

Urban Forest Management Plan

City of Shorewood, Minnesota

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revised

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Acknowledgements

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Executive Summary

Trees provide significant economic, functional, and structural benefits to the community, helping improve the quality of life within the city. When properly maintained, trees return overall benefits and values to the community far in excess of the time and money invested in them for planting, pruning, protection, and removal.

The City of Shorewood previously began a tree inventory of its public streets. In 2016, S&S Tree and Horticultural Specialists were contracted by Shorewood to inventory approximately twenty percent of the remaining street right of way. The City has commissioned this Urban Forest Management Plan to report on the inventory findings, evaluate the condition of public trees, and to establish an effective planning and management program for this resource. This document will review current conditions and explore future management options.

Resource Structure

Based on Shorewood's tree inventory:

- A total of 3,412 publicly managed trees.
- Maple represents over a quarter of the inventoried population with 858 trees.
- Average recorded diameter at breast height (DBH) was fifteen inches, classifying this as an established urban forest (9-17" DBH).
- Nearly half (45%) of trees were reported as being in "Good" condition.
- The City of Shorewood will need to manage approximately 567 ash trees for Emerald Ash Borer (EAB).

Introduction

The public trees growing on the rights-of-way in Shorewood constitute a valuable community resource. They provide tangible and intangible benefits through services, such as pollution control, energy reduction, runoff management, property values, wildlife habitat, education, and aesthetics.

Previously, the services and benefits trees provided in the urban and suburban setting were considered to be unquantifiable. However, by using extensive scientific studies and practical research, these benefits can now be confidently calculated using tree inventory information. Since Shorewood has conducted a tree inventory, accurate insight can be drawn in regards to the overall health of the City's public trees and the benefits they provide the community. The results of applying an i-Tree Eco application, a proven, defensible model and method that determines tree benefit values, to the City of Shoreview's current tree inventory data are summarized in this report.

The science behind this model and type of analysis is sound and has been published in peer-reviewed journals. The challenge now is to apply the science to enhance the quality of life in the City of Shorewood by improving the condition of the urban forest.

Goals

This management plan intends to achieve the following goals:

- Establish a public tree management program.
- Define municipal responsibilities as trees relate to the health and safety of the community.
- Emerald ash borer management strategy that addresses management options and costs.
- Creation of a reforestation plan that emphasizes forest species diversity and benefits.
- Creation of a shade tree disease program that identifies and enforces community tree insect and disease issues.
- Review of current tree ordinance with suggested additions.
- Discuss woody invasive plant management and public education.

Chapter 1: Shorewood's Tree Population

Shorewood's urban forest is a complex system of trees that vary in species, size, age, and condition. Understanding this system is important for proper decision making regarding species selection and tree care practices. This chapter provides insight into the current composition and condition of Shorewood's inventoried tree population. 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.

S&S Tree and Horticultural Specialists performed approximately 20%, thus completing the tree inventory for Shorewood in the summer of 2016. Upon completion of the citywide inventory, S&S Tree and Horticultural Specialists performed an analysis of the inventory data using i-Tree ECO to calculate benefits produced by the City's inventoried tree population. Inventory data were also used to estimate budgets and build a five year management strategy.

Tree Population Characteristics

Tree characteristics recorded during the inventory include location, tree name, DBH, condition, and other related tree and site factors. By identifying the tree, DBH, and condition of trees in the urban forest, much can be learned about the forest's composition, size distribution, relative age, and health. Species composition data are essential since the types of trees present in a community greatly affect the amount of benefits produced, levels of diversity, tree maintenance activities, and budgets.

Unmaintained Right of Way

Much of Shorewood’s street right of way is occupied by natural occurring forest edge trees and other natural areas. These areas were inventoried using a geographic positioning tool called “polyline” that allows for categorizing multiple features of interest. The polyline feature was used to map and classify forest edge right of ways by assigning the average tree species, DBH, and condition. Shorewood’s tree inventory defines 109 polylines of various lengths categorizing forest edge trees in unmaintained natural areas. Comparing all 109 polylines, data reveals the average tree growing in these areas are 10 inch DBH maples in Good condition. Regular inspections of these areas should be conducted with identified hazards being mitigated as soon as possible.



Photograph 1. Unmaintained and forest edge right of way lines a considerable portion of Shorewood’s streets.

Tree Composition and Diversity

Table 1. Significant Tree Composition in Shorewood

Tree	Number	% of Trees
Maple	859	25.18
Ash	560	16.42
Elm	269	7.88
Boxelder	217	6.36
Oak	197	5.77
Other trees	1,310	38.39

Inventoried Tree Population

Shorewood’s inventoried tree population is composed of 3,412 trees distributed among 27 different types. Genus distribution amongst the City’s tree population appears to be healthy with the exception of maple. S&S Tree and Horticultural

Specialists recommends that no one single Genus exceed 20% of the total tree population. Due to increased threat of exotic invasive pests and diseases, it is advisable that Shorewood consider adopting a policy to limit a single species to no more than 10% and genus to no more than 20% of the population. A variety of species types can decrease the impact of species-specific pests and diseases may help to limit the impacts from a number of weather events as different trees respond differently to stress.

Relative Age Distribution

By using DBH as an indicator of relative tree age, predictions about present and future costs as well as flow of benefits the tree population provides for the city. An uneven-aged population allows managers to allocate annual maintenance costs uniformly over many years and helps to maintain overall tree canopy cover.

Shorewood’s urban forest displays an uneven-aged population as reflected by size class distribution. An ideal street tree population has an imbalanced age distribution, with higher percentages of young trees than mature trees to minimize fluctuations in functional benefits over time. Trees mature and begin to decline, a tree population skewed towards young trees will ensure that the flow of benefits continues to exist. S&S Tree and Horticultural Specialists recommend that Shorewood establish a tree planting program to increase percentages of young trees to ensure a sustainable benefit producing urban forest.

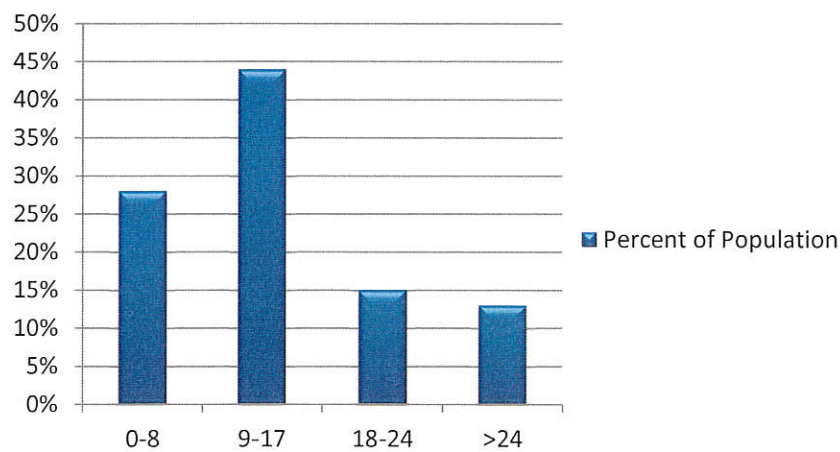


Figure 1. Diameter size class distribution of Shorewood’s inventoried tree population.

Health and Condition

S&S and the City of Shorewood assessed the condition of each individual tree during the inventory period. Several factors were considered for each tree; including root characteristics, branch structure, trunk, canopy, foliage condition, and presence of pests. Tree condition was rated as Good, Fair, Poor, or Dead/Dying. Most of the inventoried trees in Shorewood were assessed as being in Good or Fair condition, 46% and 35%, respectively (Figure 2). Based on these data, the general health of the inventoried tree population is rated as Good.

In addition to providing an overall idea of current forest health, these data can also be used to guide future management decisions. Good and Fair trees should be maintained and kept in condition for producing maximum benefits. Structural and deadwood pruning on a rotational schedule will maintain the safety and aesthetic value of these trees. Poor trees should be re-inspected annually

to monitor and manage any additional risk if the tree continues to decline. Remove all trees in Dead/Dying condition within two years. Because of their failed or failing health, these trees will most likely not recover even if care is increased.



Photograph 2. Almost 50% of Shorewood's tree population has a condition rating of "Good".

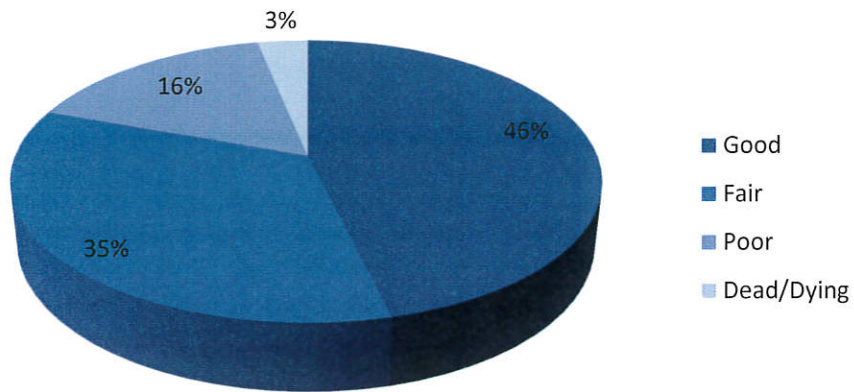


Figure 2. Condition of inventoried trees

Tree Maintenance Recommendations

One important objective of a tree inventory is determining current and appropriate maintenance needs of the tree population. Maintenance needs were assigned based on size, condition, and species. Table 2 summarizes the maintenance requirements of Shorewood’s inventoried tree population. See Appendix A for a detailed five year strategy and budget table that further breaks down the recommended maintenance activities presented in the following paragraphs by estimated cost, timing, and activity. Tables and figures within this section summarize parts of the five year maintenance plan.

Table 2. Shorewood’s Tree Maintenance Recommendations

Maintenance Required	Number of Sites	% of Maintenance
Pruning	1,890	56
Ash Removal	469	14
Re-inspection	518	15
Young Tree Training	329	10
Removal	103	3
Ash Treatment	92	2

Routine Tree Pruning

One of the most beneficial improvements that any city can accomplish to improve their urban forest is to perform routine preventative pruning. This activity works to structurally prune trees on an established schedule to maintain a safe and healthy urban forest. Shorewood currently has 1,890 trees growing on street right of ways that are good candidates for the recommended five year routine pruning program.

These trees would be on a five year rotational pruning schedule allowing an opportunity for professionals to visit each tree once every five years to perform routine maintenance.

Approximately 379 trees would be pruned each year on a cyclical basis. Table 3 summarizes pruning activities and estimates an industry average cost for each year of the cycle. A complete bid process should be assessed subsequent to each year of annual pruning.



Photograph 3. Shorewood has 1,890 trees recommended for routine pruning. A five year cycle would allow for pruning of approximately 379 trees annually.

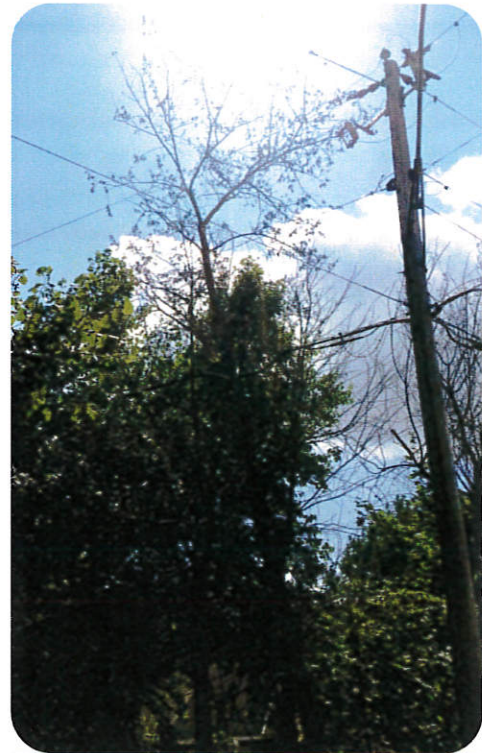
Table 3. Annual Routine Tree Pruning and Cost Estimates

Pruning	Year 1	Year 2	Year 3	Year 4	Year 5
Trees	374	377	378	381	380
Cost	\$50,495	\$51,070	\$51,240	\$52,360	\$52,055

Tree Removals

Removing dead, dying, or otherwise hazardous trees from the population is an integral part of urban forest management. From the inventory, 103 trees identified as Dead/Dying are recommended for removal. Table 4 breaks down these trees by diameter class and provides a cost estimate for removal. Shorewood's five year budget plan in Appendix A breaks down these removals over the course of two years where larger trees with increased risk are removed in year one and smaller less hazardous trees are removed in year two.

An additional 469 undesirable Ash trees deemed unfit for emerald ash borer treatment are also recommended for removal. Chapter 3 provides a strategy for removing these ash trees over the course of three years.



Photograph 4. During the inventory, 103 dead or dying trees were recorded.

Table 4. Shorewood's Tree Removals and Cost Estimates

Diameter Class	Cost/Tree	Trees	Total
1-3	\$25	6	\$150
4-6	\$105	22	\$2,310
7-12	\$220	45	\$9,900
13-18	\$355	15	\$5,325
19-24	\$525	9	\$4,725
25-30	\$845	2	\$1,690
31-36	\$1,140	2	\$2,280
37-42	\$1,470	1	\$1,470
43+	\$1,850	1	\$1,850
Total		103	\$29,700

Re-inspection

Inventoried trees with a condition rating of Poor are recommended for re-inspection. The 518 trees in this category could experience rapid health or structural deterioration and become hazardous. Others could survive and exist for many years. Therefore routine annual inspections are necessary to monitor and keep risk as low as possible. Keeping up to date with inspections would cost an estimated \$1,554 annually.

Young Tree Training

Pruning young trees to improve branch structure is the most effective method of reducing maintenance costs as trees mature. Currently, Shorewood has 329 trees recommended for Young Tree Training. At the time of planting the only pruning that should be done is removal of broken and dead branches. In the second growing season, minor pruning can be done to remove branches with poor attachments. The first Young Tree Training prune should occur during the third growing season and achieve proper branch spacing and structure.



Photograph 5.
Training for correct structure when trees are young will decrease the chance of future branch failure and increase the trees lifespan.

Table 5. Shorewood’s Young Tree Training Program

	Year 1	Year 2	Year 3	Year 4	Year 5
Trees	110	110	109	0	0
Cost	\$3,210	\$3,210	\$3,180	\$0	\$0

Ash Treatments

Shorewood has an inventoried population of 567 ash trees. In the advent of emerald ash borer infestation, the city should plan on removing the majority of ash before they are killed by the borer and become hazardous standing dead trees. The inventory identified 92 ash trees as viable candidates for treatment. These trees are in Good or Fair condition and are 19 inches DBH and greater. These trees should be maintained and protected because they provide the greatest amount of benefits among the city's ash population. Treatments remain effective over two years and therefore should reoccur once every two years. Ash treatments can be bid out or done in house with a licensed contractor.

Chapter 2: Emerald Ash Borer Management Strategy

Emerald Ash Borer

Throughout the United States, urban and community forests are under increased pressure from exotic and invasive insects and diseases. Usually these exotic pests arrive from overseas, and our native trees and shrubs do not have appropriate defense mechanisms to fight them off. One of Shorewood's largest challenges will be preparing and managing for infestation of emerald ash borer.

