carry fungal spores after feeding in stem crotches of diseased elms.

Direct transmission of the disease occurs when diseased trees and healthy trees in proximity to each other have connecting root grafts. Elms that are within 40 feet of each other have a good chance of having root grafts.

SOLUTIONS:

1. All infected elms and dead or dying branches on healthy elms should be promptly removed and destroyed to prevent build-up of beetle and fungal populations. Prompt removal of diseased branches can help stop the spread of the disease in a tree if it has not progressed within 10 feet of the main trunk.

2. To prevent root graft transmission of the disease from infected to healthy elm trees, trees suspected of having root grafts should have them severed by trenching or soil fumigation.

3. Systemic fungicides can be trunk injected for preventive and therapeutic treatment. Trees receiving therapeutic fungicide treatments have the best response if the crown has 5% or less infection.

4. Research indicates that attempts to manage the bark beetle with insecticides may not be effective. The feeding sites of beetles (stem crotches) must be protected with insecticides, which is difficult with current equipment, pesticides and technology. The alternate option is the protection of susceptible trees with preventative trunk injections of recommended fungicides.

5. Trees maintained with good cultural practices such as fertilization, watering, mulching and selective pruning will have the best health and vitality.

Printed in the U.S.A.

T15064 – 8/2002

TECHNICAL BULLETIN

DAVEY®

Prepared By The Davey Institute

Eastern Tent Caterpillar

Malocosoma americanum

The eastern tent caterpillar is a pest native to the United States whose presence was first recorded in the mid-1600's. It is found in eastern and central United States and has been seen as far west as the Rocky Mountains. It appears in large numbers, generally every ten years. The tent caterpillar favors wild cherry, apple and crabapple. It also feeds on ash, birch, sweetgum, willow, maple, oak, poplar and various *Prunus* species. It is not considered a serious pest except when attacking black cherry. Wild cherry trees seem to withstand repeated infestations.

Eastern tent caterpillar webs on host tree.

SYMPTOMS: The larvae (caterpillars) spin a silken webbing as they move. They radiate out from a branch fork creating the so-called tent. When populations are large, trees can become unsightly with webbing, and most of the foliage may be devoured by the caterpillars.

During winter, egg masses encircle smaller twigs of the host tree. The egg mass looks as if it has been varnished and can be up to 3/4" in length and contain 150 to 350 eggs.

CAUSE: The adult stage is a reddish brown moth that deposits its eggs in summer. When the eggs hatch the following spring, serious damage begins as the caterpillars' voracious feeding can defoliate the host tree.

The fully grown caterpillar is black with a white stripe down the back with several bright blue spots along each side.

Eastern tent caterpillars spinning their webbing on host tree.

SOLUTION: Damage on smaller trees can be reduced by removing the egg masses during winter. Remove larvae by clipping and destroying the tents when they are still small and inside the tent.

A commercially available bacterium, *Bacillus thuringiensis (B.t.)*, can be used to control the larvae. Natural predators include various ground beetles and parasitic wasps. Chemical applications may also be used.

Printed in U.S.A.

T15086/7-02

TECHNICAL BULLETIN DAVEY

Prepared by The Davey Institute

EMERALD ASH BORER

(Agrilus planipennis)

The emerald ash borer is an exotic Asian insect pest whose presence has been confirmed in Michigan, Ohio, Maryland and Ontario, Canada. Infested trees have been found in urban areas, woodlots and nursery stock. This borer has killed millions of trees, from small, young specimens to established, mature specimens.

Figure 1. Adult borers grow to 5/8" in length.

HOSTS: In the United States, the borer has been detected only on ash tree species, including black ash (*Fraxinus nigra*), blue ash (*F. quadrangulata*), green ash (*F. pennsylvanica*) and white ash (*F. americana*).

IDENTIFICATION AND LIFE CYCLE: The adult beetle is elongate, metallic green and 3/8 to 5/8 inches long (Figure 1). In Michigan and Ohio, adults emerge from early to mid-June until early August, feeding on a small amount of foliage (this causes jagged leaf edges). Females lay one to two eggs deep into bark crevices and lower main branches. After eggs hatch, the larvae tunnel through the bark and feed on the phloem and outer sapwood for several months. The mature larvae are cream colored and 1 to 1 1/4 inches long (Figure 2). Fully-grown larvae overwinter under the bark or sometimes in pupal cells made of outer sapwood. There is one generation per year.

Figure 2. Larva (Photo credit: Michigan State University).

SYMPTOMS AND SIGNS: Initial symptoms include yellowing and/or thinning of the foliage and longitudinal bark splitting (Figure 3). The entire canopy may die back, or symptoms may be restricted to certain branches. Declining trees may sprout epicormic shoots at the tree base or on branches. Removal of bark reveals tissue callusing and frass-filled, serpentine tunneling. The S-shaped larval feeding tunnels are about 1/4 inch in diameter. Tunneling may occur from upper branches to the trunk and root flare. Adults exit from the trunk and branches in a characteristic D-shaped exit hole about 1/8 inch in diameter. The intense tunneling disrupts water and nutrient flow, causing trees to lose between 30 and 50 percent of their canopies during the first year of infestation. Trees often die within two years following infestation.

Figure 3. Bark splitting.

MANAGEMENT: Removal and chipping or incineration of infested wood is recommended. Stumps should be ground out. Quarantines have been set up to prevent movement of untreated ash lumber, firewood or nursery stock from the affected areas. Those who are concerned about protecting valuable trees should contact a Davey arborist.

Fire Blight

Erwinia amylovora

Fire blight damage to Bradford Pear.

SYMPTOMS: Blights of blossoms, fruitlets, and leafy shoots are initial indications of fire blight. Individual flowers (or flower clusters) appear to be water-soaked and quickly droop, shrivel and turn brown or black. Lesions can move inward to the twigs. Subsequent formation of twig and branch cankers can cause dieback. Cankers caused by fire blight begin as small, slightly sunken, brown or black areas in twigs and branches. Affected plant tissue in pear is black, while brown in most other hosts. If many shoots are affected at the same time, the plant appears burned by fire, hence the name fire blight.

An important diagnostic feature is that the sapwood of newly infected shoots or twigs is discolored reddish-brown. Infected twigs often produce a "shepherd crook" effect (inverted "U") with discolored leaves remaining on trees. Damage to ornamental plants caused by fire blight ranges from mild disfiguration to death.

CAUSE: Fire blight commonly attacks plants in the rose family (Rosaceae) including: apple, firethorn, mountain ash, cherry, cotoneaster, hawthorn, pear and quince.

Bacteria may infect blossoms or twig growth, or may infect branches and the trunk of trees via wounds. During moist weather, a bacterial ooze from recently infected plant parts leads to the dispersal of the disease. Under drier conditions, strands of bacteria are produced and may also be dispersed in water. Other transmitters of this disease are insects, birds and humans.

Infection and spread of the disease is promoted by warm, humid weather. Cultural practices such as sprinkler irrigation, use of quick-release, high nitrogen fertilization and severe pruning also favor the spread of this disease.

SOLUTION: Careful pruning of all blighted twigs and branches can delay the spread of fire blight. It is important to make cuts at least eight inches below the infected area. This tactic is most successful when done during cool, dry periods. Pruning tools must be disinfected after each cut.

Resistant varieties of apples, crabapples, pears, firethorn and cotoneasters are available. There is sometimes a trade-off, however, in that plants resistant to fire blight are susceptible to other diseases such as scab.

Quick-release, high nitrogen fertilizers should be avoided, especially in the spring when new growth is most susceptible. A program of proper fertilization, irrigation, mulching and pruning will maintain the vitality of plants and support their natural abilities to survive this disease. Management of the disease is difficult, although applications of such products as Streptomgein Sulfate or Aliette, may reduce disease severity.

Printed in U.S.A.

T15210/7-02

TECHNICAL BULLETIN

Prepared by The Davey Institute

GIRDLING ROOTS

The presence of girdling roots is a common landscape occurrence for some tree species, particularly Norway maple. Other species which have a tendency to develop girdling roots are: maples, American beech, elms, oaks, poplars, pines and certain littleleaf linden cultivars.

SYMPTOMS: Indications of girdling roots include: reduced canopy growth, thin crown, leaf scorching, reduced leaf size, early fall coloration, and early defoliation on all or part of the crown. At ground level, the trunk may lack a root flare where it joins the buttress roots or appear strikingly flattened on one side, rather than as a normal cylinder (Figure 1). Girdling roots may be visible at the soil surface. If long established, they may be fused to the main trunk or other roots. A tree afflicted with girdling roots may also be more susceptible to disease, pests and other environmental stresses.

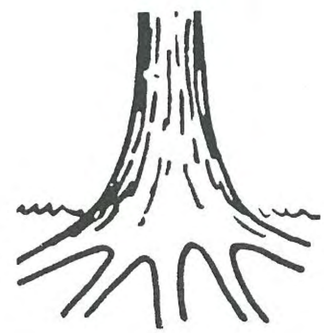


Figure 1. Normal tree trunk with flare or buttress at soil line.

CAUSE: Girdling roots are roots which grow around another root or trunk, putting pressure on the root or trunk, thus "choking" and compressing the water and nutrient conductive tissues (Figure 2). Girdling roots generally occur around or against larger roots and around or against the trunk, below, at or slightly above ground level. Because the nutrients flowing downward do not reach the roots, the root system will become stunted. This can result in decline and subsequent death and creates a hazardous situation if there are structures or pedestrians in striking range of the falling tree.

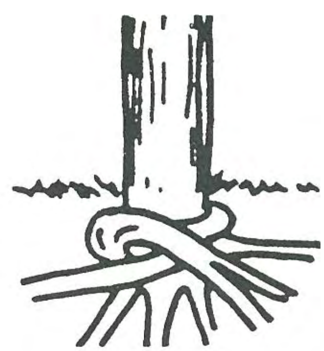


Figure 2. Girdling root. Trunk may grow straight up.

Girdling roots sometimes are initiated with container-grown (cans, pots) plants. Incorrect planting of bareroot stock can result in girdling roots or planting in soils where the difference between the soil of the root ball and the soil on-site are drastically different (Figure 3). It seems, however, that Norway maples will develop girdling roots regardless of cultural practices. Some experts believe that the most damaging girdling roots are those closest to the surface, in the first few inches of soil.

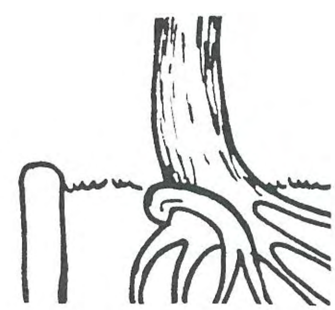


Figure 3. Girdling root caused by obstruction such as curb, sidewalk, wall or compacted soil.

SOLUTION: Recommendations vary with respect to the value and practicality of removing girdling roots. The girdling roots may be supplying a significant part of the tree with nutrients and water, and the removal of that root may further stress the tree. If the root is large enough that its removal may affect the structural stability of the tree or the root may be fused to the girdled root or stem, then nothing should be done. If a girdling root can be seen at the surface, it may be considered for removal but should not be more than ¼ of the diameter of the trunk. Removal of girdling roots on young Norway maples was actually found to result in increased girdling roots in later years, indicating that there are limits to what can be done with girdling roots of some tree species. It requires extreme caution in removing roots, as more damage than good can be done. Have a Davey expert examine the tree since there are surgery options that can be suggested. Some situations may require removal of a few roots over a period of several years so that new roots can be regenerated. Crown thinning may be required to reduce wind resistance to compensate for root removal. Deep root fertilizing with a slow release nitrogen source is also recommended.

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

HAZARDOUS TREES

Tree Risk

No tree is absolutely safe. At times, even healthy trees fail. However, a tree is classified as high risk or potentially hazardous if any of these is true:

- It has a large defective part.
- The likelihood of that part failing is high.
- There is a target in proximity.

A target may be persons, pets or property (automobiles, homes, utility lines or other structures).

Tree Defects

Defective parts include roots, trunks or larger branches (see Figure 1 on the reverse side).

- Defective roots may be the result of construction nearby that has severed the large roots or may be caused by internal decay due to rot fungi. Root rot can result in tree failure, even though little evidence is seen in the above-ground parts of the tree.
- Defective trunks may be due to large internal or external cavities, cracks or seams in the wood, v-shaped or narrow branch crotches, or internal decay due to rot fungi.
- Defective branches may be due to broken or dead branches, large internal or external cavities, insect and disease activity, narrow or v-shaped crotches, or internal decay due to rot fungi.

Risk of tree failure increases when defects are left untreated or if two or more defects occur together, as when v-shaped branch crotches also contain decay. Trees that have been topped and those damaged during home construction are highly prone to decline and become hazardous in time.

Other symptoms of tree weakness are:

- Leaning of the tree, along with buckling and heaving up of the soil at the base of the tree on the side opposite the direction of the lean. This condition is caused by severed or decayed anchoring roots.
- An unbalanced or weak canopy with numerous staghorns (dead branches).
- Animals (birds, bats, bees) nesting in cavities within decayed trunks or branches.

Other Factors

The examples listed in the sketch (Figure 1) are not exhaustive. The species of the tree in question, soil conditions, exposure of the tree to wind, overall tree health and other factors need careful evaluation, along with the tree's defects, to determine how hazardous a tree is.

Evaluation and Care

Not all trees with defects need to be immediately removed. Some defects can be treated to prolong the life of the tree. In addition, not all hazards are visible or obvious. Advanced hazard tree analysis, either through the use of a tool such as the resistograph or through root crown excavation, may be necessary. Once a tree 4 has been documented as a hazardous tree, the owner of the tree may be responsible for any damage done by the tree. A certified Davey arborist should be consulted to evaluate the tree and determine the proper course of care and action.

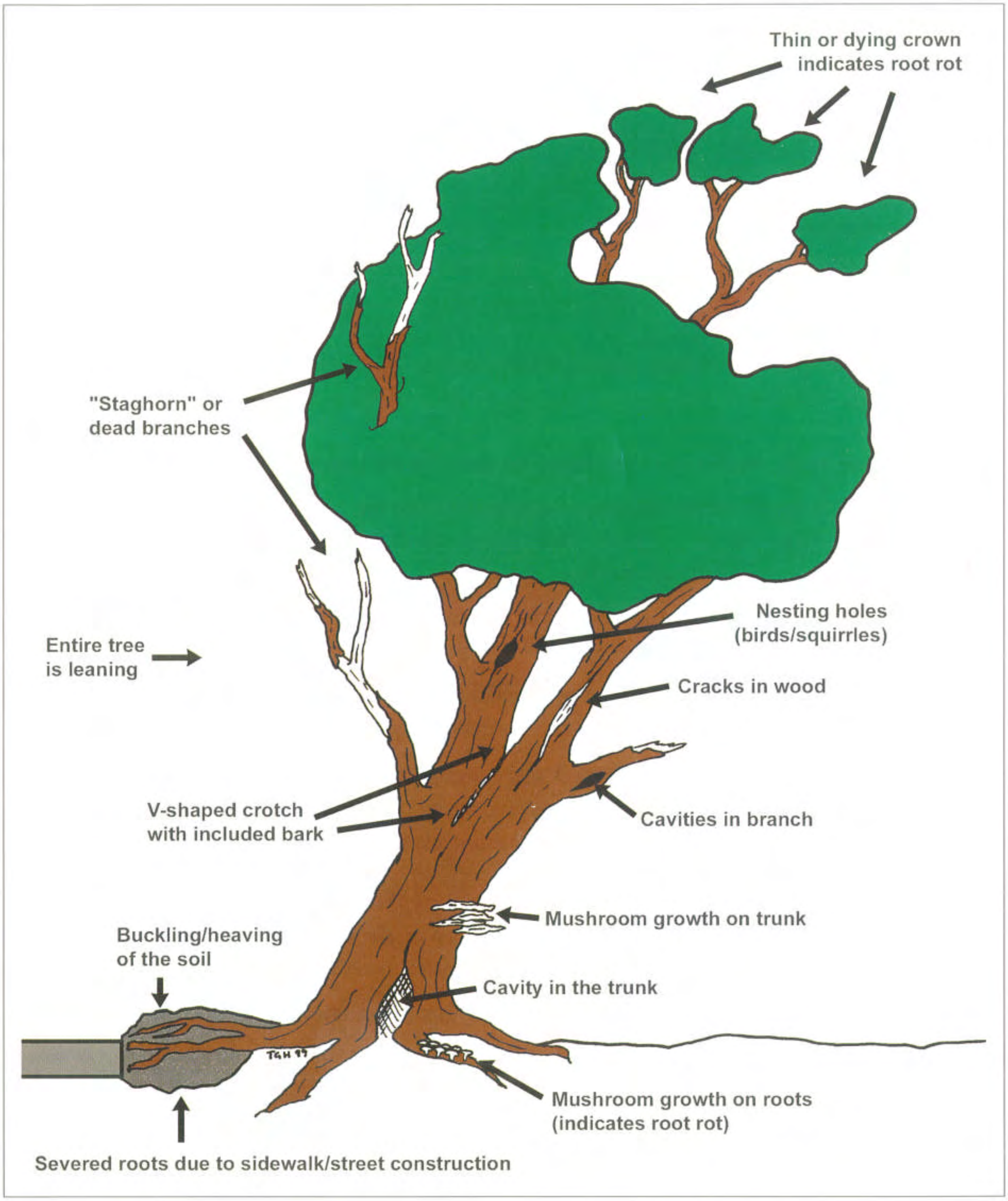


Figure 1. Any of these defective parts of a tree can make it hazardous.

Prepared by The Davey Institute

HELP FOR DROUGHT-DAMAGED TREES

Dry soil conditions can significantly reduce the life span of valuable landscape trees. Because trees are both difficult and expensive to replace, they need attention both during and after a period of drought.

SYMPTOMS: Noticeable symptoms of drought stress include wilted foliage, a sparse canopy of off-color and undersized leaves, leaf scorch, yellowing, leaf drop, and premature fall coloration. Closer inspection will reveal limited twig growth and small, poorly formed buds. Growth the next season will be stunted even if there is sufficient rainfall later in the year.

Surface-rooted trees, such as maples and dogwoods, and newly transplanted trees are especially susceptible to damage resulting from dry soil conditions. However, even large established trees may show the effects of drought. Elm, maple, sycamore, ash, tuliptree and beech are often affected in forests as well as in urban landscapes. Other species may be injured if a drought is severe.

Figure 1. Symptoms of drought stress include wilting and yellowing of foliage. Tree in right foreground was not fertilized. Tree in left background was fed with Davey Arbor Green®.

Perhaps more life-threatening than anything to trees weakened by drought is invasion by borers and other secondary pests. Studies of trees' annual rings have shown that the growth of trees can be reduced for several years following a drought. During this recuperation period, trees are more susceptible to attack by various insects and disease-causing organisms. For example, elms subjected to drought are more likely to succumb to Dutch elm disease, sweetgums are more vulnerable to bleeding canker, and white-barked birches are extremely susceptible to bronze birch borer.

SOLUTION: The practices that have been saving drought-stressed trees for years are still valid today: watering whenever the soil is dry, fertilizing to enlarge root systems, mulching to conserve moisture, using pest management to control insects and diseases, and pruning to remove dead and dying branches.

- ***Water, Water, Water!*** Since most of a tree's active roots are within the top 12 inches of soil, a watering lance attached to a hose is the most efficient way of getting water directly to the roots while reducing evaporation and runoff. Apply 1 to 3 gallons of water using 3-foot spacings with the lance. If this is impractical, simply place a lawn sprinkler beneath the tree and let it run slowly until 2 inches of water has collected in a coffee can. Be sure to water the entire root zone beneath the tree canopy.

- ***Fertilize*** – Fertilizer will help reduce the severity of drought injury and enable trees to recover more quickly. Fertilizer enhances root development, and the expanded root system supplies more water to the tree. In addition, fertilizer helps promote the production of carbohydrates, which supply the energy necessary for growth and development.