A recently completed street tree inventory shows 567 ash trees growing on Shorewood's street right of ways. Sixteen percent of the City's street tree population will be affected over the next few years by emerald ash borer. This chapter will outline a strategy that Shorewood can adopt to manage ash trees on public and private land over the next five years. When emerald ash borer is discovered in Shorewood, this management plan is intended to properly guide the city with the following issues:

1. Protection of public safety
2. Available funding and staffing
3. Protection of woodland areas and natural resources
4. Forest and tree canopy cover and composition after a reduction or loss of ash tree population

Identification

The adult beetle is elongate, metallic green, and 3/8- to 5/8-inch long. Adults emerge from late May until early August feeding on a small amount of foliage (this causes jagged leaf edges). Females lay eggs deep into bark crevices on 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 inch long.



Photograph 6. The adult EAB. (Photograph courtesy of Ohio State University)

Fully grown larvae overwinter under the bark, or sometimes in pupal cells made of outer sapwood. There is one generation per year, but some larvae can remain in the tree for two years.

Initial symptoms include yellowing and/or thinning of the foliage and longitudinal bark splitting. 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 that is about 1/8-inch in diameter. The intense tunneling disrupts water and nutrient flow, causing trees to lose between 30% and 50% of their canopies during the first year of infestation. Trees often die within two years following infestation.

Administration

The City should appoint a natural resource professional responsible for implementing this program and ensuring the plan provisions are carried out appropriately. In order to implement the provisions of this plan, maintain a comprehensive forestry program, and provide excellent service, additional staff

and or contracted help will be needed. Conversely, if additional support is not obtained, certain programs will need to be displaced, keeping in mind that many natural resource programs involve enforcing city, state, and federal regulations which cannot be displaced by EAB inspections, treatments, and removal costs.

The total number of ash trees on public and private land is unknown. The formation of a Shade Tree Disease Control Program with trained inspectors will allow proactive identification of diseased trees that are or will become hazardous.

Monitoring and Management

If an ash tree is believed to be infested, it is recommended that the city contact the Minnesota Department of Agriculture for proper identification. Removal of infested trees is recommended, and their stumps should be ground out. For more information, check the Minnesota Department of Natural Resources' (DNR) website www.dnr.state.mn.us/.

As EAB infestations increase in Shorewood, the City should consider removing and treating ash trees as part of the City's EAB management program. An elevated level of risk associated with the rapid decline of the ash trees typically occurs within three years of infestation. In order to reduce this future risk, Shorewood should begin a three-year staged ash-removal program. Shorewood should make every effort to replace any ash tree that is removed. Since ash make up 16% of the total inventoried tree population, a large amount of benefits provided by these trees will be lost if ash are removed from the population and not replaced. The public will also be more accepting of tree removals if they are being replaced with new trees. Table 6 illustrates the amount of ash trees recommended for removal as part of this three year strategy along with costs estimated from a group of seven reputable tree care companies operating in North America.

Table 6. Three-Year Staged Ash-Reduction Program

Diameter size Class (Inches)	Year 1	Year 2	Year 3	Estimated Removal Cost
1-3	1	1	0	\$50
4-6	12	12	12	\$3,780
7-12	78	78	78	\$34,320
13-18	62	62	62	\$66,030
19-24	1	1	1	\$1,575
25-30	2	1	1	\$3,380
31-36	1	0	0	\$1,140
37-42	1	0	0	\$1,470
43+	1	0	0	\$1,850
Total	159 (\$47,130)	156 (\$41,825)	154 (\$41,800)	\$113,595

Ash are large shade trees that produce significant amounts of benefits for the City. Retaining the City’s greatest benefit producing ash trees will decrease the effect of tree population loss overall. Another component of EAB management is treating the remaining desirable ash tree population not only to retain benefits but to curb the amount of tree removals. Shorewood’s desirable ash tree population are nineteen inches DBH and greater and in Good or Fair Condition. According to inventory data, 92 ash trees fit the criteria. Table 7 illustrates one year of treatments with estimated costs. Treatments remain effective over a two year span, therefore the city should plan on treating these 92 ash once every two years.

Table 7. Biannual Ash Treatments

Diameter Size Class (Inches)	First Year	Estimated Industry Treatment Cost (\$10 per Inch DBH)
19-24	61	\$12,810
25-30	25	\$6,750
31-36	5	\$1,700
37-42	1	\$400
Total	92	\$21,660

Contracting Work

Many cities employ private contractors to assist with managing emerald ash borer. Once an EAB plan is established, the time line for management activities usually dictates the amount of personnel required to carry out the plan.

Contractors are often hired to preform removals, treatments, and tree planting.

Using a request for proposal (RFP) template allows the City to clearly state their needs, and what their requirements are for prospective contractors. A typical RFP gathers the following information from prospective contractors:

- Years in business
- Years of experience performing duties in contract
- References from past work contracts
- Names, licenses, and qualifications of employees who perform the work
- Ensure training and training content, quality, and consistency with work performed
- Available and necessary equipment and staff to perform work
- Warranty period and/or guarantee
- Pricing and bid information

Information gathered from returned RFPs will help City managers narrow the field of contractors and make a decision based on qualities the City sees as being most important.

Ordinance Revisions and Policy Development

The City's ordinance will need updating to address the presence of EAB and broadened to account for other invasive insects, diseases that man be introduced over time. The intent of the EAB portion of the ordinance update is to initially limit the spread of EAB throughout the city, and once established, to ensure public safety since thousands of standing dead and brittle ash trees will pose a risk to human safety and property.

Ash Debris Handling and Disposal

The USDA and MDA have imposed a quarantine that prohibits the movement of any ash logs or firewood of any tree species out of Ramsey and Hennepin Counties. The quarantine is enacted on a large county-wide scale with the assumption that the infestation has spread beyond what is observed.

To limit the spread of EAB within the counties, leave infested or non-infested ash trees standing during the EAB active period between May 1st and September 31st. This eliminates the movement of infested material during the active period. Regardless of their infestation status, ash pruning and removals should take place during the EAB dormant period between October 1st and April 30th. All wood and brush produced must be processed by May 1st.

The volume of wood waste generated by thousands of public and private property ash removals will increase significantly once EAB is established in the City. The city will need to establish a Marshaling yard for processing infested material. A Marshaling yard is a disposal site with the purpose to help prevent EAB infested ash wood from being transported out of a newly identified EAB infested are. The yard can be used as staging site for wood processing, such as chipping, grinding, debarking and sawing. The yards also serve as temporary over flow or emergency storage sites when trees are removed. The City should explore opportunities to cooperate with Hennepin Country and other agencies when creating marshaling yards.

Chapter 3: Reforestation

The situation many Cities find themselves in today facing widespread tree population loss from EAB, is reminiscent of the 1970s when many of these same Cities were dealing with Dutch elm disease. A reason Dutch elm disease was so devastating for urban forests can be contributed to over planting of elm trees. Urban forests had high percentages of American elm, leaving the entire system exposed to the possibility of massive population loss. Ironically, Cities replaced many of their lost elms with ash trees, thus creating framework for a similar crisis taking place in the future.

Today, urban foresters focus on growing sustainable, diverse, beautiful, safe, benefit producing tree populations. S&S Tree and Horticultural Specialists recommend Shorewood replace the trees removed from both the EAB reduction program and Dead/Dying tree removals. City managers should also expect to lose 1% of their total tree population each year from natural mortality.

Tree Replacement

Replacing Shorewood's lost trees from removals and natural mortality is important for achieving the management goals of this plan. According to inventory data, the city can expect to lose 711 trees over the next five years (*Figure 3*). These removals include ash trees removed as part of the ash tree reduction program, one percent annual population loss from natural mortality, and the dead or dying trees within the right of way.

Appendix A provides framework and breaks down cost for a five year reforestation program. The program aims at replacing all 711 trees in conjunction with their removals during the five year management period. Ideally, 142 trees should be planted annually to offset removals and regenerate tree benefits for Shorewood. The budget estimates the cost for purchase and installation of balled and burlapped trees.

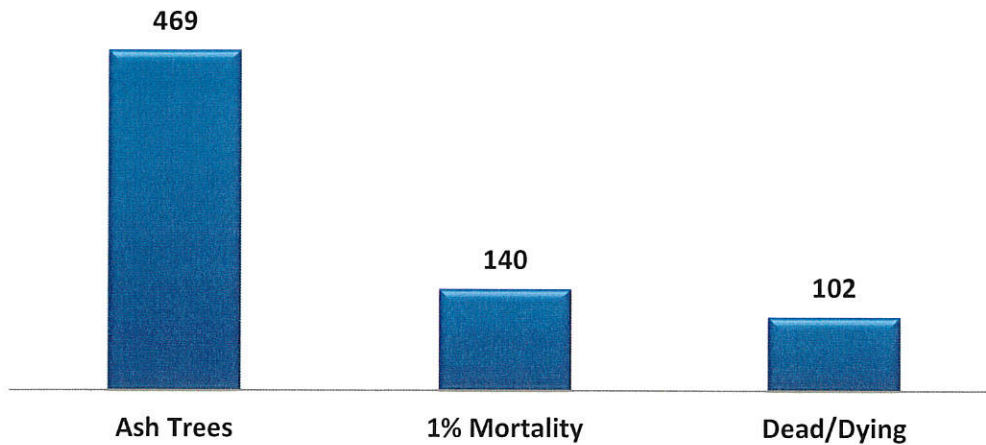


Figure 3. Projected street tree population loss over five years

Tree Species Selection

Shorewood, Minnesota, is located in Zone 4b of the USDA Hardiness Zone Map, which identifies a climatic region where the average annual minimum temperature is between -25° and -20° F. Tree species selected for planting in the city should be appropriate for this zone.

In addition to considering site characteristics, such as the availability of space, soil pH, and irrigation, species-specific features must also be scrutinized. Considered seasonal color 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 else, 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. Consider the potential threat of invasive insects and diseases when selecting species.

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 B for additional tree species and cultivars potentially suitable for planting in Shorewood.

Tree Purchases

Tree prices vary based on the species selected, but many nurseries offer trees from 1.5 to 2.5-caliper inches for \$150-\$300. As the City works toward planting more trees annually, obtaining a good price for quality trees will become more important and nursery guaranteed stock is crucial. Saving money on the cost per tree will allow a greater number of trees to be purchased.

Bare-root planting is typically less expensive than B&B plantings because, in general, the bare-root trees weigh much less than a B&B tree. The reduced weight lowers transportation costs and labor costs. Parks and recreational areas can be planted with even cheaper alternatives such as seedlings with grow tubes. Grow tubes are an accepted and proven method of transplanting and growing trees. Inexpensive tree seedlings can be transplanted and grown with relatively high survival rates.

S&S Tree and Horticultural Specialists believe 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 Shorewood explore local and regional sources for trees, discuss pricing with the current nursery source, and search for nurseries that provide bare-root planting stock. To achieve species diversity, it may be necessary to use several nurseries as sources for trees.



Photograph 7. Mulching newly planted trees increases survival rates

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 should be pulled away from the root collar. Mulch that buries the root collar provides shelter for insects, fungi, and small 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 2–4-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 to prevent mechanical damage. Mulch helps to hold moisture in the surface of the soil where most of the feeder roots established.

Chapter 4. iTree Eco and Canopy Analysis

The i-Tree Eco application was used to determine the overall and net values and benefits of Shorewood's urban forest. i-Tree Eco is a component of i-Tree, a suite of free software tools released by the U.S. Forest Service that can be used to assess and manage community forests. With these tools, cities and urban forest managers can accurately quantify the benefits of urban forests.

The i-Tree Eco tool quantifies the benefits of public trees and compares them directly with the costs of urban forestry programs to produce accurate net benefit values. It is a statistically valid, financially sound, and defensible cost-benefit analysis tool for urban forestry that may be used with existing inventories or with a sampling of streets in a community.

i-Tree Eco Benefit Categories

S&S Tree and Horticultural Specialists entered tree inventory data into the i-Tree Eco model to assess and quantify the beneficial functions of the public tree resource and to place a dollar value on the annual environmental benefits trees provide. Analysis was performed to quantify the following benefits:

- **Carbon Sequestering**—Carbon dioxide (CO₂) is used during a tree's photosynthesis process to produce the natural building blocks necessary for tree growth. This process takes CO₂ from the atmosphere and holds it as woody and foliar biomass. This is referred to as carbon sequestration.
- **Air Quality**—The air quality of Shorewood's urban environment greatly benefits from the presence of street and other public trees. Trees absorb gaseous pollutants in the form of ozone (O₃) and nitrogen dioxide (NO₂). Reduction in O₃ can also be attributed to the tree shading effect on hardscape surfaces and the transpiration process. Trees intercept volatile organic compounds (VOCs), sulfuric dioxide (SO₂), and small particulate matter (PM₁₀), such as dust, ash, dirt, pollen, and smoke from the air. Trees also emit biogenic volatile organic compounds (BVOCs), an air pollutant that contributes to the formation of O₃, a process that the i-Tree Eco model takes into account.
- **Avoided Runoff**—Shorewood's public tree population reduces the volume of runoff in neighborhoods and citywide. This function and benefit is especially important in developed settings with increased quantities of impervious surfaces (roads, driveways, homes, and parking areas) and in areas in close proximity to surface waters. A tree's surface area, especially the leaf surfaces, intercepts and stores rainfall. The root systems of trees increase soil infiltration,

thereby decreasing runoff. Trees also reduce runoff by intercepting raindrops before they hit the ground, reducing soil compaction rates and improving soils' absorptive properties. In addition, trees intercept suburban contaminants, such as oils, solvents, pesticides, and fertilizers, which are often part of runoff, reducing pollutant discharges into the city's vital waterways.

Benefits of Shorewood's Municipal Trees

Public trees provide a host of benefits to the City of Shorewood. Public trees conserve energy, reduce carbon dioxide levels, improve air quality, and mitigate runoff. In addition, trees provide numerous economical, psychological, and social benefits.

This study uses tree inventory data collected in Shorewood and an i-Tree Eco model to assess and quantify the beneficial functions of the City's public tree resource and to place a dollar value on the annual benefits they provide. Table 8 illustrates the total annual benefits for Shorewood.

Table 8. i-Tree Eco Analysis Results for Total Annual Benefits Provided by Shorewood's Inventoried Trees

Benefit Category	Sequestered Carbon Dioxide	Air Quality Benefits	Avoided Runoff	Total
Annual Amount	\$3,969.83	\$3,407.14	\$5,539	\$12,915.97

Electricity and Natural Gas Results

Shorewood's inventoried public trees provide electricity and natural gas savings by creating shade a barrier to slow or redirect wind. Energy savings are a significant benefit that trees provide. Trees can decrease the energy consumption of a typical Shorewood home by 25% through shading and other environment altering effects.

Sequestered Carbon Dioxide

Shorewood's public tree resource sequesters nearly 30 tons of carbon dioxide per year valued at a total of \$3,969.83 with the average savings per inventoried tree of \$1.16. Maple accounts for 24% of these savings while constituting 25% of the total tree inventory. Mature trees of the maple, elm, and ash variety contribute the most to this environmental benefit. Shorewood should continue to maintain these trees to continue receiving these benefits. Planting new trees and maintaining existing ones is the best approach to sustaining benefits.

Net Air Quality Improvement

Shorewood experiences a net air quality improvement worth \$3,407 per year, averaging \$1 per tree. Shorewood's population of maple helps improve the air the most by eliminating 680 lbs of pollution each year. The total inventoried tree population works to remove approximately 1.26 tons of pollution annually.

Avoided Runoff

Shorewood's inventoried tree population helps avoid 82,863 cubic feet of runoff annually producing a value of \$5,539. Each tree avoids approximately \$1.62 worth of runoff every year. In Shorewood, Silver maple, green ash, and cottonwood effect runoff amounts the greatest.