  Because of the concentration of salts found in most fertilizers, drought-stressed trees are particularly sensitive to overfertilization. Davey Arbor Green® is specially formulated to avoid injury to trees weakened by drought. This unique deep-root fertilizer releases nutrients slowly to provide a continuous, uniform supply.

  Arbor Green is injected with a high pressure watering lance to a depth of 6 to 12 inches. This technique not only distributes the nutrients for more efficient absorption by roots but also improves the porosity of soil. Dry soils, particularly those subjected to high temperatures, often become compacted and resist both water and oxygen penetration, thereby restricting root growth and function. See Figure 1 for the difference fertilizer makes.
- ***Mulch*** – Mulching the soil surface around the root system will help reduce water loss and keep the soil cool. Use wood chips, bark shavings or other suitable material. Add the mulch to a depth of about 3 inches. Be careful not to mound mulch against the base of the trunk.
- ***Use Pest Management*** – Insect infestations and disease should be controlled to prevent further weakening or death of declining trees. Drought-weakened trees are particularly susceptible to wood-boring insects that can tunnel through the nutrient-conducting tissues and cause rapid death of the tree or shrub. Proper identification of a pest and its life cycle is necessary for effective control.
- ***Prune*** – Remove dead and dying branches that attract bark beetles and other wood-boring insects and that are susceptible to destructive fungal disease. Pruning will also enable tree roots to sustain the rest of the tree more efficiently.

Printed in the U.S.A. T15053-0300

TECHNICAL BULLETIN

Prepared by The Davey Institute

HOW TO MINIMIZE STORM DAMAGE TO TREES

Storm damage due to poor branch structure.

Top heavy – entire root system failure.

Storm damage to trees can be caused by heavy, wet snow, freezing rain, lightning, or high winds. All of these put tremendous mechanical stresses on the leaves, branches, trunks, and root systems of trees on your property.

Proper tree maintenance can reduce the potential hazards that storms can cause to your safety, your property, and your trees. Proper pruning, cabling and bracing, a lightning protection system, proper tree selection, and cavity filling are all methods used by arborists to improve the chances of your trees to survive these storms.

PROPER PRUNING: Thinning the tree canopy allows wind to blow through the crown, instead of against it as though it were a sail. Properly pruned trees offer less resistance to high winds and are less likely to suffer breakage or to blow down. The removal of potentially hazardous dead or weak branches is an important safety practice.

CABLING AND BRACING: Strong metal cables and rods are used to relieve the strain that causes structurally weak trees to split and break in high winds, ice, and snow. Whether used in prevention or repair of structural damage to trees, cabling and bracing provides a support system to reduce the potential for fork splitting and branch breakage. Cabling and bracing your trees, along with thinning the crown, will reduce the chances of costly damage.

LIGHTNING PROTECTION: Lightning strikes trees because they provide better conduction of the electrical charge than the surrounding air. Lightning can severely blow apart a tree or it may only produce a spiraling dead area on the trunk. The installation of a lightning protection system in your valuable trees will prevent this destruction by harmlessly conducting the electrical charge to the ground and bypassing the tree itself.

TREE SELECTION: Certain tree species characteristically have weak wood and should not be considered for landscape situations. Although every tree has its place, quality landscapes should generally avoid weak-wooded trees such as silver maple, Siberian elm, willow, catalpa and poplar.

CAVITY FILLING: An open cavity in a tree's trunk is a weak point in its structural support system. Think of such a tree as a tube with a hole in its wall. This kind of tube can't support as much weight as an intact tube.

A cavity filling does not actually provide structural support, but rather a flat surface for callus tissue to grow over. Eventually, the continuity of the tree trunk is re-established and the trunk is better able to support the weight of its canopy. Fertilization with Davey's Arbor Green® helps promote the callusing process. A tree with strong, healthy wood is more likely to survive a destructive storm.

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

IRON CHLOROSIS

SYMPTOMS: Leaves of susceptible trees and shrubs turn yellow (chlorotic) in the interveinal areas, but the leaf tissue along the veins remains green. In severe cases, the leaves will turn brown along the margins, leaves will be undersized, branches will die, and then the entire tree may fail.

CAUSE: Chlorosis is the yellowing of leaves due to a lack of chlorophyll, the green pigment in leaves that produces carbohydrates from carbon dioxide and light. The loss of chlorophyll reduces the nutrient-producing efficiency of the leaves. This leads to reduced vigor, stunting and death of susceptible trees and shrubs.

Iron deficiency chlorosis occurs in alkaline soils (those with a pH above 7.0), which makes the iron unavailable for root absorption. Iron is necessary for the formation of chlorophyll, and without it the leaves turn yellow. Iron chlorosis commonly occurs in species that are adapted to growing in more acidic soil, such as pin oak, white oak, red oak, willow oak, sweetgum, river birch, magnolia, pine, holly, rhododendron, camellia and azalea.

A pin oak leaf showing the typical symptoms of iron deficiency chlorosis.

Poor drainage, soil compaction and construction damage can aggravate the symptoms of iron deficiency chlorosis or mimic its symptoms, particularly in older trees.

SOLUTION: Soil incorporation of iron and/or acidifying compounds may be helpful for mildly chlorotic trees and shrubs. Soil treatments are slow in producing results and may take years of treatment before the plant will respond.

Trunk injection is another approach that can provide a rapid response, even with severely chlorotic trees that may otherwise die because of a lack of response to soil treatments. Injection of a liquid iron solution directly into the lower trunk will generally provide better leaf color the same season, although tree canopy response may not be uniform because of tree decline or irregular uptake. Blackening of foliage and leaf drop may occasionally occur. However, new leaves will be a normal dark green. Trees should not be injected annually.

Iron deficiency chlorosis treatments will not give permanent results and should be repeated periodically to maintain healthy trees and shrubs. In the Midwest and North, response to the treatment may be improved if the plants are also fertilized.

Printed in the U.S.A.

T55-5/2000 7

Prepared By The Davey Institute

Lawn Herbicide Damage to Ornamentals

SYMPTOMS: Herbicide damage is usually noted in leaf tissue. Some plants, such as redbud, lilac, magnolia or petunias are especially sensitive to certain herbicides.

Herbicide exposure in the spring. Developing leaves and shoots of the plant will appear twisted, distorted, or cupped downward. The leaves usually remain green and attached to the plant, but may not fully develop. They are often narrow and thickened with veins that are close together (almost parallel rather than spreading out through the leaf blade). Blistering and dark green as well as yellowish areas may be noticed.

Herbicide exposure in the summer. Plants exposed to damaging herbicide quantities after leaf expansion will not show the same symptoms associated with leaf development. Twisting of the stalk that connects the leaf to the stem (petioles) may be the only symptom. However, leaf damage may appear the following spring if the herbicide material is long-lasting, such as dicamba.

On needle-bearing plants (conifers), symptoms of herbicide damage are also noticed in the new growth. Shoots become twisted and if the damage is severe, needles (young and old) may fall off the shoots. Dicamba may also cause new growth to turn brown and die.

Other Plant Disorders That Look Like Herbicide Damage:

Frost. Frost injury on needled plants (especially Taxus and spruce) can cause new growth to turn brown and die. On deciduous plants, cold can damage leaves as they are beginning to develop. Side effects are not noticed until the leaf enlarges and appears distorted and twisted or crumpled. This will not be noticed on younger leaves that developed after bud break and frost.

Viruses. Many viruses cause leaf distortion in plants. Virus symptoms are rare in woody ornamentals, but are often seen in herbaceous flowers as streaking and mottling of foliage and flowers.

Insect and Disease. Aphids and other sucking insects feed on the underside of leaves causing the leaf tissue to distort and become discolored. Both high and low temperatures can cause similar injury by killing newly expanding cells in leaves. Diseases which attack the leaves may also distort and discolor the new growth by injuring tissue during leaf expansion.

(over)

Nutrient deficiencies, air pollution, and excess salts should be taken into consideration in order to properly diagnose a plant problem.

CAUSES: Herbicides applied for control of broadleaf weeds in a lawn are similar to naturally occurring plant hormones that regulate growth. When applied at recommended rates, these growth regulators have a herbicidal effect by overstimulating young, rapidly expanding plant tissue, causing the weed to use up its food reserves and literally "grow itself to death." This rapid growth is responsible for the twisting and cupping characteristics of treated leaves. When carelessly or improperly applied, broadleaf herbicides also cause distortions in the new growth of sensitive ornamental plants although the effect is usually temporary.

SOLUTION: If herbicide damage is confirmed, the degree of injury should be assessed before damaged plants are treated. Most woody ornamentals resist the movement of broadleaf herbicides within the plant tissues and chemicals are normally broken down for the following season. Even severely affected plants may recover if care is taken to prevent further herbicide exposure. In general, most plants recover in time and replacement is unnecessary.

Activated charcoal will absorb certain herbicides and prevent further uptake from the soil. Pruning to remove the distorted plant tissue followed by judicious fertilization to promote new growth may help the plant recover more quickly. Other standard cultural practices such as supplemental watering and insect disease management will help maintain plant vigor and minimize the severity of herbicide damage.

Prepared By The Davey Institute

Lightning Protection for Trees

It takes years and years to grow a large, magnificent tree. It takes only seconds for lightning to strike one down.

DAMAGE: More than half of the trees that are struck by lightning eventually die. For an unprotected tree, minimal damage may be evident of the trunk (cracking, peeling bark, etc.) while the roots have suffered considerable damage. Such a tree will probably soon wilt after being struck. For other trees, lightning may break off branches, trunks may split down the middle, or the entire tree may explode or burn. Even if lightning does not physically kill a tree, it is much more vulnerable to destruction by boring insects and decay fungi.

A damaged strip of bark resulting from a lightning strike. A tree lightning protection system would have prevented this from occurring.

CAUSE: Trees are attractive lightning targets because they provide a better conducting path than air for lightning to travel from the storm cloud to the earth. The tallest trees in a grove, trees in open areas, trees on the edge of a grove facing an approaching storm, trees on hilltops, and trees located close to buildings where wiring or plumbing might enhance ground conductivity are likely points of discharge for lightning bolts. Contrary to popular belief, lightning will often strike the same place more than once.