Canopy Analysis

Many urban forest managers focus on increasing percentages of canopy cover within their cities. A component of many tree inventories is identifying and mapping vacant planting spots. These data give managers insight on how much opportunity there is for tree planting and further increasing tree canopy percentages.

Healthy urban canopy cover benefits the community by lowering summer air temperatures, reducing air pollution, reducing heating and cooling costs, increase property values, improving health, wellbeing, learning, and concentration. A single large tree can provide approximately \$76 in benefits annually and over \$3,000 across a 40 year period. Increasing urban tree canopy increases these benefits.



Photograph 8. Canopy analysis results indicate Shorewood being 50.5% covered by tree canopy.

An urban tree canopy analysis was conducted for the City of Shorewood using i-Tree Canopy, a product developed by the U.S. forest service. Within Shorewood’s boundaries, 200 random points were surveyed remotely to determine canopy cover. Results from the analysis project an urban tree canopy covering 50.5% of Shorewood which is considered good for an urban area. Table 9 displays i-Tree Canopy calculations of approximate benefits provided by all trees in Shorewood.

Table 9. Benefits Provided by all Trees in Shorewood

Benefit Description	Value	Amount
CO Removed Annually	\$276.82	416.65 lb
NO2 Removed Annually	\$2,561.60	4.11 T
O3 Removed Annually	\$89,150.92	29.99 T
Particulate Matter Removed Annually	\$200,210.40	12.02 T
SO2 Removed Annually	\$101.30	899.78 lb
CO2 Sequestered Annually	\$261,209.12	7,223.83 T
CO2 Stored in Trees	\$8,771,607.66	242,581.94 T
Total	\$9,325,117.82	249,851.89 T

Chapter 5. Private Tree Management

Tree Ordinance Review

Part of a successful urban forest management program is creating an effective tree ordinance that helps facilitate the community's management goals. Understanding the current state of a city's urban forest is the first step toward developing relevant and effective policies. Decisions can be made based on biological, management goals, and community needs.

Upon review of Shorewood's City ordinance, S&S Tree and Horticultural Specialists recommend that changes be made to the City's tree related ordinances to create a framework that better facilitates achievement of Shorewood's urban forestry goals. Cities are moving in the direction of further defining their forestry departments and activities and how they fit with other initiatives and regulations. For Shorewood to begin moving in a similar direction, it must have a defined section within the code that deals with trees directly. The code should include the following subdivisions that further define Shorewood's intentions.

- City Forester Duties and Forestry Program
- Maintenance and Removal of Trees
- Tree Work License
- Minimum Height of Tree Limbs
- Shade Tree Disease Regulation
- Tree Preservation
- Nuisance Tree Declaration
- Inspections and Investigations
- Abuse or Mutilation of Public Trees

S&S Tree and Horticultural Specialists created a sample tree ordinance that expands the wording and procedures for each subdivision listed above. We recommend Shorewood integrate this sample and amend their ordinance according to the suggested material.

Tree Preservation Ordinance Review

Shorewood's Tree Preservation Policy covers all aspects of tree preservation at multiple levels. It has straightforward definitions consistent with many other municipal tree preservation ordinances which provide simple and easy to understand requirements for sub-dividers and builders alike. It emphasizes tree protection, preservation of root space, escrow funds, and penalties for failing to address the ordinance.

Many communities are concerned about the tear down of smaller homes to make way for much larger homes usually to the detriment of the trees. Trying to find balance between personal rights and community benefits can be challenging. The current Tree Preservation Policy recommends a site visit with the Zoning Administrator before a project begins. Ideally, the Forester would also meet on site prior to provide input on the forest resource with regards to preserving the property's unique characteristics. Choices made by developers can have dramatic impacts on trees and the land they grow on.

Guidelines for replanting lost trees are critical for every tree preservation policy. With Shorewood's high percentage of canopy cover, planting for diversity may be more important than planting strictly for canopy coverage. Issues arise when not enough trees can be planted in the area because of lack of space. Cash in lieu funds can be put towards the cost of implementing the forestry program with regards to contractor fees and enforcement. Many checks and balances are in place to make sure escrow funds are held until the completion of the project.

The current Tree Preservation Policy is understandable, enforceable and perfectly acceptable for the city's current situation. With a few exceptions some minor changes to specific parts of the ordinance can be found but overall the plan can remain as is. Providing schematics for tree fencing, tree planting, will allow for a more stream-lined and consistent process. Also, a template to sub-dividers and builders can act as a checklist to insure that all aspects of the ordinance are being followed.

A planting schedule including type, size, and location of trees to be replanted should also be included within the Tree Preservation Plan. The list of acceptable trees for planting should be removed from the ordinance as it could discriminate against certain tree species which may be a valuable part of the urban forest. All planting schedules should be approved by the Forester before planting.

Extending oak wilt dates from the middle of March to the end of June will prevent more oak wilt infection centers from becoming established within the city limits during the high oak wilt season. If oak tree work needs to occur during the high oak wilt season a Forester consultation is recommended to prevent the spread of oak wilt. Consulting with a Forester will help the City determine a safe time to prune oaks.

Woody Invasive Plant Management

Invasive plants are an unwelcome menace for many ecosystems. Forested urban ecosystems oftentimes have thriving populations of various woody invasive plant species. Human activity, development, and disturbance each contribute to the introduction and spread of invasive plants. Identifying invasive plants in Shorewood and finding ways of educating residents is the aim of this section.

Displayed in Table 10 is a list of high priority invasive plants that grow in Shorewood. These plants have the capacity to quickly take over native forest or disturbed areas and severely limit diversity. Shorewood’s available control areas are limited to right of ways, parks, and other public property. The majority of invasive plants will be found colonizing private properties throughout the City. Public awareness and educational initiatives focused on identification, effects, and control of woody invasive plants can be an effective management approach.

Table 10. High Priority Woody Invasive Plants

Common Name	Genus	species
Buckthorn	Rhamnus	cathartica
Honeysuckle	Lonicera	tatarica
Mulberry	Morus	alba
Barberry	Berberis	thunbergii
Russian Olive	Elaeagnus	angustifolia
Amur Maple	Acer	ginnala

Identifying areas of concern in regards to invasive species could start with surveying parks and other public spaces. Once areas of significant infestation have been identified, a method of control must be chosen. Usually the method of control is depicted by species, area of influence, and species maturity. Buckthorn poses the largest challenge to Shorewood when speaking of woody invasive plants.

Methods for buckthorn removal depend on acreage, stem diameter, and location. The most effective method of eradicating buckthorn is cutting and treating freshly cut stumps with herbicide. Further action depends on how established buckthorn was on the site. The activity that accompanies buckthorn removal makes conditions perfect for buckthorn regeneration. The site will need to be retreated with herbicide as buckthorn should be expected to regenerate. The number of retreatments depends on how established the seed bank is within the treatment area. Heavily populated sites with larger diameter buckthorn have well established seed banks, making retreatment necessary for a number of following years.

Because most of the Shorewood's woody invasive plants are on private property, encouraging residents to eradicate them from their properties will be essential. Offering workshops on invasive species removal could help educate and influence homeowners to take action.

A major initiative of the Minnesota Department of Natural Resources (MDNR) is community outreach and invasive species control. The MDNR website (www.dnr.state.mn.us) has extensive content pertaining to invasive species management and community education.



Photograph 9. Dense buckthorn patch growing on the right of way of a street in Shorewood.

Shade Tree Disease Program

A full-service shade tree disease program can help preserve Shorewood's valuable tree resource and save taxpayers from potentially costly burdens. Without controls in place, shade tree diseases can quickly spread from one area to the next without regards for property lines. Early identification, proper sanitation, and treatment are the backbone of successful programs. Benefits of these programs to communities have been well documented over the years.

The City has a shade tree disease ordinance in place that specifically addresses oak wilt and Dutch elm disease. Emerald Ash Borer is not specifically addressed but can be included with the "shade tree with an epidemic disease" group as specified within the ordinance. In the future, anticipation of more shade tree diseases will find their way into our region. Asian long-horned beetle and gypsy moth are a few examples of potential threats. However, as worded, the ordinance sufficiently addresses for these contingencies.

Shade tree diseases can have a significant impact on both public and private trees. The majority of urban communities have active shade tree disease suppression programs in place. An active program will involve the services, at minimum, of a Tree Inspector certified by the Department of Natural Resources. Their role will be to canvas the city, actively looking for dead/dying shade trees as well as responding to homeowner calls specifically related to oak wilt, Emerald Ash Borer, or Dutch elm disease. Sound diagnostic tools are a must to succeed at this role as a host of other non-lethal insects and diseases can mimic shade tree diseases.

Proper notification of residents with diseased trees and the locations of said trees, including any supporting documentation, will need to be provided to the correct landowner. Re-inspection will be required to insure that all trees are being promptly removed and that full compliance has been met. Delinquent residents will be provided a certified letter stating that the tree(s) will need to be removed by a specific date. If the landowner fails to comply, the city can authorize the removal of the tree and the landowner will be assessed through their property tax.

Shade tree disease abatement is an important part of any successful urban forestry management program and the enforcement of existing ordinances is highly recommended to limit harmful impacts to the community and preserve natural resources.

Public Education

Homeowner Site Visits

The contracted forester is able to provide homeowner site visits May through September. This is a budgeted amount of 100 site visits per growing season to be scheduled through city hall. Site visits will be scheduled based on shade tree insect and disease issues such as oak wilt, Dutch elm disease, emerald ash borer, bur oak blight and many other tree related insect or disease issues.

Public Education (City Events, Newsletters, Social Media)

The contracted forester is able to provide timely public education articles that can be distributed in print or electronically. Following are a list of those items we can provide.

- Staff an “Ask the Arborist” booth at city events such as spring or summer events. These could include spring clean up days, open house events, etc.
- Shade tree insect or disease information for the newsletter, similar content can be provided for blog posts, social media posts

Public Education (Website)

Home>Departments>Public works> Forestry

Forestry Home

Municipal arboriculture is a specialized field of arboriculture and urban forestry that deals with the management of planted and naturally occurring greenspaces on public land in communities. It involves planning, planting, establishing, protecting, and managing public trees and associated vegetation.

We plant and manage trees because they provide significant benefits to our community. Among the most basic reasons for planting trees is for their beauty and the shade they provide. While these are excellent benefits, trees serve many other purposes. The following documents provide in-depth information and research about why trees are important:

[Midwest Community Tree Guide](#)

[The Value of Trees](#)

[The Benefits of Trees](#)

City Tree Maintenance

The City of Shorewood monitors and maintains the health and safety of trees on public property. Public trees are on a 10 year rotational pruning cycle where certified professionals provide maintenance and mitigate risks in a timely manner.

Rotational pruning takes place between December and March, when tree disease transmission is not a concern. High priority tree work will be completed immediately. High priority situations include, hazardous trees or tree parts, sightline impediment, and failed trees on structures.

Requests for tree maintenance concerning sightline obstruction, hazard tree or tree part, and diseased trees can be made by contacting the forestry information line at ###-###-####

Hiring A Professional Arborist

Your trees are an investment. Among the many diverse benefits provided by trees are the recordable financial benefits such as increased property values. When the time comes where your trees require maintenance, be sure to hire someone who can do the job responsibly and professionally. A professional arborist will protect your investment and ensure its growth.

The City of Shorewood has a list of licensed tree care business that can be used as a starting point when hiring an arborist. When scheduling work with a tree care company, ask if a ISA Certified Arborist will be overseeing work. Although the title of ISA Certified Arborist does not always guarantee high quality, it does indicate a level of professionalism in the tree care industry. Receiving this credential from a professional organization demonstrate a willingness on the part of the arborist to stay up-to-date on the latest techniques and information. Ask for a list of references, and if possible talk to former clients. Experience, education, and a good reputation are signs of a good arborist. The following is a list of some professional organizations.

[International Society of Arboriculture](#) (ISA)

[Minnesota Society of Arboriculture](#) (MSA)

[Tree Care Industry Association](#)

Things homeowners should consider when hiring a tree care company

Be sure to deal with insured professionals only. Ask for certificates of insurance, including proof of liability for personal and property damage and workers' compensation. Contact their insurance provider to make sure the policy is current. Protect yourself against being held financially responsible if an uninsured worker is hurt on your property or damage is done to your neighbor's property.

Door-to-door solicitors offering tree work, especially those not based in the metro should not be dealt with. Improper tree care can take years to correct and may negatively affect the health of the tree.

A good tree care professional will:

- Offer a wide range of services, including pruning, removal, fertilizing, cabling/bracing, pest control and others
- Never ask you to pay in advance
- Never use climbing spikes on a healthy tree unless it is being removed from the landscape
- Never recommend "topping" a tree.
- Never be eager to remove a healthy, living tree. Tree removal is the last resort.
- Provide a written contract

Shade Tree Disease Control Program

The City's shade tree disease control program manages tree diseases such as Dutch elm disease and oak wilt on private and public property, in order to actively prepare for emerging or new threats to the community forest such as emerald ash borer. The city provides Certified Tree Inspectors who scout throughout the summer, and fit in inspection requests from homeowners.

Tree disease of concern:

[Bur Oak blight](#)

Tree insects of concern:

[Emerald ash borer](#)

[Dutch elm disease](#)

[Gypsy moth](#)

[Oak wilt](#)

[Asian longhorned beetle](#)

Caring for trees

-Tree selection

Selecting the right trees and their planting locations are the two most important decisions a homeowner can make when adding or replacing trees on their property. Trees have the potential to outlive those who plant them so the impact of this decision can last a lifetime.

Before selecting a tree, consider the following questions:

- What function will the tree serve?
- Is the location best suited for a small, medium, or large tree?
- Is there enough soil available of sufficient quality to support a mature tree?
- How will maintenance be provided as needed? Will someone water, fertilize, and prune the tree?

The mantra “right tree, right place” is often used to as a reminder of the importance of planting a tree that satisfies all of the questions above. If the planning is done before planting, trees can be an investment that continues to appreciate as they mature.

[Find your next tree!](#)

-Proper Planting

Planting correctly is important for both the short and long term health of your new tree. Improper planting and young tree neglect are the main reason newly planted trees die. After selecting the right tree for the right place, the next step is proper installation. Techniques may vary some whether your tree is balled and burlapped, containerized, or bare root but generally, the following rules about planting new trees will apply.

[Planting guide](#)

- Dig the planting hole three times the size of the root ball
- Planting hole should be no deeper than the root mass

- Back fill with dirt taken from the hole
- Do not cover stem with dirt
- Soak with water and apply mulch

-Mulching

Mulch is valuable for your trees health and care. Newly planted trees benefit greatly from mulch. Mulch insulates the soil helping to provide a buffer from heat and cold temperatures and retains water which helps keep roots moist. Mulch also plays a role in preventing soil compaction and reducing lawn mower damage by providing a barrier between turf and tree.

Properly mulching a tree is easy. First, add mulch to the base of your tree by removing any grass within a 3 to 10 foot area depending on the size of your tree. Second, pour natural mulch such as wood chips or bark pieces 2 to 4 inches deep within the circle.

-Pruning

Tree pruning often will occur throughout a trees life. Trees need to be pruned typically for one of four reasons; structure, safety, aesthetics, or clearance. Structural pruning is most important when the tree is young. Structure pruning should happen right after planting and several years thereafter. “Young tree training” is beneficial in that it corrects any structural defects the tree has early while the problems are small. If left unpruned, these structural defects can grow into large problems down the road.

Removing storm damage or a hanging limb is an example of safety pruning. After severe weather, trees are often left with broken branches hung up in their canopies that pose a safety risk for people and property. Removing these branches from trees and correcting any damage caused by storms is accomplished by pruning.

Maintaining form and clearing unsightly dead wood from trees is important for keeping up appearance. Raising a tree for pedestrian or vehicle traffic is both important for the trees health and the safety of people. Pruning for building clearance will lessen the chance of damage to buildings and trees.

-Tree pest control

Pests are a part of the landscape and need to be dealt with whenever they threaten the health or aesthetics of your trees and shrubs. Most pests will not kill whatever their feeding on so the time when pest control is necessary depends on the homeowners

damage threshold. However, pests that will kill your trees such as emerald ash borer and oak wilt, must be addressed earlier for prevention. An ISA Certified Arborist will be able to offer insight on your landscape and what pest control measures are necessary.

Conclusion

Shorewood is on the right path to a sustainable urban forest. The recommendations of this report can be used to guide the City's public tree management strategy, promoting a valuable asset with numerous qualities. By strengthening its network with partners and urban forest managers, Shorewood will help to develop the relationships and resources it needs to achieve its urban forestry goals.

Shorewood has a tree population in relatively Good condition that adds to the beauty and livability of the city. 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. Keeping that in mind, Shorewood should strive to achieve the goals of this Management Plan.



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Appendix A

Estimated Costs for Each Activity			YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8		YEAR 9		YEAR 10		10-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	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost		
Dead/Dying Tree Removal	1-3"	\$25		\$0	6	\$150																	\$150	
	4-6"	\$105		\$0	22	\$2,310																	\$2,310	
	7-12"	\$220		\$0	45	\$9,900																	\$9,900	
	13-18"	\$355	15	\$5,325																			\$5,325	
	19-24"	\$525	9	\$4,725																				\$4,725
	25-30"	\$845	2	\$1,690																				\$1,690
	31-36"	\$1,140	2	\$2,280																				\$2,280
	37-42"	\$1,470	1	\$1,470																				\$1,470
43"+	\$1,850	1	\$1,850																				\$1,850	
Activity Total(s)			30	\$17,340	73	\$12,360	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	\$29,700	
Tree Inspections	Poor	\$3	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	518	\$1,554	\$15,540	
	Private Calls	\$65	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	100	\$6,500	\$65,000	
																							\$0	
																							\$0	
																							\$0	
																							\$0	
Activity Total(s)			618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	618	\$8,054	\$80,540	
Ash Removals	1-3"	\$25	1	\$25	1	\$25	1	\$25	1	\$25	1	\$25	1	\$25	1	\$25		\$0					\$125	
	4-6"	\$105	4	\$420	4	\$420	4	\$420	4	\$420	4	\$420	4	\$1,680	4	\$1,680		\$0					\$2,100	
	7-12"	\$220	38	\$8,360	38	\$8,360	38	\$8,360	38	\$8,360	38	\$8,360	38	\$8,360	38	\$8,360		\$0					\$33,440	
	13-18"	\$355	27	\$9,585		\$0	25	\$8,875	56	\$19,880	27	\$9,585	27	\$9,585	27	\$9,585		\$0						\$47,925
	19-24"	\$525	1	\$525		\$0		\$0		\$0	4	\$2,100	1	\$525	1	\$525		\$0						\$2,625
	25-30"	\$845	2	\$1,690		\$0		\$0		\$0	4	\$3,380	1	\$845	1	\$845		\$0						\$5,070
	31-36"	\$1,140	1	\$1,140		\$0		\$0		\$0	1	\$1,140	1	\$1,140	1	\$1,140		\$0						\$2,280
	37-42"	\$1,470	1	\$1,470		\$0		\$0		\$0	1	\$1,470	1	\$1,470	1	\$1,470		\$0						\$2,940
43"+	\$1,850	1	\$1,850		\$0		\$0		\$0	1	\$1,850	1	\$1,850	1	\$1,850		\$0						\$3,700	
Activity Total(s)			76	\$25,065	43	\$8,805	68	\$17,680	99	\$28,685	81	\$28,330	75	\$25,480	75	\$25,480	0	\$0	0	\$0	0	\$0	\$100,205	
Ash Treatments	1-3"	\$20		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	4-6"	\$50		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	7-12"	\$100		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	13-18"	\$160		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	19-24"	\$210	31	\$6,510	30	\$6,300	31	\$6,510	30	\$6,300	31	\$6,510	30	\$6,300	31	\$6,510	30	\$6,300	31	\$6,510	30	\$6,300	\$64,050	
	25-30"	\$270	13	\$3,510	12	\$3,240	13	\$3,510	12	\$3,240	13	\$3,510	12	\$3,240	13	\$3,510	12	\$3,240	13	\$3,510	12	\$3,240	\$33,750	
	31-36"	\$340	3	\$1,020	2	\$680	3	\$1,020	2	\$680	3	\$1,020	2	\$680	3	\$1,020	2	\$680	3	\$1,020	2	\$680	\$8,500	
	37-42"	\$400	1	\$400		\$0	1	\$400		\$0	1	\$400	1	\$400	1	\$400		\$0	1	\$400		\$0	\$2,000	
43"+	\$590		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0		
Activity Total(s)			48	\$11,440	44	\$10,220	48	\$11,440	44	\$10,220	48	\$11,440	44	\$10,220	48	\$11,440	44	\$10,220	48	\$11,440	44	\$10,220	\$108,300	
Replacement Tree Purchasing and Installation	Purchase	\$250	28	\$7,000	14	\$3,500	11	\$2,750	11	\$2,750	16	\$4,000	12	\$3,000	11	\$2,750	65	\$16,250	75	\$18,750	79	\$19,750	\$80,500	
	Instalation	\$250	28	\$7,000	14	\$3,500	11	\$2,750	11	\$2,750	16	\$4,000	12	\$3,000	11	\$2,750	65	\$16,250	75	\$18,750	79	\$19,750	\$80,500	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
								\$0		\$0		\$0		\$0		\$0		\$0		\$0			\$0	
Activity Total(s)			56	\$14,000	28	\$7,000	22	\$5,500	22	\$5,500	32	\$8,000	24	\$6,000	22	\$5,500	130	\$32,500	150	\$37,500	158	\$39,500	\$161,000	
Tree Pruning 10-Year Cycle	1-3"	\$20		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	4-6"	\$30		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0					\$0	
	7-12"	\$75		\$0	91	\$6,825	91	\$6,825	91	\$6,825	91	\$6,825	91	\$6,825	91	\$6,825	91	\$6,825	91	\$6,825	90	\$6,750	\$61,350	
	13-18"	\$120		\$0	40	\$4,800	40	\$4,800	40	\$4,800	40	\$4,800	40	\$4,800	40	\$4,800	40	\$4,800	40	\$4,800	39	\$4,680	\$43,080	
	19-24"	\$170		\$0	25	\$4,250	25	\$4,250	24	\$4,080	24	\$4,080	24	\$4,080	24	\$4,080	24	\$4,080	24	\$4,080	24	\$4,080	\$37,060	
	25-30"	\$225		\$0	18	\$4,050	35	\$7,875	18	\$4,050	18	\$4,050	18	\$4,050	17	\$3,825	17	\$3,825	17	\$3,825	17	\$3,825	\$39,600	
	31-36"	\$305		\$0	10	\$3,050	10	\$3,050	10	\$3,050	10	\$3,050	9	\$2,745	9	\$2,745	9	\$2,745	9	\$2,745	9	\$2,745	\$26,230	
	37-42"	\$380		\$0	4	\$1,520	4	\$1,520	4	\$1,520	4	\$1,520	4	\$1,520	4	\$1,520	4	\$1,520	4	\$1,520	3	\$1,140	\$13,300	
43"+	\$590		\$0	3	\$1,770	3	\$1,770	3	\$1,770	3	\$1,770	3	\$1,770	3	\$1,770	2	\$1,180	2	\$1,180	2	\$1,180	\$14,160		
Activity Total(s)			0	\$0	191	\$26,265	208	\$30,090	190	\$26,095	190	\$26,095	190	\$26,095	189	\$25,790	187	\$24,975	187	\$24,975	184	\$24,400	\$234,780	
Young Tree Training Pruning	1-3"	\$20		\$0	28	\$560	42	\$840	53	\$1,060	36	\$720	38	\$760	39	\$780	39	\$780	88	\$1,760	151	\$3,020	\$10,280	
	4-6"	\$30		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0				\$0		
	7-12"	\$75		\$0		\$0		\$0		\$0		\$0		\$0		\$0		\$0				\$0		
Activity Total(s)			0	\$0	28	\$560	42	\$840	53	\$1,060	36	\$720	38	\$760	39	\$780	39	\$780	88	\$1,760	151	\$3,020	\$10,280	
1% Natural Mortality Removals *	Removals	\$355	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	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	\$0	0	\$0	0	\$0	0	\$0	0	\$0	\$0	
Activity Grand Total			828	\$75,899	1,025	\$73,264	1,006	\$73,604	1,026	\$79,614	1,005	\$82,639	989	\$76,609	991	\$77,044	1,018	\$76,529	1,091	\$83,729	1,155	\$85,194	\$784,125	
Cost Grand Total				\$75,899		\$73,264		\$73,604		\$79,614		\$82,639		\$76,609		\$77,044		\$76,529		\$83,729		\$85,194	\$784,125	

*Removal Costs for Natural Mortality is based on the average inventoried tree size

Appendix B

Recommended Trees for Southeast Minnesota (Conifers)

Species	Height (feet)	Width (feet)	Shape	Fall Color	Street use?	Under utility lines?		Shade Tolerance	Notable Flower	Notable Cone	Other Notes
						Yes	No				
Cedar, white [<i>Thuja occidentalis</i>]	15+	6+	Pyramidal	Green	No	Yes	Partial	No	No	Yes	Native to Blufflands and Twin Cities Highlands. Cultivars: 'Techny', 'Brandon'. Native to all of Southeast Minnesota. Tolerates hot and dry sites, produces a cone that looks like a blue-green berry. Cultivar: 'Canaertii'.
Cedar, red [<i>Juniperus virginiana</i>]	15+	6+	Pyramidal	Green	No	Yes	No	No	No	Yes	Native to Blufflands and Anoka Sand Plain. Not very drought/heat tolerant.
Fir, balsam [<i>Abies balsamea</i>]	40+	20+	Pyramidal	Green	No	No	Yes	No	No	Yes	Native to Blufflands and Anoka Sand Plain. Not very drought/heat tolerant.
Fir, white [<i>Abies concolor</i>]	30+	20+	Pyramidal	Green/Blue	No	No	Partial	No	No	Yes	Good fir for the urban landscape; more tolerant of heat and drought, but not heavy soils. A better fit than balsam for the southern part of the state; requires more moisture and nutrients than white.
Fir, fraser [<i>Abies fraseri</i>]	30+	20+	Pyramidal	Green/Blue	No	No	No	No	No	Yes	Does best in south half of the region.
Douglas-Fir [<i>Pseudotsuga menziesii</i> var. <i>glauca</i>]	40+	20+	Pyramidal	Green	No	No	No	No	No	Yes	Native to all areas of Southeast Minnesota except the Rochester plateau.
Larch, American [<i>Larix laricina</i>]	40+	20+	Pyramidal	Yellow	Sometimes ¹	No	No	No	No	Yes	
Larch, European [<i>Larix decidua</i>]	40+	20+	Pyramidal	Yellow	Sometimes ¹	No	No	No	No	Yes	
Larch, Japanese [<i>Larix kaempferi</i>]	40+	20+	Pyramidal	Yellow	Sometimes ¹	No	No	No	No	Yes	
Larch, Siberian [<i>Larix sibirica</i>]	40+	20+	Pyramidal	Yellow	Sometimes ¹	No	No	No	No	Yes	
Pine, eastern white [<i>Pinus strobus</i>]	40+	20+	Pyramidal	Green	No	No	No	No	No	Yes	Native to Blufflands and Anoka Sand Plain. A novelty tree; due to its irregular growth habit; does better than many other trees in poor, sandy soils.
Pine, jack [<i>Pinus banksiana</i>]	35+	25+	Irregular	Green	No	No	No	No	No	Yes	Native to Anoka Sand Plain and Twin Cities Highlands. The Minnesota state tree.
Pine, red (Norway) [<i>Pinus resinosa</i>]	40+	25+	Pyramidal	Green	No	No	No	No	No	Yes	
Pine, ponderosa [<i>Pinus ponderosa</i>]	40+	25+	Pyramidal	Green	No	No	No	No	No	Yes	
Pine, Scots [<i>Pinus sylvestris</i>]	30+	25+	Irregular	Green/Blue	No	No	No	No	No	Yes	Unique shape as it gets older; orange bark.
Spruce, black [<i>Picea mariana</i>]	30+	15+	Pyramidal	Green	No	No	Partial	No	No	Yes	Native to all of Southeast Minnesota.
Spruce, Black Hills [<i>Picea glauca</i> var. <i>densata</i>]	40+	20+	Pyramidal	Green	No	No	No	No	No	Yes	Better heat and drought tolerance than some other spruces.
Spruce, Norway [<i>Picea abies</i>]	40+	20+	Pyramidal	Green	No	No	No	No	No	Yes	Needs wind protection; large, showy cones.
Spruce, white [<i>Picea glauca</i>]	40+	20+	Pyramidal	Green	No	No	No	No	No	Yes	Native to Blufflands and Anoka Sand Plain. Avoid hot, dry sites.

¹ All larches may be considered for street use, particularly in tough sites. They are deciduous conifers (losing their needles in the autumn), which creates a rather coarse winter habit. Japanese larch is the least winter hardy; American larch does the best on wet sites; European larch has the most refined growth habit; Siberian larch is an excellent shelterbelt/windbreak tree.

Recommended Trees for Southeast Minnesota (Conifers)

Other Notes

Species

Cedar, white [Thuja occidentalis]

Native to Blufflands and Twin Cities Highlands. Cultivars: 'Techny', 'Brandon'.

Cedar, red [Juniperus virginiana]

Native to all of Southeast Minnesota. Tolerates hot and dry sites; produces a cone that looks like a blue-green berry.

Fir, balsam [Abies balsamea]

Cultivar: 'Canaerti'.

Native to Blufflands and Anoka Sand Plain. Not very drought/heat tolerant.

Fir, white [Abies concolor]

Good fir for the urban landscape; more tolerant of heat and drought, but not heavy soils.

Fir, fraser [Abies fraseri]

A better fit than balsam for the southern part of the state; requires more moisture and nutrients than white.

Douglas-Fir [Pseudotsuga menziesii var. glauca]

Does best in south half of the region.

Larch, American [Larix laricina]

Native to all areas of Southeast Minnesota except the Rochester plateau.

Larch, European [Larix decidua]

Larch, Japanese [Larix kaempferi]

Larch, Siberian [Larix sibirica]

Pine, eastern white [Pinus strobus]

Native to Blufflands and Anoka Sand Plain. A novelty tree, due to its irregular growth habit; does better than many other trees in poor, sandy soils.

Pine, jack [Pinus banksiana]

Pine, red (Norway) [Pinus resinosa]

Native to Anoka Sand Plain and Twin Cities Highlands. The Minnesota state tree.

Pine, ponderosa [Pinus ponderosa]

Unique shape as it gets older; orange bark.

Pine, Scots [Pinus sylvestris]

Native to all of Southeast Minnesota.

Spruce, black [Picea mariana]

Better heat and drought tolerance than some other spruces.

Spruce, Black Hills [Picea glauca var. densata]

Needs wind protection; large, showy cones.

Spruce, Norway [Picea abies]

Native to Blufflands and Anoka Sand Plain. Avoid hot, dry sites.