The tree species most often struck are: oak, elm, pine, tulip tree, cottonwood, ash, maple, sycamore, hemlock, and spruce.

SOLUTION: Although a tree lightning protection system does not prevent a tree from being struck by lightning, it is possible to equip a tree so that lightning will be conducted harmlessly into the soil. A system of heavy, copper cables is installed from the highest point in the tree and from the ends of the major branches, down the trunk, and into the soil beyond the tree's main root area.

(over)

Copper is a better conductor, making it more attractive to lightning than wood. If lightning were to strike the protected tree, it would actually strike only the copper and travel down the conductor cable into the ground where its energy would be safely dissipate, thus saving the tree from being damaged or destroyed.

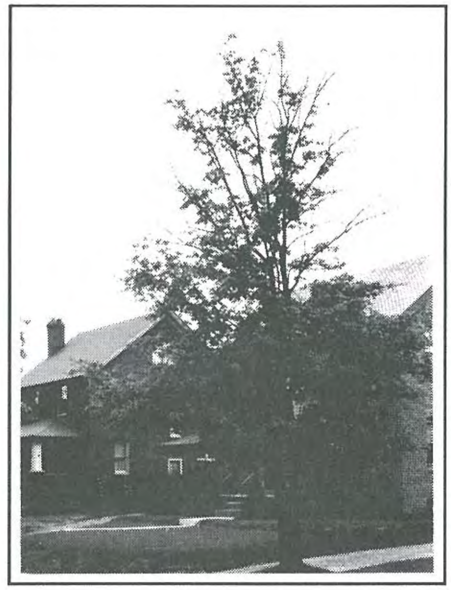
An added benefit of a tree lightning protection system is called the cone of protection. This refers to an area beneath and around a tree that is protected from lightning strikes. Lightning that would normally strike anywhere within this area will be attracted instead to the copper protection system of the tree. The cone of protection reduces the chance of injury or damage for people, buildings, or animals within the cone.

Prepared By The Davey Institute

Maple Decline

Maple decline affects primarily sugar maple, Norway maple, and red maple in the Northeast and Midwest. The problem is not a new one; stagheaded maples were described as early as 1917 in Massachusetts. At that time, dieback was attributed mainly to drought and poor conditions for tree growth afforded by the urban environment. These same conditions exist today, and reports of the incidence and severity of maple decline have increased markedly in recent years.

In urban sites, principle stress factors in maple decline include drought, de-icing salts, and/or road and sidewalk construction. These stresses also facilitate invasion by secondary organisms, including root rots, decays and twig blights, which greatly reduce chances of recovery from the original stress(es). When a healthy tree is stressed repeatedly, the stress alters the tree's internal chemistry to allow repeated attack by secondary organisms, and the tree declines and ultimately dies.



Maple decline affects upper portion of tree.

SYMPTOMS:

- **Reduced twig growth.** A general rule of thumb is that if the annual increase in twig length averages less than 5 cm., the tree may be in trouble.
- **Reduced foliage growth.** Sparse, light-green or scorched foliage signals that the tree may be declining.
- **Early fall coloration.** Maples normally begin showing fall color after the first frost or in mid to late September. When fall color develops earlier than normal, in late July or early August, the maple is definitely suffering from decline.
- **Dead branches in upper canopy.** Small dead branches seen in tree tops in late spring or early summer are indicative of decline. Over time, larger, more visible branches and limbs will die. The more numerous the dead twigs or branches are, the more severe the die-back decline conditions.
- **Poor root conditions.** If roots can be examined, look for reduced occurrence of small feeder rootlets; dead, brittle roots; and decaying buttress roots.

SOLUTIONS: The success of treatment to declining maples depends primarily on early detection of maple decline, the health of the tree prior to treatment, and its ability to respond to treatment.

(over)

Treatment for declining urban maples includes: watering, fertilizing, pruning dead branches, and reducing salt-laden spring water runoff over the roots.

Watering trees every week or two during dry weather is recommended. Trees should be watered slowly to soak the entire soil area under the tree canopy to a depth of 12 or more inches.

Fertilizing is best done with a slow-release fertilizer to minimize soil salts and safeguard the sensitive absorbing roots. Davey recommends Arbor Green injected into the root area to a depth of 12 inches. Proper fertilization will help stimulate new roots and improve the health and vigor of trees.

Dead branches should be pruned as well, to stimulate renewed vigorous shoot growth. Pruning, in addition to fertilization, helps revitalize declining trees and helps the tree ward off secondary organisms.

Road salt impact can be reduced by placing a barrier (curb, berm, ditch, etc.) to catch or divert the spring runoff water which often contains copious amounts of salt. If soil and foliar analyses have been run and high sodium or chloride concentrations were found, then leaching the soil with fresh water or applying gypsum to improve soil structure may be useful.

Printed in U.S.A. T69-92-2M

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

MULCH INSTALLATION AND RENOVATION

Mulch, as a protective and ornamental feature among herbaceous and woody plants, has gained wide popularity in contemporary landscapes.

BENEFITS: Mulches promote root growth and plant survival in a number of ways.

- Mulch materials allow for the exchange of gases between the atmosphere and soil (oxygen into soil, carbon dioxide out).
- Mulches help provide for better water penetration into soil.
- Mulches reduce evaporation of soil water, conserving soil moisture for optimal root development.

The insulating effect of mulch is an important feature because it moderates extremes of soil temperature. Mulched soil does not get as cold in the winter or as hot in the summer as unmulched soil. This is important because the root systems of most plants are not effective in taking up water and elements at unusually low or high temperatures. Also, mulches cause soil temperatures to lag behind air temperatures. Thus, soil cools slowly in fall (allowing a longer period of high root activity) and warms slowly in spring.

Mulches are also useful in suppressing weeds that compete with desirable plants for moisture and nutrients. However, they will not totally eliminate weeds. Maximum weed control can be achieved with the use of pre-emergent herbicides and/or landscape fabric (not sheet plastic) before applying mulch.

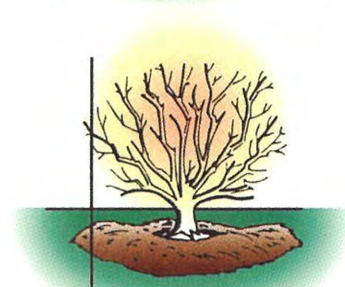
Mulch makes a layer of well-aerated soil near the surface available for long periods of almost continuous root activity. This layer is normally unavailable because of reoccurring periods of extreme dryness and fluctuating temperatures.

EVALUATION & PROCEDURE: Two common mistakes in mulch distribution are applying material too thickly or deeply and mounding up mulch on plant stems. Effects of too much mulch in planting areas include excessive moisture, reduced oxygen and fungal growth. Decay fungi are also promoted when mulch is piled on stems. Just outside of the stem, mulch dressing should be no more than ½ inch deep.

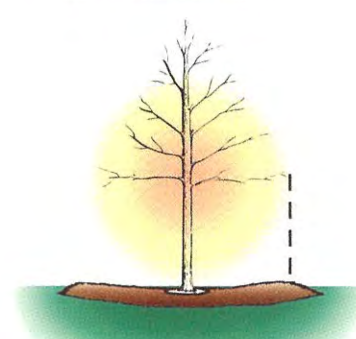
Most mulches need only be applied and maintained at 2- to 4-inch depths at the plants' dripline, ranging from 2 inches on heavy clay

This shrub has outgrown its original mulch bed, and the mulch is piled up around the stem. Mulch should be no more than ½ inch deep just outside the stem.

Clear excess mulch from the stem area.



This shows the drip line.



Extend mulch to the drip line.

(over)

soils to 4 inches on sandy soils. One to 2 inches of mulch in maintained beds can be added every two to three years as original mulch decomposes.

As woody plants develop over subsequent growing seasons, mulch under the crowns can be annually raked out to the expanding drip lines. Use of this mulch management technique achieves several objectives. Mulch is brought out from under plants, stirred, fluffed, exposed to air and light, and arranged to continue to provide soil protection. At this time, the mulch can be evaluated for any redressing needs or removal. Waterlogged or compressed mulch material can be stirred, turned over, or broken up, if necessary, to improve aeration and water diffusion capability.

Printed in the U.S.A.

T15089-09/03

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

PEST MANAGEMENT REDUCES STRESS

The complexities of survival in today's world create stressful situations not only for humans, but also for members of the plant world – your trees and shrubs.

Figure 1. *White malady is another name for pine needle scale.*

Figure 2. *Japanese beetles defoliate plants in hungry hoards.*

What causes stress?

Among the many stress factors which may affect your trees are air pollution, drought, mechanical injury, adverse soil conditions and winter injury. Two other major causes of stress are insects and diseases, which destroy or impair the function of leaves. Leaves are the important energy manufacturing system in trees.

Figure 3. *Borers are a serious threat as they sever vascular tissues, a plant's main nutrient pipeline.*

A variety of insect pests feed on trees. These include leafminers, scales (Figure 1), mites, weevils, leaf-chewing caterpillars and beetles (Figure 2), bark beetles and borers. Bark beetles and borers (Figure 3) are especially attracted to "stressed" trees. Research shows that trees defoliated two years in a row may be killed or thrown into an irreversible decline.

Leaf diseases such as apple scab (Figure 4), rust and anthracnose of ash, maple, oak and sycamore can weaken trees and subject them to attack by other insects or fungus. Many cankers and root rots can only become established upon stressed plant material. This stress often starts at planting and is due to selecting poorly drained planting sites, improper soil texture or pH.

Figure 4. *Apple scab is a fungal disease that can defoliate crab apple trees.*

What can be done to alleviate tree & shrub stress?

Spraying or soil injection treatments are effective techniques to reduce insect populations in trees and minimize plant damage. A preventive maintenance, "inspect and treat program" provides the best protection. Winter "dormant" oil applications suppress many scale insects, mites and eggs that overwinter on trees. These should be followed by three to four “inspect and treat” visits scheduled during the spring and summer or as needed. Applications may not be necessary every visit, but evaluation by a horticultural expert is necessary to ascertain the best option to avoid pest damage.

In conjunction with pest management, proper fertilization, mulching and watering also can help alleviate stress. By pre-scheduling your landscape plants’ inspect and treat visits, you can help maximize the beauty and health of your valuable trees and shrubs.

Printed in the U.S.A.

T15218-698

TECHNICAL BULLETIN DAVEY

Prepared By The Davey Institute

Davey Tree Plant Health Care for Your Landscape

Davey Tree Plant Health Care service provides a versatile approach that develops vigorous landscape plants through the use of property checkups, pest management, nutrition and cultural practices. This strategy strengthens the natural ability of trees, shrubs, and turfgrasses to resist certain insect and disease pests. This minimizes the need for pesticides.

Tradition...

Plant Health Care uses modern technology based on over 75 years of field experience and research. In 1987, Davey Tree implemented its Plant Health Care (PHC) service by recognizing and treating plant problems with technically supported pest control timing and with the least environmentally intrusive methods. PHC is currently promoted by many universities and the International Society of Arboriculture (ISA).

Unique Davey Technology...

Through extensive in-house research, we are continually creating new services as well as developing equipment, systems and materials that allow us to better service our customers. Davey Arbor Green®, our exclusive fertilizer, and our deep-root injection technique supplies nutrients that trees require for vigorous and healthy growth. This helps to strengthen the inherent (natural ability) of plants to tolerate and resist certain insect and disease pests better, as well as survive unfriendly environmental extremes.

Regular Checkups and Care...

Plants, as with people, should have regular checkups to ensure good health. This is where Plant Health Care really begins, with the checkup. The first step is the inspection of the lawn and/or all trees and shrubs. Thorough inspections pinpoint potential health problems so the technician can determine what action needs to be taken. Preventive health care measures will also be recommended at this time. These may include fertilization, pruning, cabling/bracing and lightning protection for trees and shrubs, as well as cultural practices such as fertilization, aerification, lime application, proper mowing and watering for lawns.

Prevention and Pest Management...

Because Plant Health Care emphasizes the benefits of cultural practices to plants, care through preventive measures and proper maintenance, pesticide use can be reduced. In addition to selective applications of pesticides, alternative materials such as horticultural oils or soap may be used. Davey Tree uses eco-smart products. That is, they have minimal residual and impact in the environment, such as B.t. *(Bacillus thuringiensis)*, a bacterium derived formulation that controls only caterpillars. In-house research at the Davey Institute gives us not only the best 'window-of-control' or the most vulnerable time in a pest's live cycle for maximum results, but also the most effective, eco-smart products to use.

Plant Health Care...care for Landscape Plants, the Environment and for our Customers

Printed in the U.S.A.

L1500-97-2M

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

POST-PLANTING CARE OF WOODY PLANTS

SYMPTOMS: Transplanted trees and shrubs frequently undergo a prolonged period (2 to 5 years) of slow growth and reduced vigor due to transplant shock.

CAUSE: Problems with transplant shock following successful tree or shrub planting are usually due to improper post-planting care.

SOLUTIONS: Proper site selection and good planting techniques help induce root growth into surrounding soil so that the original balance between roots and above-ground shoots is restored as quickly as possible, minimizing the severity and duration of transplant shock.

If the plant has been suitably matched to the environment in which it is placed and has been correctly planted, post-planting care to minimize transplant shock should include proper watering, mulching, staking, pruning and fertilizing.

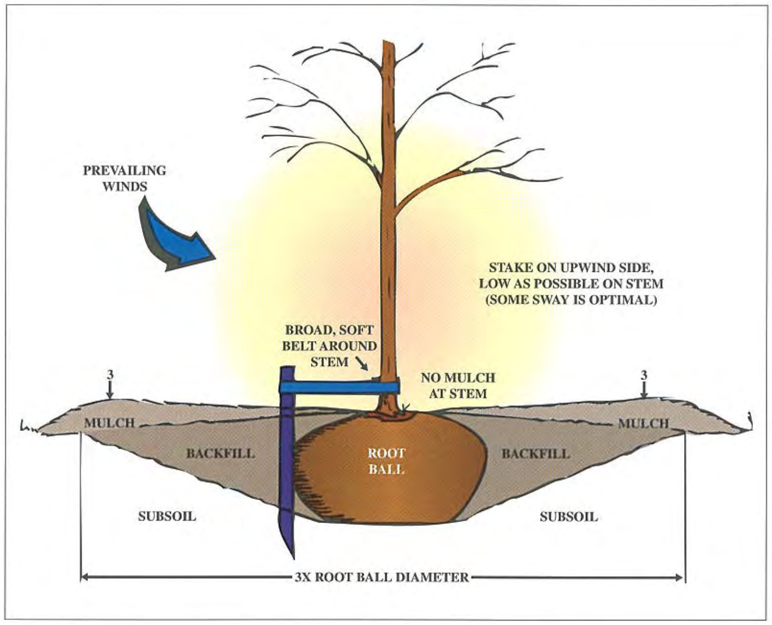


Figure 1. Some elements of good planting and post-planting care are illustrated.

Proper irrigation (**watering**) is crucial to balance water and oxygen supply to new roots. The most common problem with young trees and shrubs is either too little or too much water in the soil. Most woody plants do best with deep, but infrequent, watering. Soils should ideally contain 25% water and 25% air space.

Newly transplanted trees should be **mulched**. Good mulch beds replicate organic forest-litter "sponges" that buffer water, air and temperature extremes in nature. The ideal mulch pattern tapers from a two- to four-inch depth of well-composted organic matter at the dripline of trees and shrubs to bare soil at the trunk. Sandy soils need deeper mulch layers over the new root zone than clay soils.

Trees that are **staked** when installed in spring for protection from prevailing winds generally can have staking and banding material removed in fall; fall-planted trees can be freed late the following spring. Tree wrap should generally be removed at planting time; however, some fall-planted trees with thin, smooth bark may overwinter with wrap, as long as it is removed before leaf growth in the spring.

All injured, malformed, crossing and poorly attached branches should be **pruned** at the time of planting. Pruning to branch growth can be initiated after one full growing season has passed, but winter-killed and dead wood should be removed promptly. Avoid the practice of "balancing" above-ground shoot growth with the root system upon installation. Root systems require as many branch tips left intact to trigger other growth.

If the transplant was not fertilized at planting time, **fertilize** with a low-burn/low-salt-index material that will provide slow-release nitrogen. The nitrogen benefits shoot and root growth within the first growing season following application. Davey's Arbor Green® fertilizer is a superior source of controlled-release nutrients.

Printed in the U.S.A.

T15091-4/2001

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

POWDERY MILDEW OF WOODY ORNAMENTALS

Caused by several fungi, such as Microsphaera, Erysiphe and Sphaerotheca

Figure 1. White fungal growth of powdery mildew on lilac foliage.

Figure 2. Powdery mildew disease distorts dogwood leaves.

CAUSE: This disease is caused by several species of fungi. As the fungi grow on the upper leaf surfaces, they produce mats of white mycelium and powdery spores *(Figure 1)*, which give the disease its descriptive name. These pathogens are somewhat host-specific, so the powdery mildew on a sycamore tree will not be a threat to the bluegrass of the adjoining lawn. Powdery mildew is most severe in late spring and early fall or when the days are warm, the nights are cool, and the rainfall is light. Spore germination and infection development occur most rapidly on dry plant surfaces at mild temperatures and at a relative humidity of at least 95 percent. The heaviest coatings of powdery mildew occur in humid, shaded areas. Powdery mildew has become more of a problem on dogwoods *(Figure 2)* during the last four years or so.

Hosts are many. Commonly afflicted plants include azalea (Kurume types), crabapple, crapemyrtle, euonymus japonica, lilac, rose, sycamore, etc.

Figure 3. Crapemyrtle flower head, in center, is blighted by powdery mildew disease.

SYMPTOMS: Usually, powdery mildew is brushed off as being a late-season event that only attacks senescent leaves, and essentially, no big deal! However, powdery mildew attacks dogwoods and crapemyrtles earlier in the season. Also, powdery mildew invades the upper parenchyma layer of younger leaves and, to a lesser degree, mature leaves. The "sign" – mycelial fungal growth – shows first, which serves as a little white flag to get the fungicides before the symptoms show. Leaves then become distorted and exhibit marginal scorch, dead patches, reddish discoloration, yellowing and premature defoliation. When the fungus attacks flower buds of plants such as crapemyrtle *(Figure 3)*, flower set is reduced. Other plants, such as lilacs *(Figure 1)* and dogwoods, may fail to produce enough carbohydrates to yield flower buds due to the early leaf drop and because photosynthesis is limited.

SOLUTION: Fungicides are not usually recommended for trees. However, flowering shrubs such as crapemyrtles, lilacs and dogwoods that may lose flower production due to powdery mildew infection will benefit. Two to three applications will minimize the impact of this disease. Banner®, Bayleton or Cleary's 3336® are the products that do the best job. For dogwoods and lilacs, start applications about mid-June or when you first see the little white patches. For crapemyrtles, make applications as early as bud break, especially as flower buds appear.

Printed in the U.S.A.

T15212-12/2000

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

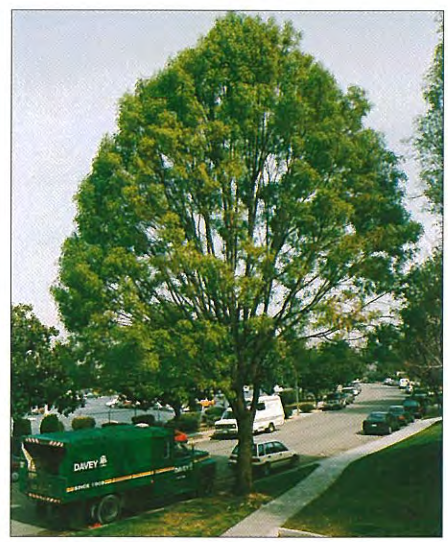
PROPER PRUNING OF TREES

Proper pruning improves the health and appearance of trees and prolongs their useful life by removing undesirable branches which are dead, weakened, interfering, diseased or insect-infested.