Spruce, white [Picea glauca]

¹ All larches may be considered for street use, particularly in tough sites. They are deciduous conifers (losing their needles in the autumn), which creates a rather coarse winter habit. Japanese larch is the least winter hardy; American

Recommended Trees for Southeast Minnesota (Deciduous)

Species	Other Notes
Alder, European black [<i>Alnus glutinosa</i>]	
Alder, Manchurian [<i>Prunus americana</i> var. <i>Mandschurica</i>]	
Birch, paper [<i>Betula papyrifera</i>]	Cultivars: 'Sungold', 'Moongold', 'Manchu'. May need winter protection from rabbits.
Birch, river [<i>Betula nigra</i>]	Native to all of Southeast Minnesota. Performs best where root system is cool and shaded, and free from grass competition. Attractive, exfoliating white bark. Native to the Blufflands and Twin Cities Highlands. Use single stemmed for street use. Bark is attractive, exfoliating, copper colored. Common birch is recommended. Cultivars: 'Heritage'.
Buckeye, Ohio [<i>Aesculus glabra</i>]	
Burning Bush [<i>Euonymus alata</i>]	Salt tolerant. Red fall color develops best in full sun. Interesting corky bark. May need winter protection from rabbits.
Catalpa, northern [<i>Catalpa speciosa</i>]	Intermediate salt tolerance. Due to messy fruit, a better tree for parks than most streets.
Cherry, sour [<i>Prunus cerasus</i>]	Cultivars: 'North Star', 'Meteor'. Fruit may cause problems if near pavement. All cherries may need winter protection from rabbits.
Cherry, Amur choke [<i>Prunus maackii</i>]	Has potential as a street tree where budgets allow for early and frequent formative pruning. Probably better as a park tree. A very attractive, red-copper, peeling bark. All cherries may need winter protection from rabbits.
Cherry, black [<i>Prunus serotina</i>]	Native to all of Southeast Minnesota. All cherries may need winter protection from rabbits.
Coffeetree, Kentucky [<i>Gymnocladus dioica</i>]	Native to all of Southeast Minnesota. Female trees produce pods, but male trees do not. Late to leaf out in spring.
Coffeetree, Espresso [<i>Gymnocladus dioica</i> 'Espresso']	
Coffeetree, Stately Manor [<i>Gymnocladus dioica</i> 'Stately Manor']	
Corktree, Amur [<i>Phellodendron amurense</i>]	
Corktree, Sakhalin [<i>Phellodendron sachalinensis</i>]	Sakhalin is more difficult to find, but a better landscape tree due to its upright habit.
Corktree, Mancho [<i>Phellodendron amurense</i> 'Mancho']	Performs well in poor soils. Male cultivar so no fruit.
Corktree, Shademaster [<i>Phellodendron amurense</i> 'Shademaster']	More compact size. All the other attributes of corktree.
Corktree, His Majesty [<i>Phellodendron amurense</i> 'His Majesty']	Excellent boulevard tree. More upright than 'Mancho' or the spacies.
Crabapple [Malus]	Cultivars: 'Adams', 'Calocarpa', 'David', 'Donald Wyman', 'Dolgo', 'Harvest Gold', 'Pralinefire', 'Professor Sprenger'. Due to the many varieties of crabapples available, you can almost customize the tree to the site. Select a variety that is disease tolerant, slower growing, and non-suckering. Because of the maintenance involved with crabapples, many of the varieties are best suited for parks; these cultivars may be considered for street use, however. All crabapples may need winter protection from rabbits.
Dogwood, Pagoda [<i>Cornus alternifolia</i>]	Native to all of Southeast Minnesota.
Eastern Wahoo [<i>Euconymus atropurpureus</i>]	Native to all of Southeast Minnesota. Fall color develops best in full sun. May need winter protection from rabbits.
Elm, 'Cathedral' [<i>Ulmus pumila</i> hybrid]	
Elm, 'Accolade' [<i>Ulmus japonica</i> hybrid]	
Elm, 'Patriot' [<i>Ulmus wilsoniana</i> hybrid]	Upright grower; excellent resistance to DED; fast grower.
Elm, 'New Horizon' [<i>Ulmus pumila</i> hybrid]	Excellent resistance to DED; fast grower; very cold hardy.
Elm, 'Princeton' [<i>Ulmus americana</i> 'Princeton']	Good resistance to DED; been around a long time; looks like an American elm.
Elm, 'Valley Forge' [<i>Ulmus americana</i> 'Valley Forge']	Excellent resistance to DED; looks like an American elm.
Elm, Javan Japanese [<i>Ulmus japonica</i> selection]	These elms are Dutch Elm Disease resistant, and have a shape similar to American elm.
Ginkgo [<i>Ginkgo biloba</i>]	Female trees produce a foul-smelling fruit. Deciding salt tolerant. Cultivars: 'Autumn Gold' is a male and produces no fruit.
Hackberry [<i>Celtis occidentalis</i>]	Native to all of Southeast Minnesota. Interesting corky bark. Does better than many other trees in alkaline soils. Sensitive to spray salt. Common hackberry is recommended over cultivars.
Hawthorn, thornless cockspur [<i>Crataegus crusgalli</i> var. <i>hermsii</i>]	
Hawthorn, downy [<i>Crataegus mollis</i>]	May need winter protection from rabbits.
Hickory, shagbark [<i>Carya ovata</i>]	Native to all of Southeast Minnesota.
Hickory, bitternut [<i>Carya cordiformis</i>]	Native to Oak, Savannah and Blufflands.
Honeylocust, thornless [<i>Gleditsia triacanthos</i> var. <i>inermis</i>]	Native to all of Southeast Minnesota.
Hop Tree [<i>Ptelea trifoliata</i>]	Native to all of Southeast Minnesota. Fruit pods occur on female trees. Cultivars: 'Shademaster', 'Skyline', 'Summerlace'.
Hophornbeam (ironwood) [<i>Ostrya virginiana</i>]	This tree does well in wet-sites, as well as drained sites.
Ilac, Japanese tree [<i>Syringa reticulata</i>]	Native to all of Southeast Minnesota. Very strong-wooded and tough tree for the landscape; it needs watering during dry summers, though.
Linden, (littleaf) [<i>Tilia cordata</i>]	
Linden, Crimean [<i>Tilia x euhrata</i>]	
Linden, American [<i>Tilia americana</i>]	
Linden, Redmond [<i>Tilia hybrid</i>]	
Maackia, Amur [<i>Maackia amurensis</i>]	Cultivars: 'Ivory Silk', 'Summergreen'. Bark has attractive lenticels. Deciding salt tolerant.
Magnolia, cucumbar tree [<i>Magnolia acuminata</i>]	All lindens are sensitive to delicing salt.
Maple, Amur [<i>Acer ginnala</i>]	Drought tolerant, and soil pH adaptable. Sensitive to delicing salt run-off.
Maple, red [<i>Acer rubrum</i>]	
Maple, Freeman [<i>Acer saccharinum</i> x <i>A. rubrum</i>]	Can spread. Do not plant near natural areas. Select a cultivar for better foliage, summer and autumn. May need winter protection from rabbits.
Maple, Shantung [<i>Acer truncatum</i>]	Native to Big Woods, Anoka Sand Plain, Twin Cities Highlands, and Blufflands. Cultivars: 'Northwood', 'Oblong' are worth a try. Common maple is recommended over cultivars.
Maple, tatarian [<i>Acer tataricum</i>]	This hybrid probably occurs naturally where silver maple and red maple grow together.
Maple, sugar [<i>Acer saccharum</i>]	May be invasive near natural areas.
Maple, 'Senna Glen' [<i>Acer x freemanii</i> 'Senna']	Native to all of Southeast Minnesota. Common sugar maple from a nearby seed source recommended over cultivars.
Mountain ash, Korean [<i>Sorbus altilifolia</i>]	Best Freeman maple for form. Excellent performance on urbanized soils/sites.
Oak, white [<i>Quercus alba</i>]	Sorbus is tolerant of delicing salt spray.
Oak, bur [<i>Quercus macrocarpa</i>]	Native to all of Southeast Minnesota. More oak will resistant than red oaks; tolerates partial shade when young.
Oak, bicolor [<i>Quercus bicolor</i>]	Native to all of Southeast Minnesota. More oak will resistant than red oaks; one of the best trees for urban sites.
Oak, black [<i>Quercus velutina</i>]	Native to all of Southeast Minnesota. More oak will resistant than red oaks; needs an acidic-neutral soil; adapts better than other oaks to heavy/wet soils.
Oak, red [<i>Quercus rubra</i>]	Native to Blufflands. Susceptible to oak wilt.
Oak, northern pine [<i>Quercus ellipsoidalis</i>]	Native to all of Southeast Minnesota. Susceptible to oak wilt.
Pear, Ussurian [<i>Pyrus ussuriensis</i>]	Fruit is not edible. Very cold hardy. Cultivar: 'Princess Diana'.
Serviceberry, Allegheny [<i>Amelanchier laevis</i>]	Native to all of Southeast Minnesota. Susceptible to oak wilt; prefers acidic soils.
Serviceberry, downy [<i>Amelanchier arborea</i>]	Native to Blufflands.
Yulonium, nannyberry [<i>Viburnum lentago</i>]	Native to all of Southeast Minnesota. Cultivars: 'Cumulus', 'Princess Diana', 'Autumn Brilliance'. Tolerant of spray salt.

in lawn or park settings, and in groups, rather than specimens in fully exposed boulevard settings. Planting with the root collar at ground line is

Appendix C

City Forester Duties and Forestry Program

(A) *Position created.* (Declared person) shall be the Forester. The powers and duties as set forth in this subchapter are hereby conferred upon the Forester or his or her duly authorized agent.

(B) *Duties.* It is the duty of the City Forester to coordinate, under the direction and control of the Council, all activities of the city relating to the control and prevention of insect-infested and diseased trees, including but not limited to, emerald ash borer, Dutch elm, and oak wilt diseases. The Forester shall recommend to the Council the details of a program for the control of insect-infested and diseased trees, and perform the duties incidental to a program adopted by the Council, and other duties as provided by this chapter.

The forestry program shall provide for inspection of trees on public and private property for the purposes of enforcement of applicable sections of this code.

Maintenance and Removal of Trees

(A) *Duties.* The city shall have the right to maintain and/or remove trees while performing maintenance duties within any public right-of-way or easement. Maintenance duties shall include, but are not limited to, sidewalk, path, utility and street maintenance and/or repair. The city shall notify property owners adjacent to trees that may be impacted by the performing of maintenance duties. In cases of emergency maintenance within a public right-of-way or easement, the city shall attempt to contact adjacent property owners when trees may have to be maintained and/or removed, but shall also consider the general health, safety and welfare of the community with respect to hazards that may exist.

(B) *Charges for services.* The city may charge the abutting property owner or legal possessor the cost incurred by the city for maintenance and/or removal of trees located within any right-of-way or easement. Any charges not paid within 30 days of the due date stated on the city's invoice shall be deemed delinquent and subject to collection as a special assessment to be collected in accordance with (Code).

(C) *Removal of hazard tree.* Any hazard tree on any private property, which if it fell may land within any public right-of-way or property owned by another person or entity, shall be removed immediately and in no case more than 15 days after being served notice by the city to remove the tree. Any such tree shall be deemed a public safety hazard and public nuisance and subject to the provisions for special charges assessment as set forth in division (B) herein.

Tree Work License

(A) *License required.* It shall be unlawful for any person to conduct as a business the cutting, trimming, pruning, removal, spraying or otherwise treating of trees in the city without first having secured a license from the city to conduct the business.

(B) *Application; fee and expiration.*

(1) Application for a license shall be made at the office of the City Clerk.

(2) The application for a license shall be made at the office of the City Clerk.

(3) The annual fee for the license shall be in the specified amount.

(4) All licenses issued under the provisions of this chapter shall expire on December 31 following the date of issue.

(C) *Liability insurance.* No license or renewal shall be granted, nor be effective, until the applicant files with the City Clerk proof of a public liability insurance policy covering all operations of the applicant hereunder for the sum of at least \$300,000 combined single limit coverage. The policy shall provide that it may not be canceled by the insurer, except after ten days written notice to the city, and if the insurance is so canceled and the licensee fails to replace the same with another policy conforming to the provisions of this section, the license shall be automatically suspended until the insurance shall have been replaced.

(D) *Conformance required.* All contractors licensed under the requirements of this section shall conform with the abatement methods as prescribed by this subchapter, as they relate to emerald ash borer infestation, and Dutch elm and oak wilt diseases.

(E) *Revocation of license.* Failure to comply with any part of the tree treating license shall be grounds for revocation of the license by the City Council, following a public hearing. Written notice of the public hearing shall be mailed at least ten days prior to the hearing to the current holder of the license. The notice should outline the violation(s) considered by the city to be grounds for revocation and inform the current holder of the license of the opportunity to be heard at the public hearing.

(F) *Chemical treatment requirements.* Applicants, who propose to use chemical substances in any activity related to treatment or control of insect-infested and diseased trees, shall file with the City Clerk proof that the applicant or employee of the applicant administering treatment has been certified by the Agronomy Division of the state department of agriculture as a "commercial pesticide applicator." Certification shall include knowledge of tree disease or insect infestation chemical treatment.

Minimum Height of Tree Limbs

All limbs of trees or portions of limbs which overhang public streets, sidewalks or paths and are less than ten feet above the surface of any public sidewalk or path or are less than 13 feet above the surface of any public street constitute a nuisance and are prohibited. When limbs of a tree overhang both a public sidewalk and a public street, they shall be trimmed to a height of 13 feet above the surface of the street. This section shall not apply to any tree to which pruning or trimming would endanger the tree's health as determined by the city, unless a public nuisance exists.

Right of Way Trees

- (A) *Right of Way Tree Planting.* Trees and shrubs shall not be planted within the public right of way and easements unless otherwise approved with new developments with homeowners association responsibilities for tree maintenance as defined by development agreement. Trees and shrubs shall not be planted within a distance of 15 feet from the edge of a public roadway where easement or right of way is not dedicated, or recorded. Trees and shrubs shall not be planted in locations where conflicts may arise with vehicle driver sight lines to traffic, as determined by the Engineer.
- (B) *Managing the Right of Way.* Homeowners are responsible for maintaining and mowing the right of way. Trees and shrubs currently growing within the right of way will be maintained by the City.
 - (1) No person can obstruct, excavate, remove or destroy vegetation in the right of way without first obtaining a permit from the City.
- (C) *Vegetative Screening.* Trees and shrubs used for screening shall be planted at least 10 feet behind the right of way. Screens using trees and shrubs shall be designed so that they are architecturally harmonious with the principle structures on the site and they shall be properly maintained so as not to become unsightly or hazardous.

Shade Tree Disease Regulation

- (A) *Declaration of policy.* The Council has determined that the health of ash, elm and oak trees within the municipal limits are threatened by insect infestation known as emerald ash borer, and fatal diseases known as Dutch elm and oak wilt. It has further been determined that the loss of ash, elm and oak trees growing upon public and private property would substantially depreciate the value of property within the city, and may impair the health, safety and general welfare of the public. It is declared to be the intention of the Council to control the spread of insect infestation and diseases affecting trees, and this section is enacted for that purpose.
- (B) *Insect and disease control programs; coordinator.* It is the intention of the Council to conduct a program of plant pest and disease control pursuant to the authority granted by

(Code), as amended. The program is directed specifically at the control and elimination of the emerald ash borer, Dutch elm disease fungus, elm bark beetles and oak wilt fungus, and is undertaken at the recommendation of the Minnesota Department of Agriculture, the Minnesota Department of Natural Resources and the University of Minnesota Extension.