Before pruning

TYPES OF PRUNING: The Davey Tree Expert Company recognizes four general classes of pruning which define the type and degree of recommended pruning.

- Aesthetic or Fine Pruning is the thorough removal of undesirable branches over ½ inch in diameter. This includes selective thinning to lessen wind resistance (see photos).
- Maintenance or Standard Pruning is the removal of undesirable branches over 1 inch in diameter.
- Hazard Reduction Pruning is the removal of undesirable branches over 2 inch in diameter. This class is recommended where safety considerations are paramount.
- Crown Reduction Pruning, also called natural or drop crotch pruning, is the proper reduction in the height or spread of the tree canopy.
- Crown Raising is the removal of lower branches in order to provide clearance.



After fine pruning

TOPPING vs. THINNING: Proper pruning is not to be confused with the disfiguring practice of "topping." Topping (heading, stubbing, hat-rocking, etc.) is the indiscriminate removal of a tree's main leader and branches resulting in stubs. The cut surfaces of the stubs do not close readily, and accelerated internal decay develops. The resulting flush of multiple epicormic branches (watersprouts) from the stubbed branches form terminals that are very weak. Topping leaves a tree highly susceptible to damage from strong winds, sunscald, winter injury, insects and diseases.

Thinning is the correct method for removal of branches to their point of attachment to the trunk or another branch sufficient in size. This method eliminates unhealthy and unsightly stubs, resulting in an open, airy, natural appearance to trees. Thinning requires more skill and time to perform than does topping. Trees that are properly pruned and thinned will live longer and should not need to be pruned as often as trees that have been topped.

WHEN TO PRUNE: Maintenance pruning of most shade trees can be done anytime. Severe pruning, however, should be done in late winter or early spring before new growth begins. Pruning trees like birch and maple, which seep profusely from cut surfaces in the spring, is sometimes delayed until the fall, although the loss of sap is seldom injurious. Pruning of trees susceptible to certain vascular diseases, like American elm and certain oaks, should be avoided during the activity period of beetles that spread the diseases.

Printed in the U.S.A.

T15061-4/2001

TECHNICAL BULLETIN

DAVEY

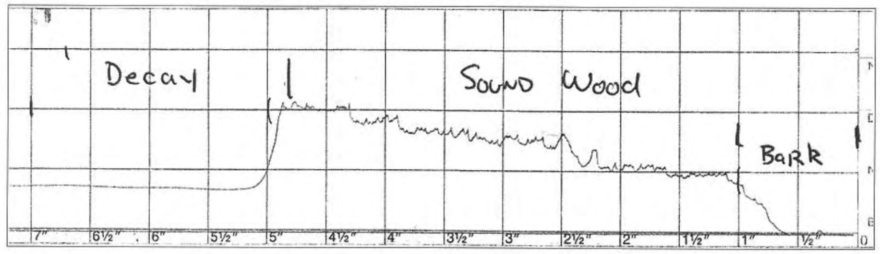
Prepared by The Davey Institute

ADVANCED DECAY DETECTION USING THE RESISTOGRAPH

WHY TEST FOR DECAY?

Wood decay in shade and ornamental trees is the most common disease in the urban forest. Decay and other tree defects can result in failure of branches, large stems or the entire tree. Importantly, not all trees with decay require treatment. The presence of decay does not necessarily mean that the tree is hazardous or requires treatment. More important than the presence of decay is the location and amount of decay.

In many cases, visual assessment of decay, simply sounding with a hammer, or probing with a sharp tool can provide adequate information to judge the amount of decay in a tree. However, because decay is often hidden internally by the bark, more advanced tools may be needed to make better judgments on how much decay is present.



Labeled Resistograph chart.

SYMPTOMS OF DECAY: There are many symptoms or indicators of decay in trees. A few examples include cavities; decayed branch stubs; loose or missing bark; fruiting bodies of wood decay fungi on roots, the trunk, or stems; or the presence of carpenter ants. These indicators do not tell how much decay might be present in a tree.

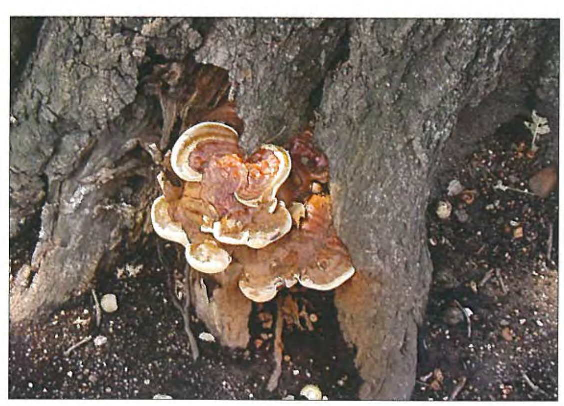
CAUSE: Wood decay in trees is caused by a closely related group of basidiomycete fungi that can digest the cellulose and lignin components of wood. These fungi may fruit on a tree in the area where the decay is present.

SOLUTION: The first step in the treatment of trees with indicators or symptoms of decay is to make an assessment of the amount of decay. If visual observation, sounding or probing techniques cannot adequately provide enough information, more advanced techniques may be needed.

The Resistograph is a relatively new tool in arboriculture that provides a means to assess and document hidden decay in a tree. This tool has a very small (3 mm), non-spiraled bit that can probe areas in the tree where decay is suspected. The distance the bit has traveled and the resistance to the bit are recorded on graphs. Reading these charts allows your Davey arborist to determine the presence and amount of decay in a particular location.

Once an evaluation of the amount of decay in a tree is made, treatment options can be developed. Unfortunately, there are no treatments to stop decay once it starts inside a tree. Treatments such as removal, pruning, cabling, bracing or moving of the target (what the tree might hit if it or a part of it fails) are potential options that can be developed with your Davey arborist.

Drilling into a sycamore with a Resistograph.



Fungal conks indicate internal decay in a tree.

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T 15246 – 02/04

Prepared by The Davey Institute

Root Collar Excavation

Planting trees too deeply and excessively piling up mulch on the trunks of trees has become a chronic problem in urban landscapes. These practices can have a number of serious, negative, long-term effects on tree health. Deeply planted or buried trees are prone to stem girdling roots, poor growth performance, pest problems, and decline or death. Root collar excavation, or the removal of soil and mulch from against the trunk, is a simple, effective process that can correct deep planting, over mulching or fill.

A root crown excavation being performed on a deeply planted tree with a supersonic air tool. Note that the tree lacks a normal flare at the base.

SYMPTOMS: Normally, a tree should have a well-defined flare or expanded area where the soil meets the trunk. For example, most natural forest trees have a well-defined flare at their base. Trees that lack this flare or look similar to a utility pole at the base may be suffering from soil or mulch improperly placed against the trunk. These trees may also be showing symptoms of stress, such as yellowing of leaves, premature fall coloration, small or undersized leaves, reduced growth rates or increased attack by pests.

CAUSE: The lack of a normal root/stem flare can have a number of causes. Deep planting is a common cause (either in the tree nursery or in the landscape), as well as piling mulch up around the stem. Fill soil that has been moved in around the base of a tree during construction is another common cause.

Left untreated, deeply planted or over-mulched trees may be killed by wet soil and mulch piled against the stem of the tree.

SOLUTION: Exposure of the original root/stem flare or root collar is a process known as root collar excavation. In some cases, all trees on a property may require inspection and root collar excavation treatment.

While root collar excavation can be done manually, this is a time-consuming process. Davey arborists now have supersonic air tools that greatly reduce the time required for excavation. The air tools use compressed air to remove the soil from the base of the tree and expose the root flare. Use of the air tool also greatly reduces the potential for injuring large roots and tree trunks (this can happen when manual techniques are used).

After root collars are excavated, inspections can be made for root girdling, twine left behind from planting, decay and disease. The tree is then left with the root/stem flare exposed and a greatly increased potential for a normal, vigorous life.

Printed in the U.S.A.

T 15245 – 02/04

TECHNICAL BULLETIN

Prepared by The Davey Institute

SCALE INSECTS

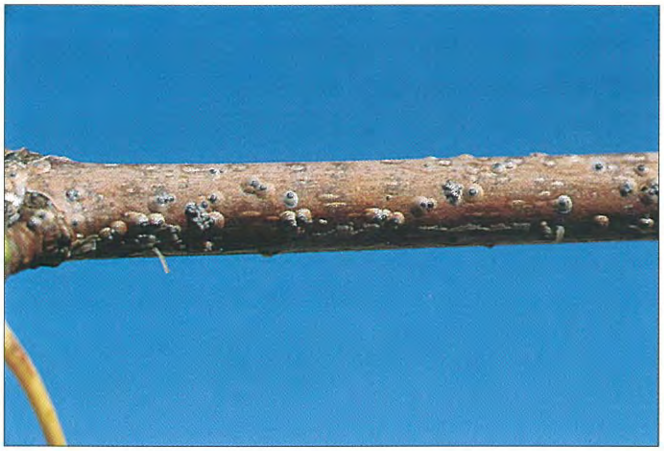

Figure 1. Gloomy scale, *Melanaspis tenebricosa,* is an armored scale that infests silver maple. Armored scales are typically flattened and blend into the bark.

Figure 2. The bumps on this live oak twig are a lecanium scale, *Parthenolecanium* species, an example of a soft scale insect. These insects resemble miniature cowry shells.

SYMPTOMS: Look for undersized and sometimes, yellow-mottled leaves. A severe infestation will cause canopy thinning due to premature leaf drop and branch dieback. These insects can be found on bark, twigs, leaves or needles. Scale insects are a serious threat to plant health.

CAUSE: Scale insects are usually overlooked because they are small and blend into the bark or leaf tissue where they are feeding and they are not as mobile as larger insects. In fact, they are anchored into the plant's vascular tissue with their thread-like mouth parts, much like a button is sewn onto a shirt. There are two general groups of scale insects, the armored and soft scale insects.

Armored scales create a durable covering from wax pores on their body. This cover is like a lid which can be flipped off to reveal the vulnerable scale. This group of scales is flattened and smaller than soft scales, usually ⅛ to ¼ inch in length. Armored scales may have multiple generations each growing season, however, they only produce 10 to 50 eggs per female. There are around 300 species of armored scales in the United States such as the gloomy scale (Figure 1), pine needle scale, euonymus scale and oystershell scale.

Soft scales are larger (¼ to ½ inch long) and rounded in a profile with a flexible, waxy covering that is directly connected to the insect's body. Because these scales imbibe a large volume of sap, they excrete the excess as a sticky substance, politely referred to as "honeydew" or "ghost rain". People often complain that their trees are "weeping" or dripping, when it is actually the soft scale population in the tree that is dripping the honeydew. Due to the high sugar content of the honeydew, it is frequently colonized by the black growth of a fungus called a sooty mold. Females produce 1000 to 2000 eggs, another factor that makes them difficult to control as it does not take long for a plant to become re-infested if just a few females survive the pesticide applications. Fortunately, there is usually only one generation per year. There are about 85 soft scale species in the United States, such as oak lecanium (Figure 2), cottony maple scale, pine tortoise scale and magnolia scale.

SOLUTION: Scale insects are difficult to control or "manage". Winter applications of "dormant" oil can be effective for some species, such as most of the soft scale group. However, the armored group, the euonymus, gloomy and obscure scales are in a susceptible stage at that time. But, in the winter, the pine needle scale and oystershell scale are [redacted] in the egg stage and are not as vulnerable to "dormant" oil treatments. Management of some species requires pesticides that provide residual activity that will outlast the prolonged hatch periods of the crawlers (nymph that hatches from the egg) and the second instar stage. Reducing large populations of scales may take several applications per year and several years to achieve.

Printed in the U.S.A.

T15079-1097

TECHNICAL BULLETIN

Prepared by The Davey Institute

Soil Invigoration

Treatments for Declining Trees and Construction-Impacted Trees

Until recently, treating construction impact or tree decline (or the slow loss of vigor and gradual death of shade trees) was mostly unsuccessful. However, new treatment methods and tools have greatly expanded our ability to treat, and reverse, decline in our valuable shade trees.

SYMPTOMS: Trees affected by construction or decline can show a range of symptoms, including yellowing of leaves, premature fall coloration, undersized foliage and reduced shoot growth (which can give the overall crown of the tree a thin appearance), and eventually death of branches. Left untreated, these symptoms are often followed by death of the tree.

CAUSE: Decline can have many causes, but two of the most common are compacted or poor-quality soil. Soil compaction is so harmful that many trees cannot survive its effect. Compaction often follows construction activities or excessive foot or vehicle traffic. Poor soil conditions (little topsoil and compacted subsoil) are common in landscapes that are left behind after new homes are built. Other possible causes are root injury or cutting, drought, defoliation due to pest problems, lightning injury, or combinations of these factors.

SOLUTION: Treating the soil around large, established shade trees affected by decline is a process called soil invigoration. Supersonic air tools that use compressed air to break up compacted soil and replace it, if needed, are making the treatment of poor soil conditions possible without harming the roots of trees. Depending on the cause of the poor vigor or decline, one of the three techniques described below could be useful in modifying the soil around a tree:

VERTICAL MULCHING: Vertical mulching causes the least disturbance. It is most useful when a compacted layer of soil beneath the topsoil is inhibiting soil drainage and root growth. This process uses a grid pattern of circular holes in the tree's rooting zone. The holes are usually backfilled with a mixture of new soil and compost. Fertilization with Davey's Arbor Green® has proven beneficial with this treatment.

RADIAL TRENCHING: Radial trenching replaces existing soil and provides four or more trenches or channels for root growth. These trenches are created with the supersonic air tool, then filled with a compost/topsoil mixture. Radial trenching is often used when the topsoil is so compacted that it cannot be used again around the tree.

SOIL INVIGORATION: Soil invigoration breaks up soil compaction and adds organic matter (compost) to the existing soil without removing it. A large, powerful air tool is used to fracture the soil, and a smaller air tool is used to work the compost into the soil profile. Only a portion of the tree's rooting area is usually treated the first time.

After the soil invigoration treatments described above, the area can be mulched or returned to turf. Tree owners should be aware of the short-term disruption to the site in exchange for the potential saving of mature, valuable shade trees.

Vertical mulching installs vertical holes that are backfilled with soil and organic matter or other materials. This procedure works well when a compacted layer exists beneath the surface.

Radial trenches are used to replace poor soil and provide channels for root growth. The soil is replaced with a 50/50 mixture of topsoil and organic matter.

Soil invigoration leaves the soil in place and fractures it with the use of a large, supersonic air tool. Organic matter is then mixed into the soil profile.

Prepared by The Davey Institute

TOPPING vs. PROPER PRUNING

Many people have no idea that cutting large diameter main branches of a tree back to stubs in an effort to reduce the height is an unacceptable, and unskilled way to prune trees. This approach guarantees quick, visible results, but leaving stubs (also referred to as "hat-racking") permanently disfigures and essentially initiates the decline of that tree (see Figure 1 and 2).

The trees on this beautiful lot have been topped. The beauty and the value of this property have been greatly decreased.

Topping invites internal decay. When a branch is correctly pruned at its point of attachment (Figure 2) to the trunk just outside of the branch collar and the branch bark ridge, internal decay is usually stopped from progressing into the trunk by a barrier inside the collar. Also, a correct cut results in more rapid wound closure so that the bark quickly grows over the injury.

Branch stubs produced by topping harbor decay fungi which have an avenue to break through the protective barrier in the collar and then proceed into the main trunk. Whenever a cut is made in the main leader by topping, there is nothing to prevent decay from developing in the trunk. The tree may be structurally weakened and its useful life-span reduced. Other adverse effects of topping are:

1. Topping removes a major portion of a tree's leaves which are necessary for the production of carbohydrates.

2. Once-shaded bark in the canopy may be scalded by exposure to direct sunlight. This weakens the integrity of the protective bark and it is more prone to borers, diseases and decay fungi.

3. Stubbing stimulates the development of watersprouts just below the cut. These shoots grow rapidly, causing a topped tree to grow back to its original height faster and denser than a properly pruned tree. These watersprouts are weakly attached and are in danger of splitting out in a storm.

If the height of a tree has to be reduced because of storm damage or interference with electrical wires, it can be correctly done by a method called ***crown reduction or drop crotch pruning***. This procedure involves the removal of a main leader or main branch at the point of attachment of a lateral branch (see Figure 2). The final cut should be parallel to the lateral branch and the branch bark ridge without cutting into the bark ridge. The lateral branch should be at least one-third the diameter of the branch or leader that is being removed.

The National Arborists Association considers "topping back to stubs" as an unacceptable arboricultural practice and advises against it. The NAA has developed pruning standards which define the type and degree of recommended pruning.

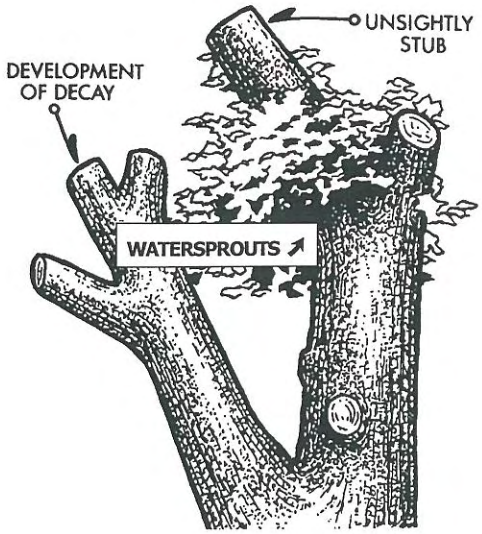

Figure 1. **Incorrect Topping**

Topping in this manner not only ruins the natural form of the tree but weakens the tree. The stubs are unsightly and invite the entrance of disease and decay. Weak watersprouts (new shoots) proliferate in a witches'-broom fashion.

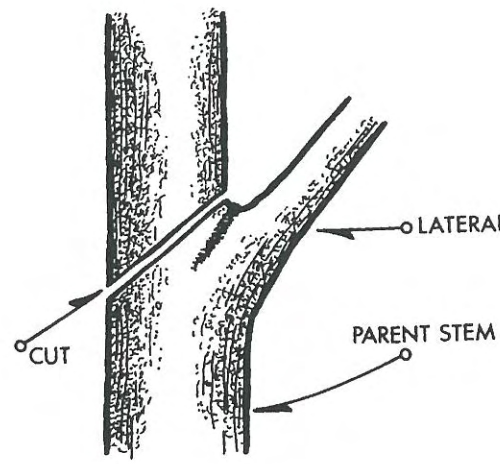

Figure 2. **Crown Reduction Pruning**

In reducing the crown of a tree, the main branch should be cut back to a lateral branch to reduce the possibility of decay and to encourage the growth of tissue over the wound.

Printed in the U.S.A.

T15206-198

TECHNICAL BULLETIN

DAVEY

Prepared by The Davey Institute

TREE AND SHRUB FERTILIZATION

Why Fertilize Trees and Shrubs?

Forest trees usually thrive without the addition of fertilizer, which can give the erroneous impression that trees in general do not require it. However, while forest soils are rich in humus (organic matter) that is replenished by the decay of plant residues, urban soils are usually very low in humus and nutrients. Because leaves in home landscapes are removed (raked away), nature's recycling program for nutrients is interrupted. Because ornamental trees and shrubs are also subjected to harsh and unfavorable soil and environmental conditions, the need for fertilizer is even greater.

The addition of fertilizer not only improves the appearance and condition of trees and shrubs (Figures 1 and 2), but it helps them to better withstand minor insect and disease problems, drought, and other stresses. Fertilization is not a cure-all, but after years of research we have found that well-nourished trees do not have as many serious and costly problems as unfertilized trees.

Figure 1. Before fertilizing

Figure 2. The same tree, after fertilizing

What is the Best Fertilizer to Use?