(C) *Nuisance declared.* The following shall constitute a public nuisance:

(1) Any living or standing elm tree or part thereof infected to any degree with the Dutch elm disease fungus *Ophiostoma Ulmi*, or which harbors any of the elm bark beetles *Scolytus Multistriatus* (Eichh.) or *Hyluigopinus Rufipes* (Marsh);

(2) Any living or standing red oak tree or part thereof infected to any degree with the oak wilt fungus *Ceratocystis Fagacearum*;

(3) Any dead elm or red oak tree or part thereof, including logs, branches, stumps, firewood or other elm or oak material from which the bark has not been removed or sprayed with an effective elm bark beetle insecticide or oak wilt fungus deterrent; or

(4) Any living or standing ash tree, or any part thereof, harboring or infested with emerald ash borer beetles or larvae or eggs thereof (*Agrilus planipennis*); or any dead ash tree or part thereof, including logs, branches, stumps, firewood, or other ash tree material from which the bark has not been removed or sprayed with effective emerald ash borer insecticide.

(D) *Inspection and investigation.*

(1) *Annual inspection.* The City Forester or assignee shall inspect all premises within the city, annually or as often as practicable, to determine whether any condition exists which is in violation of this chapter. The Forester shall investigate all repeated incidents of tree disease.

(2) *Entry on private premises.* The Forester or assignee may enter upon private premises at any reasonable time for the purpose of carrying out any of the duties assigned.

(3) *Diagnosis.* In determining tree disease or insect infestation, the Forester shall use current technical procedures.

(E) *Nuisance abatement methods.* In abating any public nuisance as defined in this section, the Forester shall cause the infected tree or wood to be sprayed, removed or otherwise effectively treated so as to destroy and prevent the spread of emerald ash borer, Dutch elm disease fungus, elm bark beetles, oak wilt fungus or other regulated tree disease. Any abatement shall be carried out in the following manner:

(1) In trees infected with Dutch elm disease that have the potential to spread the disease, any portion of the tree larger than two inches in diameter shall have the bark removed, chipped or covered with at least four mil plastic, making a tight seal to the ground, until the bark falls off.

(2) Pre-sporulating red oak wood, infected with oak wilt fungus, that is larger than two inches in diameter shall have the bark removed, chipped or covered with at least four mil plastic, making a tight seal to the ground, until the bark falls off.

(3) All ash tree wood must be chipped into pieces no larger than one inch diameter.

(4) Other current technical procedures which are accepted by such agencies as the Minnesota Department of Agriculture, the Minnesota Department of Natural Resources or the University of Minnesota may be utilized with city approval.

(F) *Procedure for removal of infected trees and wood.* Whenever the Forester finds that infestation or disease exists in any tree or wood in any public or private place in the city, the Forester shall proceed as follows:

(1) If the Forester finds that danger of insect infestation or spread of tree disease is imminent, the Forester may order any treatment or tree removal determined to be necessary to abate the nuisance.

(2) In all other cases, prior to any treatment or removal, the Forester shall cause written notice of proposed actions to be sent by regular mail or personally delivered to the occupant or the owner of the premises. Failure to give notice shall not invalidate the city's actions. The Forester may order any treatment or tree removal determined necessary to abate the nuisance.

(G) *Payment for abatement.* Any costs incurred by the city in connection with the city's abatement of any diseased tree, as permitted in this section, shall be the responsibility of the property owner. The city may charge the property owner or legal possessor the cost incurred by the city in connection with the abatement of any diseased tree. Any charges not paid by the property owner or legal possessor within 30 days of the due date stated on the city's invoice shall be deemed delinquent and subject to collection as a special assessment, which shall be collected in accordance with (Code).

(H) *Transporting of infected ash, elm or oak wood.* It is unlawful for any person to transport within the city any infected, bark-bearing ash, elm or oak wood determined to be a nuisance by the Forester. The Forester shall grant permission for the transportation of the wood only when the purpose of this chapter is served.

(I) *Unlawful acts.* A violation of this section is declared to be a public nuisance and it is unlawful for any person to permit the public nuisance to remain on any property owned or controlled by the person within the city. All public nuisances may be abated by the city and the costs thereof assessed against the property as prescribed in the code.

Tree Preservation

(A) *Tree removal and replacement.* Removal or loss of significant trees shall be in accordance with the city-approved tree preservation component of the natural resources management plan. All significant trees on the property, as identified in the tree preservation component of the plan, shall be tagged with the coordinating number as stated in the plan before any project work begins and shall remain tagged until completion of the project. Tree removal and replacement shall be as follows:

(1) For individual lot development for commercial, industrial, and institutional uses, 10% of the total number of diameter inches of significant trees removed must be replaced with caliper inches within the subject lot. Trees replaced under this requirement may be used to satisfy part of the landscape requirement for the lot;

(2) For individual lot development for residential use, when tree removal that occurs within the building footprint, impervious surface areas (such as driveways and sidewalks), or within 20 feet of foundation walls and:

(a) Exceeds six significant trees, replacement shall consist of a maximum of 12 caliper inches, located on the subject lot; or

(b) Consists of six significant trees or less, replacement shall consist of a minimum of two caliper inches for every significant tree removed, located on the subject lot;

(3) When tree removal occurs more than 20 feet outside the foundation walls, replacement shall be a minimum of two caliper inches for every significant tree removed, located on the subject lot; and

(4) For all projects not covered by divisions (1), (2) and (3) above including, but not limited to, subdivision grading, 10% of the total number of diameter inches of significant trees removed must be replaced with caliper inches within the subdivision. Trees replaced under this requirement may be used to satisfy part of any landscape plan requirements under this code.

(B) *Size, types, diversification of replacement trees.* No more than one-third of the replacement trees shall be of the same species of tree, without approval of the city. Box elder, poplar, willow and silver maple are not permitted as replacement trees. Replacement trees must be no less than the following sizes:

(1) Deciduous trees shall be no less than two caliper inches; and

(2) Coniferous trees shall be no less than six feet high.

(C) *Time to perform.* Replacement trees shall be planted prior to the expiration of the permit or within 30 days of completion of all construction on the property, whichever first occurs, unless otherwise approved by the city for reasons of time of planting season. The applicant shall

inform the city when all replacement trees have been planted in order that the city may inspect the subject property for compliance with the tree preservation component.

(D) *Quality of replacement trees.* Replacement trees shall be healthy stock, free of insects and disease and meet the guidelines set by the American Standards of Nursery Stock.

(E) *Violation of natural resources management plan-Tree Preservation Component.* The applicant shall comply with the following requirements if any loss of any significant tree, as defined herein, occurs in violation of the city-approved tree preservation component of the natural resources management plan for the subject property:

(1) Replace the diameter inches of the significant tree lost with equal caliper inches in accordance with division (B) of this section; and

(2) Any loss of a significant oak tree shall be replaced by an oak tree and the location of the replacement oak tree shall be determined by the city.

(F) The applicant shall comply with the foregoing requirements upon a 30-day written notice by the city of the loss of a significant tree in violation of the city-approved tree preservation component of the natural resources management plan.

Nuisance Tree Declaration

(A) Any living or standing elm tree or part thereof infected to any degree with the Dutch elm disease fungus, *Ceratocystis ulmi* (Buisman) Moreau, or which harbors any of the elm bark beetles, *Scolytus multistriatus* (Eichh.) or *Hylurgopinus rufipes* (Marsh).

(B) Any bark intact, dead or dying elm tree or part thereof, or an elm wood including, but not limited to, logs, branches greater than two inches in diameter, stumps, roots, firewood or other elm material, which has not been stripped of its bark and burned, or sprayed with an effective elm bark beetle insecticide that poses a threat, as determined by city forester, of harboring or acting as a breeding site for the elm bark beetles, *Scolytus multistriatus* (Eichh.) or *Hylurgopinus rufipes* (Marsh).

(C) Any living or standing oak tree or part thereof infected to any degree with the oak wilt fungus, *Ceratocystis fagacearum*, that has been determined by the city forester to pose a threat of overland transmission of the fungus to other oak trees. To reduce incidents of overland or long range spread of oak wilt fungus and to prevent oak wilt fungus from producing spores during the hazardous spring period.

(D) Any bark intact dead or dying oak tree or part thereof, or an oak tree wood including, but not limited to, logs, branches greater than two inches in diameter, stumps, roots, firewood, or other oak material, which has not been stripped of its bark and burned, or sprayed with an effective fungicide that poses a threat, as determined by city forester, of

harboring or acting as a breeding site for the oak wilt fungus, *Ceratocystis fagacearum*. Any tree that wilted from oak wilt in July or August of one year may be declared a nuisance for the spring of the following year as determined by the city forester. The hazardous spring period for overland or long range spread of oak wilt fungus is hereby defined as April 15 to July 1. Dead standing wood or tree material of the red oak group that has advanced beyond the potential for spore production is not considered a nuisance unless it constitutes a hazard to life and/or property. The red oak group is defined as, including but not limited to, Northern red oak, Northern pin oak, black oak, scarlet oak, Eastern pin oak, red oak, pin oak.

- (E) Any tree considered in the opinion of the city forester to pose eminent danger to life or property to adjoining properties. Trees of such condition will be determined hazardous.
- (F) It shall be unlawful for any person to permit any public nuisance to remain on any premises owned or controlled by such person within the city. Such nuisances may be abated in the manner prescribed by this article.

Inspections and Investigations

- (A) *Inspections.* The city forester shall inspect as often as necessary all public and private places within designated control areas of the city which might harbor plant pests, to determine whether a public nuisance exists. The city forester shall investigate all reported incidents of infection or infestation by the Dutch elm fungus, elm bark beetles, oak wilt fungus, or any other epidemic diseases or insect infestation of shade trees. The term "private place" means every place except the private home.
- (B) *Right of entry.* The city forester or the city forester's duly authorized agents may enter upon all public and private places at any reasonable time for the purposes of carrying out any of the duties assigned in this section.
- (C) *Disease determination.* Whenever possible, diagnosis will be based upon accepted field symptoms. The city forester and/or city forester's duly authorized agents may, upon finding indications of oak wilt or Dutch elm disease take such steps as may be appropriate to confirm the diagnosis. These steps may include analysis of twig and stem samples from trees, or parts thereof, suspected of being infected. Laboratory isolation and confirmation of the presence of the fungi will be done by the state department of agriculture disease diagnosis laboratory or other laboratories capable of performing such services approved by the state commissioner of agriculture. Except as provided in this section, no action to remove infected trees or wood shall be taken until there has been a positive diagnosis.

Abuse or Mutilation of Public Trees

- (A) Unless specifically authorized by the city forester, no person shall intentionally damage, cut, carve, transplant, remove any tree, attach any rope, wire, nails, advertising poster, or other contrivance to any tree, allow any gaseous liquid, or solid substance which is harmful to come

in contact with any tree, or set fire or permit any fire to burn when the heat could injure any portion of any tree, or top a tree by severely cutting back the tree canopy to a stub.

TREE PRESERVATION AND REPLACEMENT POLICY

CITY OF SHOREWOOD

I. **Purpose.** It is the policy of the City of Shorewood to recognize and preserve existing natural resources of the community. In its effort to maintain the wooded character of the area, the City finds that trees provide numerous benefits including, but not limited to: stabilization of the soil by the prevention of erosion and sedimentation, reduction of storm water runoff, improvement of air quality, reduction of noise pollution, control of urban heat island effect, protection and increase of property values, protection of privacy, energy conservation through natural insulation, providing habitat for birds and other wildlife and conservation and enhancement of the city's physical and aesthetic environment.

The purpose of this policy is to preserve and protect significant trees or stands of trees whose loss due to land disturbances associated with the process of development or construction would adversely affect the character of neighborhoods, subdivisions, public or semipublic projects and commercial developments. This policy also recognizes that, despite the best efforts of the City and property owners, trees may occasionally be lost in the development or construction process. In those cases tree replacement or reforestation shall be required.

II. **Applicability.** This policy shall apply to any person or entity that would disturb land areas and impact significant trees or stands of trees in neighborhoods, subdivisions, commercial building developments, public and semipublic projects such as streets, utilities and parks whether disturbed by a public agency or private developer; except when the City Council may waive these requirements where there would be greater public need for the project than to meet the requirements of this policy. The terms and provisions of this Policy, in conjunction with the Shorewood Tree Preservation Ordinance No. 324, shall apply to all activity which requires the issuance of a Land Disturbance Permit.

III. **Definitions.** All words in this Policy have their customary dictionary definition except as specifically defined herein. The word "shall" is mandatory and the words "should" and "may" are permissive. Technical terms used in this Policy are defined in Appendix A.

Buildable Area: The portion of a lot which is not located within any minimum required yard, landscape strip/area, or buffer; that portion of a lot wherein a building may be located, as prescribed by the Shorewood Zoning Code.

Caliper: The American Association of Nurserymen standard for trunk measurement of nursery stock, whereby the diameter of the trunk is measured 6 inches above ground for stock up to 4 inches in caliper size.

DBH (Diameter-at-Breast-Height): A standard measure of tree size, whereby a tree trunk diameter is measured in inches at a height of four and one-half feet (4 1/2') above

ground. If a tree splits into multiple trunks below four and one-half feet (4 1/2'), then the trunk is measured at its most narrow point beneath the split.

Dripline: A vertical line extending from the outer surface of a tree's branch tips down to the ground.

Land Disturbance Permit: An official authorization issued by the Zoning Administrator, allowing defoliation or alteration of the site for the commencement of any construction.

Protection Zone: All lands that fall outside the buildable area of a parcel.

Significant Trees: Any healthy long-lived hardwood deciduous tree measuring eight inches (8") DBH or greater; any healthy softwood deciduous tree measuring twelve inches (12") DBH or greater; or any healthy coniferous tree measuring eight feet (8') or more in height. Box-elder, cottonwood, and willow trees shall not be considered to be significant trees.

Specimen Tree or Stand: Any tree or grouping of trees which has been determined to be of a high value by the Zoning Administrator because of its species, size, age, or other professional criteria.

Structure: Anything which is built, constructed or erected; an edifice or building of any kind or any piece of work artificially built up or composed of parts jointed together in some definite manner whether temporary or permanent in character.

Tree: Any self supporting woody plant, usually having a single woody trunk, and a potential DBH of two inches (2") or more.

Tree Preservation Plan: A plan established in Section IV(B) of this Policy. See Appendices B and C.

Zoning Administrator: The agent of the City of Shorewood having the primary responsibilities of administration and enforcement of this Policy.

IV. **Procedures**

A. Development Standards. Developments shall be designed to preserve large trees where such preservation would not affect the public health, safety or welfare. The City may prohibit removal of all or part of a stand of trees. In addition, nothing in this policy shall prevent building on an existing lot of record, provided that such building shall be designed to save as many trees as possible. This decision shall be based on, but not limited to, the following criteria:

1. Size of trees.
2. Species, health and attractiveness of the trees including:

- a. Sensitivity to disease
 - b. Life span
 - c. Nuisance characteristics
 - d. Sensitivity to grading
- 3. Potential for transplanting.
 - 4. Need for thinning a stand of trees.
 - 5. Effect on the functioning of a development.
- B. Land Disturbance Permit.
- 1. A tree survey, prepared by a registered land surveyor or landscape architect, shall be submitted showing size, species and location of significant trees.
 - 2. A Tree Preservation Plan shall be submitted with the following:
 - a. Preliminary plat for the subdivision of property.
 - b. Other permit drawings as a part of the building permit process for the construction of new principal buildings.
 - c. Nonresidential site plans, either as a separate drawing or as part of the landscape plan.
 - 3. The Tree Preservation Plan shall be certified by a forester, arborist, or registered landscape architect and shall include the following information:
 - a. Identification of spatial limits:
 - (1) Limits of land disturbance, clearing, grading and trenching
 - (2) Tree protection zones
 - (3) Specimen trees or stands of trees
 - (4) Location of significant trees which will be saved
 - (5) Location of significant trees which will be removed
 - (6) Location of trees to be transplanted
 - (7) Location of replacement trees
 - b. Detail drawings of tree protection measures as provided for in Section VI. of this Policy (where applicable):
 - (1) Protective tree fencing
 - (2) Tree protection signs

c. Drawings indicating location of applicable utilities:

- (1) City water or well
- (2) City sewer
- (3) Electricity
- (4) Gas
- (5) Cable TV
- (6) Telephone

4. These plans shall be reviewed by the Zoning Administrator for conformance with this Policy, in conjunction with the Shorewood Tree Preservation Ordinance No. 324, and will either be approved, or returned for revisions. Reasons for denial shall be noted on the Tree Preservation Plan, or otherwise stated in writing.
5. Issuance of the Land Disturbance Permit is contingent upon approval of preliminary plats, or metes and bounds subdivision approval for the subdivision of property, or approval of the Tree Preservation Plan for other building permit processes or nonresidential site plans.
6. A fee as provided in Chapter 1302 of the City Code shall be charged for review of Tree Preservation Plans. Any costs incurred by the City in reviewing plans for plats and nonresidential site plans shall be charged to the developer. The Zoning Administrator may submit the plan to a consulting forester for a recommendation, the costs of which shall be paid by the developer or builder.
7. All tree protection measures shall be installed prior to beginning building construction and inspected by the Zoning Administrator or his agent.
8. The Zoning Administrator or his agent will conduct follow-up site inspections for enforcement of this Policy, in conjunction with the Shorewood Tree Preservation Ordinance No. 324.
9. If any significant tree in a development or on a building site is cut, damaged, or the area within the tree's dripline has been encroached upon by grading equipment, without City authorization, the City shall require replacement pursuant to 10. below. In addition, if the City determines that a damaged tree will probably not survive, it shall be removed by the developer or builder.
10. Except as provided in IV.13. of this Policy, all significant trees removed or damaged during the process of land development or construction activities shall be replaced on site. The removal of trees on public right-of-way, conducted by or on behalf of a

governmental agency in pursuance of its lawful activities or functions, shall be exempt from this replacement.

- a. Any trees required to be planted shall be varied in species, shall maximize the use of species native to the area, shall not include any species under disease epidemic, and shall be hardy under local conditions.
- b. Tree Replacement Ratio.
 - (1) Significant deciduous trees eight inches (8") DBH or greater shall be replaced by two (2), three (3) inch caliper or greater deciduous trees or two, six-foot (6') high coniferous trees.
 - (2) Significant deciduous trees twelve inches (12") DBH or greater shall be replaced by three (3), three (3) inch caliper or greater deciduous trees or three (3), six-foot (6') high coniferous trees.
 - (3) Significant coniferous trees six feet (6') high or greater shall be replaced by one (1) six-foot (6') high or greater coniferous tree.
 - (4) Significant coniferous trees twelve feet (12') high or greater shall be replaced by two (2) six-foot (6') high or greater coniferous trees.
 - (5) In no case will the total number of replacement trees exceed eight (8) trees per acre.
- c. Before any construction takes place, tree protection measures as set forth in VI.B. of this Policy shall be placed around tree protection zones and around the driplines of significant trees to be preserved. Signs shall be placed along fence lines prohibiting grading beyond the fence line.
- d. Any trees required to be planted shall be replaced if they die or appear to be dying within two (2) full growing seasons of planting by the person responsible for the planting.
- e. Replacement trees shall be of a similar species to the trees which are lost or removed and shall include those species shown on the following list:

Deciduous Trees

Green Ash - <i>Fraxinus pennsylvanica</i>	Black Locust - <i>Robinia psuedoacacia</i>
Mountain Ash - <i>Sorbus spp.</i>	Amur Maple - <i>acer ginnala</i>
River Birch - <i>Betula nigra</i>	Norway Maple - <i>Acer platanoides</i>
Kentucky Coffeetree - <i>Gymnocladus dioicus</i>	Red Maple - <i>Acer rubrum</i>
Amur Corktree - <i>Phellodendron amurense</i>	Silver Queen Maple (seedless) - <i>Acer saccharinum 'Silver Queen'</i>
Flowering Crabapple - <i>Malus spp.</i>	Sugar Maple - <i>acer saccharum</i>
Ginkgo (male only) - <i>Ginkgo biloba</i>	Northern Catalpa - <i>Catalpa speciosi</i>
Hackberry - <i>Celtis occidentalis</i>	Bur Oak - <i>Quercus macrocarpa</i>
Hawthorn - <i>Crataegus spp.</i>	Pin Oak - <i>Quereus palustris</i>
Shagbark Hickory - <i>Carya ovata</i>	Red Oak - <i>Quercus rubra</i>
Honeylocust - <i>Gleditsia Hatriacanthos</i>	Swamp White Oak - <i>Quercus bicolor</i>
Ironwood - <i>Ostrya virginiana</i>	White Oak - <i>Quercus alba</i>
Japanese Tree Lilac - <i>Syringa amurensis japonica</i>	Ohio Buckeye - <i>Aesculus glabra</i>
American Linden - <i>Tilia americana</i>	Russian Olive - <i>Eleagnus angustifolia</i>
Littleleaf Linden - <i>Tilia cordata</i>	Black Walnut - <i>Juglans nigra</i>
Redmond Linden - <i>Tilia americana 'Redmond'</i>	

Conifers

American Arborvitae - <i>Thuja occidentalis</i>	Red Pine - <i>Pinus resinosa</i>
Balsam Fir - <i>Abies balsamea</i>	Scotch Pine - <i>Pinus sylvestris</i>
Douglas Fir - <i>Pseudotsuga menziesii</i>	White Pine - <i>Pinus strobus</i>
White Fir - <i>Abies concolor</i>	Black Hills Spruce - <i>Picea glauca densata</i>
Canadian Hemlock - <i>Tsuga canadensis</i>	Colorado Spruce - <i>Picea pungens</i>
European Larch - <i>Larix decidua</i>	Norway Spruce - <i>Picea abies</i>
Austrian Pine - <i>Pinus nigra</i>	White Spruce - <i>Picea glauca</i>
Norway Pine - <i>Pinus resinosa</i>	Tamarack - <i>Larix laricina</i>

11. Financial Guarantee - Subdividers.
 - a. Subdividers shall provide a financial guarantee as part of the development contract to ensure replacement of significant trees lost in the development process. The amount of the financial guarantee shall be determined by the Zoning Administrator, based upon estimates made by the subdivider's registered landscape architect or actual bids prepared by a certified nurseryman. This shall be a

separate line item in the development contract and shall be the basis for a development contract where the lack of public improvements would otherwise not require a contract.

This financial guarantee shall be held for at least two (2) full growing seasons beyond the date of installation of the last replacement tree or beyond the last date of site activity that may impact tree survival.

- b. In addition to a. above subdividers shall provide a financial guarantee as part of the development contract to ensure protection of all significant trees to be saved. For each mass graded lot with at least one (1) significant tree to be saved and each custom graded lot with at least one (1) significant tree, the subdivider shall pay a fee as established in Chapter 1302 of the Shorewood City Code.

This financial guarantee will be released upon 1) certification in writing by the subdivider's forester, arborist, or landscape architect indicating that tree protection measures were installed on mass graded lots and tree replacement is completed, if necessary and/or 2) the builders have posted security for the custom graded lots.

12. Financial Guarantee - Builders.

- a. Homebuilders shall provide a financial guarantee as part of the building permit application to ensure protection of all significant trees to be saved. For all lots with at least one (1) significant tree to be saved the builder shall provide a letter of credit or cash escrow as established by Chapter 1302 of the City Code.
- b. Prior to the issuance of a certificate of occupancy or release of the tree protection guarantee, the builder's forester, arborist, or landscape architect shall certify to the City in writing that all the tree protection measures identified on the tree preservation plan were installed from the start of construction to the end of construction and tree replacement is completed, if necessary.
- c. The Building Official will monitor the tree protection measures at the time of routine inspections.
- d. Builders are liable for subcontractors which destroy or damage significant trees which were indicated to be saved on the individual lot tree preservation plan.

13. Tree Replacement Fund.
 - a. In cases where it can be demonstrated that a construction site can not accommodate additional trees, a builder or developer may place replacement trees on public property at the direction of the Zoning Administrator. The City shall maintain a list of public properties where replacement trees may be planted.
 - b. As an alternative to placing trees on public property, the City may require a builder or developer to contribute to a City tree replacement fund. This fund shall be used solely for the purpose of planting trees on public property. The Zoning Administrator shall annually establish a fee schedule for replacement trees, based upon market conditions.

V. **Tree & Site Related Disturbances.**

- A. Tree protection zones, specimen trees or stands of trees designated to be saved must be protected from the following damages which may occur during all phases of land disturbance and construction processes. Methods of tree protection and disturbance prevention are provided in Section VI.
 1. Direct physical root damage
 2. Indirect root damage
 3. Trunk and crown disturbance
- B. Direct physical root damage most frequently occurs during site clearing and grading operations, where transport or feeder roots are cut, torn, or removed.
 1. Transport and feeder roots tend to tangle and fuse among the roots of adjacent trees. The removal of trees with heavy machinery along the outer periphery of a tree save area causes root damage.
 2. The most substantial form of root damage for all root types occurs in the form of cut roots. Roots are cut in grade reduction, or from trenching for underground utilities, sanitary sewer, or storm sewer lines.
 3. A more subtle type of root damage is the loss of feeder roots. Feeder roots normally occur within the organic layer, and the surface four inches (4") of top soil, subsequently, these roots can be easily damaged by the track action from a single bulldozer pass.

The stripping of top soil within a tree's critical root zone can totally eliminate its feeder root system.

- C. Indirect root damage through site modification can result from positive grade changes, temporary storage of fill material, the sedimentation of erosion materials, soil compaction, and soil chemical changes.
 - 1. Positive grade changes from fill and sedimentation causes a decrease in soil oxygen levels. An increase in soil carbon dioxide and other toxic gases can also occur, leading to large areas of anaerobic conditions. Anaerobic soil conditions cause a decrease in the root respiration process which is essential for the uptake and transport of minerals and nutrients.
 - 2. Anaerobic soil conditions are also produced by soil compaction, the increase in soil bulk density with a decrease in soil spore space. Compacted soil is also impervious to root penetration, and thus inhibits root development. Soil compaction is generally caused by the weight and vibrations of heavy machinery, vehicle parking, and the storage of fill and/or construction materials within the critical root zones of trees.
 - 3. Changes in soil chemistry will adversely affect tree survival. The most frequent occurrence is the change (decrease) in soil acidity by concrete washout. The leakage or spillage of toxic materials such as fuels or paints can be fatal for trees.
- D. Trunk and crown disturbances are generally mechanical in nature and are either caused directly by clearing and grading machinery, or indirectly by debris being cleared and falling into trees marked for protection.
 - 1. Common forms of damage include stripped bark and cambium, split trunks, and broken limbs.
 - 2. Damage also occurs from the posting of signs such as building permits, or survey markers on trees.
 - 3. Indirect damage can be caused by the placement of burn holes or debris fires too close to trees. The possible range of damages include scorched trunks with some cambial dieback, the loss of foliage due to evaporative heat stress (leaf desiccation), and completely burned trunks and crowns.

VI. Methods of Tree Protection.

- A. Planning and considerations. Tree space is the most critical factor in tree protection throughout the development process. The root system of trees can easily extend beyond the dripline of the tree canopy (Figure 1). The

root system within the dripline region is generally considered to be the protected root zone. Disturbance within this zone can directly affect a tree's chances of survival. With reference to root zones, the following standards shall apply:

1. The use of tree save islands and stands is encouraged rather than the protection of individual (nonspecimen) trees scattered throughout a site. This will facilitate ease in overall site organization as related to tree protection.
2. The protective zone of specimen trees or stands of trees or otherwise designated tree save areas shall include no less than the total area beneath the tree(s) canopy as defined by the farthest canopy dripline of the tree(s). In some instances, the Zoning Administrator may require a protective zone in excess of the area defined by the tree's dripline.
3. Layout of the project site utility and grading plans shall accommodate the required tree protective zones. Utilities must be placed along corridors between tree protective zones.
4. Construction site activities such as parking, material storage, concrete washout, hole placement, etc., shall be arranged so as to prevent disturbances within tree protective zones.
5. Alterations to the protective zone of the specimen trees or stands of trees must be approved by the Zoning Administrator.

B. Protective Barriers.

1. Active protective tree fencing shall be installed along the outer edge of and completely surrounding the critical root zones of all specimen trees or stands of trees, or otherwise designated tree protective zones, prior to any building construction.
2. These fences will be a minimum four feet (4') high. Four-feet (4') high orange polyethylene laminar safety fencing is acceptable (Figure 2).
3. All tree protection zones should be designated as such with "Tree Save Area" signs posted visibly on all sides of the fenced area. These signs are intended to inform subcontractors of the tree protection process. Signs requesting subcontractor cooperation and compliance with tree protection standards are recommended for site entrances.

4. All tree fencing barriers must be installed prior to and maintained throughout building construction and should not be removed until completion of construction and until landscaping is installed.
- C. Encroachment. Most trees can tolerate only a small percentage of critical root zone loss. If encroachment is anticipated within the critical root zones of specimen trees, stands of trees, or otherwise designated tree protective zones, the following preventive measures shall be employed:
1. Clearing Activities: Roots often fuse and tangle amongst trees. The removal of trees adjacent to tree save areas can cause inadvertent damage to the protected trees. Wherever possible, it is advisable to cut minimum two foot (2') trenches (e.g., with a "ditch-witch") along the limits of land disturbances, so as to cut, rather than tear, roots. Directionally felling trees outward into disturbance areas and grinding stumps is also acceptable.
 2. It is very strongly suggested that all clearing in oak stands be done before May 1st and after July 1st of each season. This will help to prevent the inadvertent wounding of trees with the consequential spread of oak wilt. If clearing has to be done at this time, all stumps and wounded trees shall have the wound areas painted thoroughly with a tree paint. To be effective, the painting shall be performed within the same day of cutting. Should oak wilt get started as a result of construction during the months of May and June, then the developer/builder shall pay for all additional on-site oak wilt control measures needed to control the disease.
 3. Where the Zoning Administrator has determined that irreparable damage has occurred to trees within tree protective zones, they must be removed and replaced by the developer/builder as provided in Section IV(B)9.
- D. Reclamation of the Growing Site. A tree's ability for adequate root development, and ultimately its chances for survival, are improved with reclamation of the growing site. Whenever possible, the soil should be brought back to its natural grade. Unnecessary fill, erosion sedimentation, concrete washout, and construction debris should be removed. When machinery is required for site improvement, it is recommended that a "rubber-tired skid steer loader" or similar light weight rubber tire vehicle be used so as to minimize soil compaction.

TREE PRESERVATION POLICY
CITY OF SHOREWOOD

APPENDIX A

Technical Terms:

Cambium: The tissue within the woody portion of trees and shrubs which gives rise to the woody water and nutrient conducting system, and the energy substrate transport system in trees.

Cambial dieback: The irreparable radial or vertical interruption of a tree's cambium, usually caused by mechanical damage, such as "skinning bark", or from excessive heat.