Davey's Arbor Green® 30-10-7 is a complete slow-release fertilizer, containing nitrogen, phosphorous and potassium. The nitrogen in Arbor Green® is bound in organic molecules and then released in soil by microorganisms. This provides a prolonged availability, and the plants become more vigorous.

Fertilizers with high levels of water-soluble nitrogen release quickly and leach away, offering little nutrient carryover from one season to the next. Due to the complex nature of the organic compounds found in Arbor Green, the release rate is slow and consistent, resulting in a uniform growth response and healthier plants.

The salt index, which measures the salt concentration and, thus, the burn potential of fertilizer, is very low for Arbor Green. This means that Arbor Green will not burn the roots of trees and shrubs that have low salt tolerance, stressed or declining landscape plants, or newly planted trees and shrubs.

How Should Trees and Shrubs be Fertilized?

Our trained professionals inject the proper amount of Arbor Green and water directly into the soil of the root zone. This technique, done under pressure, provides better distribution of the nutrients in the soil profile for more efficient contact and absorption by the roots. It also improves soil porosity and replenishes moisture within the root system. Our Davey fertilization technique will help plants develop a denser root system, which will improve nutrient and water uptake.

The health and appearance of trees and shrubs will noticeably improve with fertilization. Because prevention is the goal, trees should be fertilized before problems occur.

Printed in the U.S.A. T15081 – 8/2002

TECHNICAL BULLETIN DAVEY
Prepared By The Davey Institute

Vascular Wilt Diseases

Verticillium Wilt / Oak Wilt

These diseases are caused by separate fungi that attack the water-conducting (vascular) system of trees. A tree responds by blocking its vascular system to contain the disease and, in so doing, cuts off the water supply to its leaves.

SYMPTOMS:

VERTICILLIUM WILT - The first symptoms of this disease are sudden wilting and dying of leaves on scattered individual branches during the summer. In some cases, large areas in the tree may wilt and die. Infected branches often show an olive-green discoloration in the new sapwood. This disease is most commonly found in maples, but it also affects several other plant species. Some trees will recover if the disease is managed properly.

OAK WILT - Leaves in the upper crown turn a dull green, bronze, or tan beginning at the leaf margin. Soon the leaves wilt and drop off the tree with various degrees of discoloration. Brown streaks develop in the new sapwood. Trees in the red oak group (red, black, pin, and scarlet) are not known to recover once infected. The white oak group (white, bur) varies in species resistance to oak wilt, but these trees usually die slowly over a period of several years.

CAUSE: Verticillium wilt is a soil-borne fungus that invades susceptible trees through the roots. It does not readily move from tree to tree.

Oak wilt can be spread by insects that carry the pathogen on their bodies from an infected tree to an uninfected tree. It also spreads via the vascular system of grafted roots of adjacent trees.

SOLUTION: For trees with only a few branches affected by Verticillium wilt, prune the affected parts and then fertilize. Trees with vigorous growth can "wall-off" or contain the disease within the old wood tissue, producing new wood which is not infected. During dry periods, water and mulch the tree to help improve recovery.

The major strategy with oak wilt is to prevent its spread to healthy oaks. This can be an extensive project involving the prompt removal of infected trees and the disruption of root grafts. Without these measures, the disease will almost assuredly spread and kill more trees. If there is a healthy oak within 40 feet of the diseased one, fumigation or trenching should be done to prevent root graft transmission of this fungus at least 10-15 days prior to the removal of the diseased tree. Live oaks (only in Texas) infected with oak wilt can be injected with labeled fungicides to suppress the growth and spread of the disease-causing fungus.

Printed in U.S.A.

T80-01-2500

TECHNICAL BULLETIN

Prepared by The Davey Institute

VERTICAL MULCHING

Soil in an ideal state for tree growth contains 50% solids (Figure 1). The solids in a soil are composed of mineral material (weathered rock) and organic matter (decayed plants and animals). In an optimum condition, a soil contains 45% mineral material and 5% organic matter.

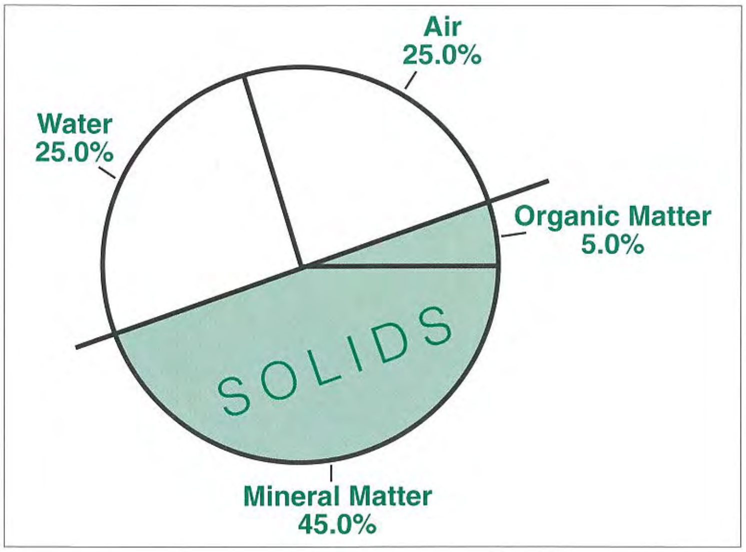

Figure 1

Figure 1

Individual solid particles in a soil combine into groups known as aggregates. Aggregates form the framework for the other 50% of a soil known as pore space. Pore space is the space between the solids and is occupied by air and water. In an ideal state, a soil's pore space contains 25% air and 25% water (Figure 1).

Compaction is the destruction of the aggregates in a soil. Compaction is caused when foot or vehicular traffic places downward pressure on a soil (Figure 2). When the solids in a soil are pressed together, pore space is lost. Eliminating pore space reduces the supply of air and water to trees.

Figure 2

The effect of soil compaction on tree growth is subtle. Symptoms include poor growth, susceptibility to pest problems and environmental stress, and failure of the tree to respond to proper care. The stress caused by soil compaction can lead to a gradual decline in tree health. If left untreated, soil compaction can cause premature death.

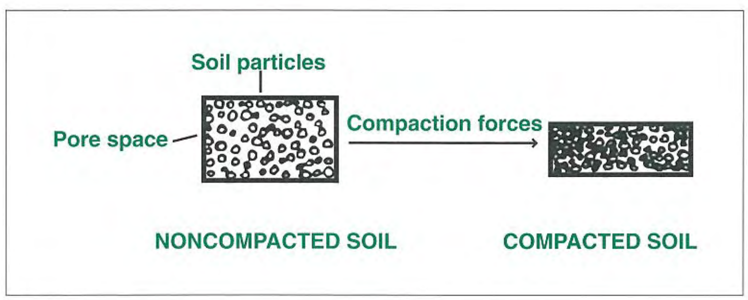

Figure 2: The influence of soil compaction on pore space.

Vertical mulching is sometimes practiced to relieve soil compaction. Vertical mulching involves using a gasoline or electrically powered auger to drill holes into soil (Figure 3). The holes generally measure 1-2 inches (2.5-5.0 centimeters) in diameter, drilled to a depth of 12-18 inches (30-45 centimeters) and are spaced 1-3 feet (0.3-1.0 meter) apart. The holes generally begin 2-3 feet (0.6-1.0 meter) from the trunk and are made in the soil underneath the canopy of the tree.

Figure 3

The holes are frequently backfilled with porous materials like gravel, sand, perlite or peat moss. Likewise, if appropriate, fertilizer may be placed in the holes.

Vertical mulching may also be used if the area underneath a tree's canopy has received "fill." During construction, soil or fill is sometimes placed over the existing soil surface. The fill can limit availability of air and water and adversely affect tree growth. Depending on the species and situation, as little as 2 inches (5.0 centimeters) of soil placed over the existing soil can cause tree decline and death.

Figure 3

Printed in the U.S.A.

15238-1/2002

TECHNICAL BULLETIN

Prepared By The Davey Institute

Winter Injury To Ornamental Plants

The winter season can be particularly injurious to ornamental trees and shrubs, particularly if they have been stressed by poor growing conditions or are planted north of their hardiness zone.

Boxwood, camellia, crape myrtle, forsythia, Southern magnolia, mahonia, American holly, pyracantha, and rhododendron are commonly injured in the winter.

Winter injury to a broadleaf evergreen appears as a browning along the edge of the leaf.

CAUSES OF WINTER INJURY:

Winter injury is a catch-all for various kinds of injury which show up after the winter. Most so-called winter injury results from low temperatures, winter drying, or sunscald.

LOW TEMPERATURES

Damage caused by low temperatures can occur in early fall before leaf drop, in spring soon after leaf buds open, or in winter when dormant or semi-dormant plant tissue is subjected to abnormally low temperatures or wide temperature fluctuations. It is important to realize that there may be a delay of injury symptoms until several weeks after leaf and twig growth or until a water shortage and/or high temperatures occur.

WINTER DRYING

Broad and narrowleaf evergreens lose moisture even during the winter. If the soil is frozen or very dry, this moisture cannot be replaced and various parts of the tree or shrub, such as foliage, buds or twigs, are damaged. Symptoms of winter drying are browning of the margins of the broadleaf evergreens and the tips of the narrowleaf evergreens.

WINTER SUNSCALD

Winter sunscald is damage to the trunk where bark or cambium is killed. High temperatures on a sunny, bright winter day, followed by low temperatures after sunset, can lead to this sort of injury. In this instance, it is not simply the cold, but the rapid change in temperature, which destroys plant tissue. Winter sunscald is more often seen on thin-barked and transplanted trees and, of course, favors the south and west sides of the tree.

SOLUTIONS: To improve the appearance and health of the injured plant and to increase the chances for survival, follow these practices:

1. Prune out dead and dying tissue after the leaves emerge in the spring.
2. Help invigorate the plant through fertilization and proper watering.
3. Control insects and diseases to prevent further plant stress.
4. Protect stressed plants because they are attractive to bark beetles and borers.

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T15067-03/02