Coniferous: Belonging to the group of cone-bearing evergreen trees or shrubs.

Deciduous: Not persistent; the shedding of leaves annually.

Feeder roots: A complex system of small annual roots growing outward and predominantly upward from the system of "transport roots". These roots branch four or more times to form fans or mats of thousands of fine, short, non-woody tips. Many of these small roots and their multiple tips are 0.2 to 1mm or less in diameter, and less than 1 to 2mm long. These roots constitute the major fraction of a tree's root system surface area, and are the primary sites of absorption of water and nutrients.

Major Woody Roots: First order tree roots originating at the "root collar" and growing horizontally in the soil to a distance of between 3 and 15 feet from the tree's trunk. These roots branch and decrease in diameter to give rise to "rope roots". The primary function of major woody roots include anchorage, structural support, the storage of food reserves, and the transport of minerals and nutrients.

Protected Root Zone: The rooting area of a tree established to limit root disturbances. This zone is generally defined as a circle with a radius extending from a tree's trunk to a point no less than the furthest crown dripline. Disturbances within this zone will directly affect a tree's chance for survival.

Root Collar: The point of attachment of major woody roots to the tree trunk, usually at or near the groundline and associated with a marked swelling of the tree trunk.

Root Respiration: An active process occurring throughout the feeder root system of trees, and involving the consumption of oxygen and sugars with the release of energy and carbon-dioxide. Root respiration facilitates the uptake and transport of minerals and nutrients essential for tree survival.

Rope Roots: An extensive network of woody second order roots arising from major woody roots, occurring within the surface 12 to 18 inches of local soils, and with an average size ranging from .25 to 1 inch in diameter. The primary function of rope roots is the transport of water and nutrients, and the storage of food reserves.

Soil Compaction: A change in soil physical properties which includes an increase in soil weight per unit volume, and a decrease in soil pore space. Soil compaction is caused by repeated vibrations, frequent traffic and weight. As related to tree roots, compacted soil can cause physical root damage, a decrease in soil oxygen levels with an increase in toxic gases, and can be impervious to new root development.

Transport Roots: The system or framework of tree roots comprised of major roots and rope roots.

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APPENDIX B






Checklist for Tree Protection Plan:

1. Tree Protection Plans.
 - a. Provisions for tree protection on the site shall be, at minimum, in conformance with the requirements of the City of Shorewood Tree Preservation Policy in conjunction with the Shorewood Tree Preservation Ordinance No. 324.
 - b. A Tree Preservation Plan shall be submitted either as part of a landscape plan, preliminary plat, or as a separate drawing, to include the following:
 - (1) All tree protection zones
 - (2) Approximate location of all specimen trees or stands of trees
 - (3) Approximate location of all specimen trees when their preservation is questionable, or might result in a change of the site design
 - (4) Identification of specimen trees to be removed. (Removal of specimen trees is subject to Zoning Administrator approval.)
 - (5) Limits of clearing and land disturbance such as grading, trenching, etc. where these disturbances may affect tree protection zones.
 - (6) Proposed location of underground utilities.
 - (7) Methods of tree protection shall be indicated for all tree protection zones, aeration systems, staking, signage, etc.
 - (8) The plan should indicate staging areas for parking, material storage, concrete washout, and burial holes where these areas might affect tree protection.
 - c. The following notes shall be indicated on both tree preservation plans and grading plans in large letters:
 - (1) Contact the City Planning Department at (952) 474-3236 to arrange a preconstruction conference with the City Zoning Administrator prior to any land disturbance.
 - (2) All tree protection measures shall be installed prior to building construction.
 - (3) Contact the City of Shorewood Planning Department at (952) 474-3236 for a Site Inspection upon completion of landscape installation.



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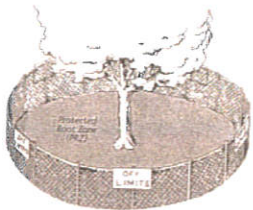
APPENDIX C

Preservation Plan:

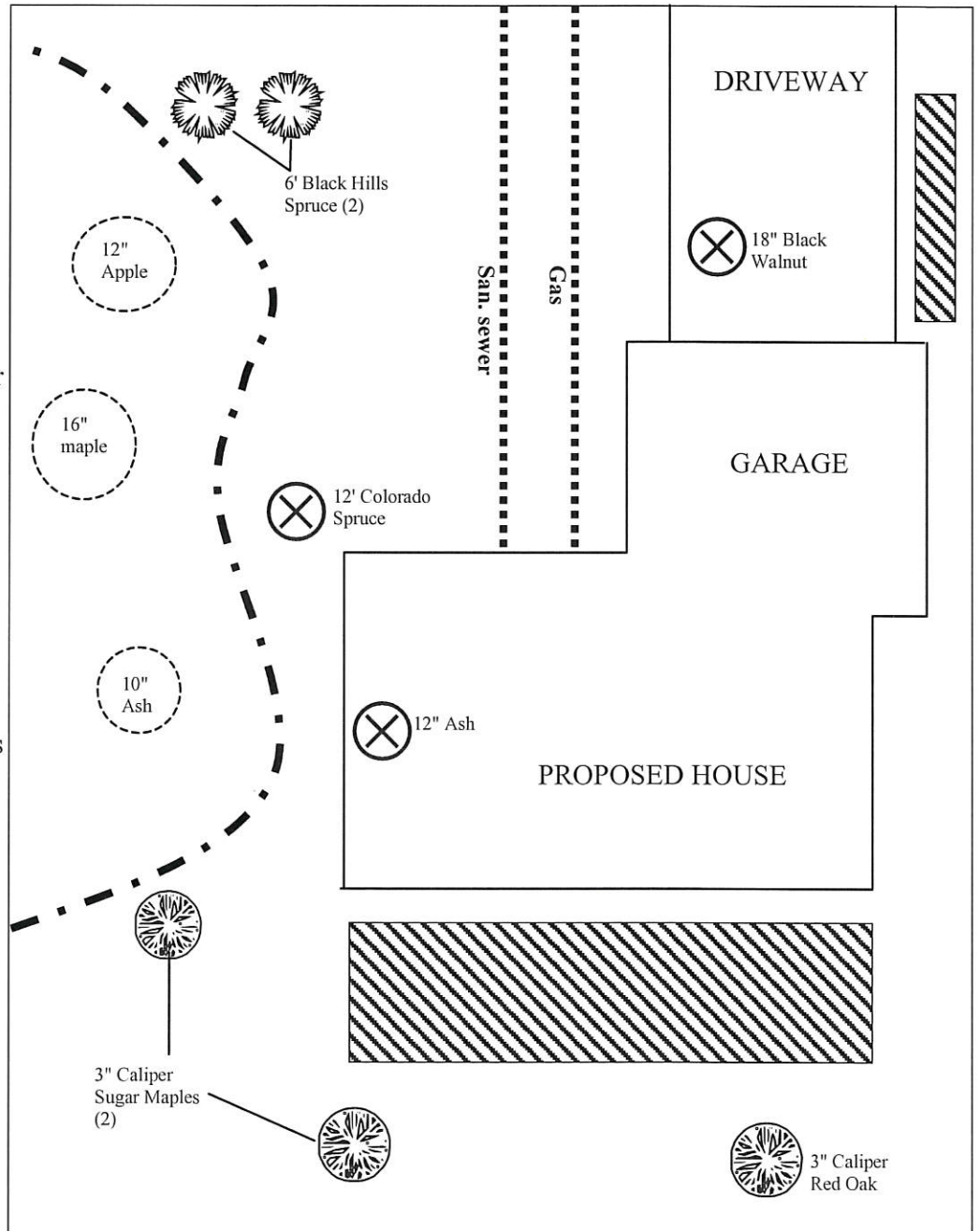
-  Existing trees to remain
-  Trees to be removed
-  Protective fencing
-  Construction material and stockpile perimeter
-  Utilities location

Replacement Plan:

-  Deciduous trees to be shown by species and caliper size
-  Coniferous trees to be shown by species and height



Tree fencing shall consist of 4' high minimum orange polyethylene laminar safety netting.



NOTICE:

- Contact the City Planning Dept. at (952) 474-3236 to arrange a preconstruction conference with the City Zoning Administrator prior to any land disturbance.
- All tree protection measures shall be installed prior to building construction.
- Contact the Planning Dept. for a site inspection upon completion of landscape installation.

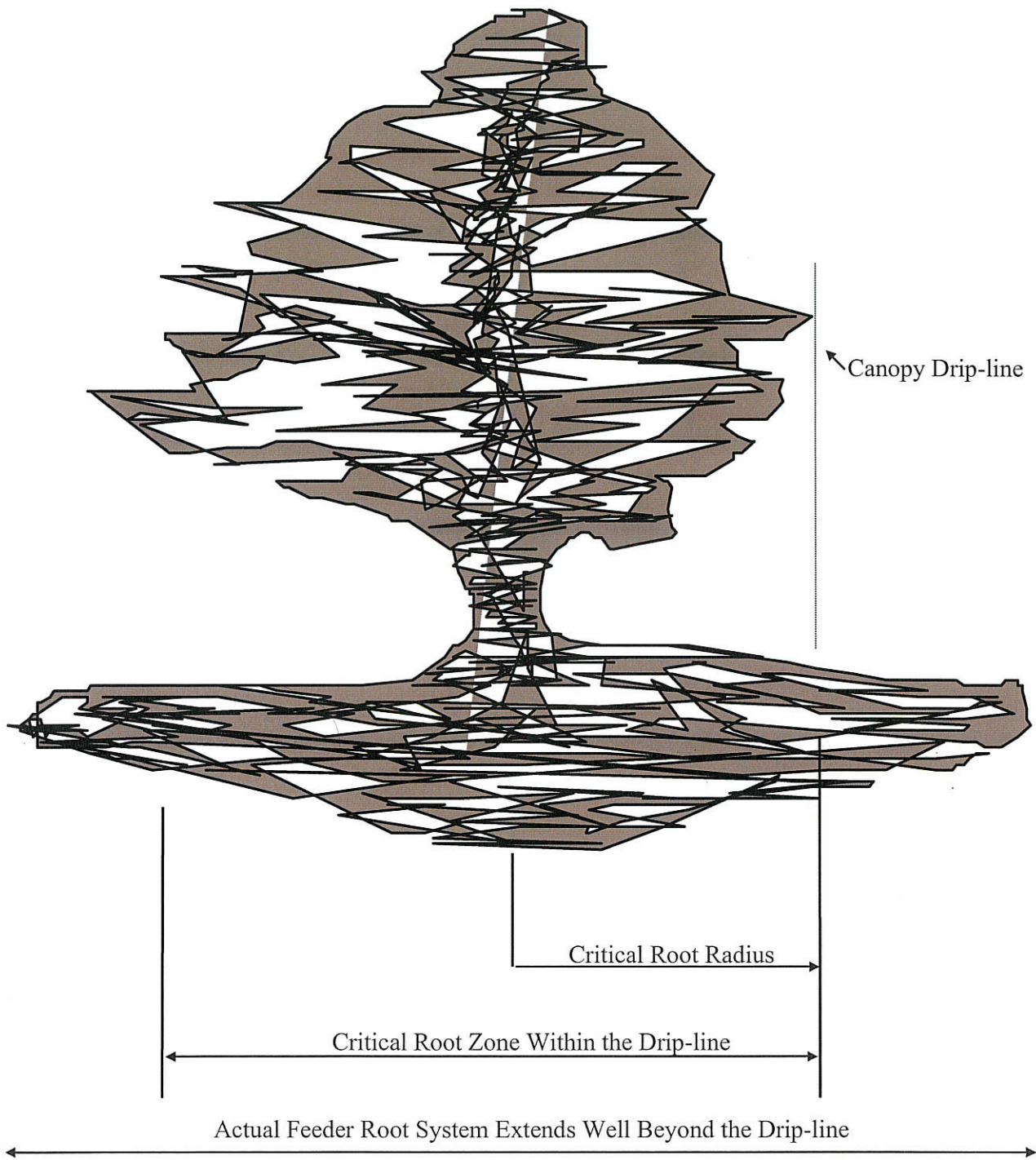


FIGURE 1
TYPICAL CRITICAL ROOT ZONE

TREE FENCING SHALL CONSIST OF
4.0' HIGH MINIMUM ORANGE POLYETHYLENE
LAMINAR SAFETY NETTING.

FENCE SHALL BE SECURELY ANCHORED BY
STEEL FENCE POSTS INSTALLED 6.0 FEET ON
CENTER.

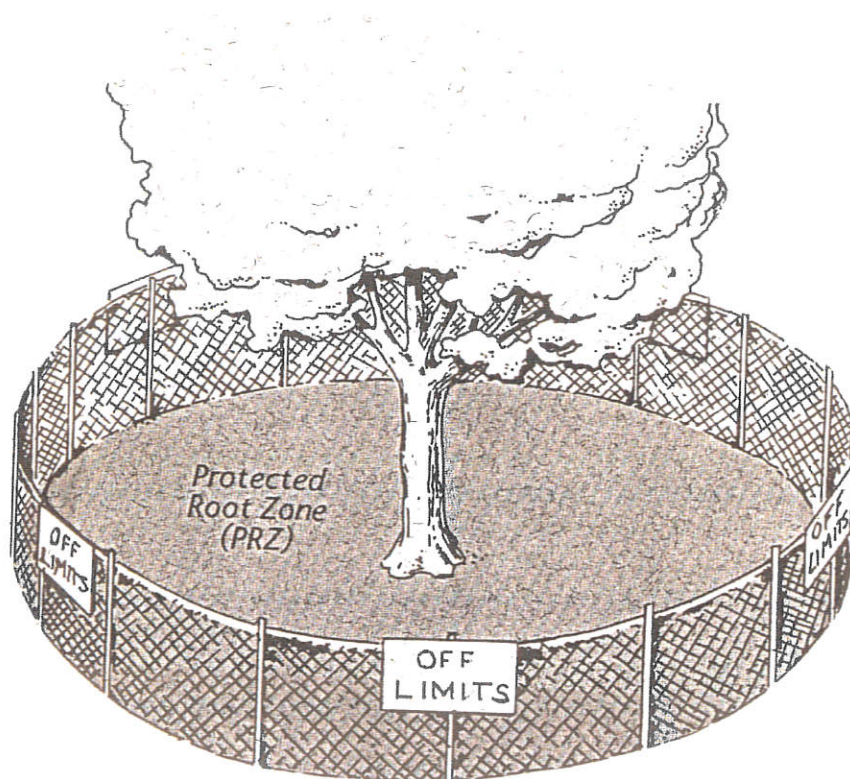
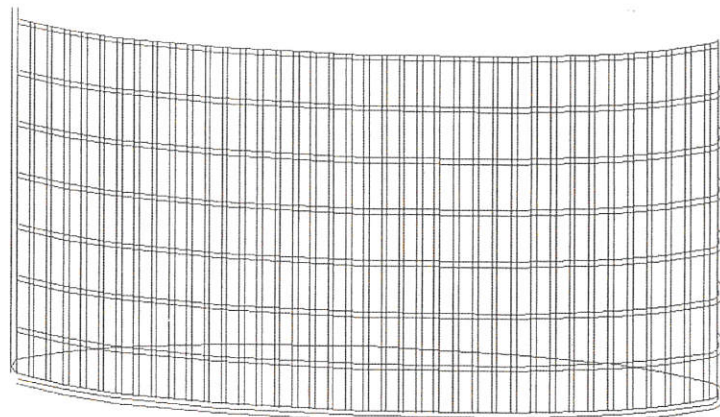


FIGURE 2

ACTIVE PROTECTIVE TREE FENCING