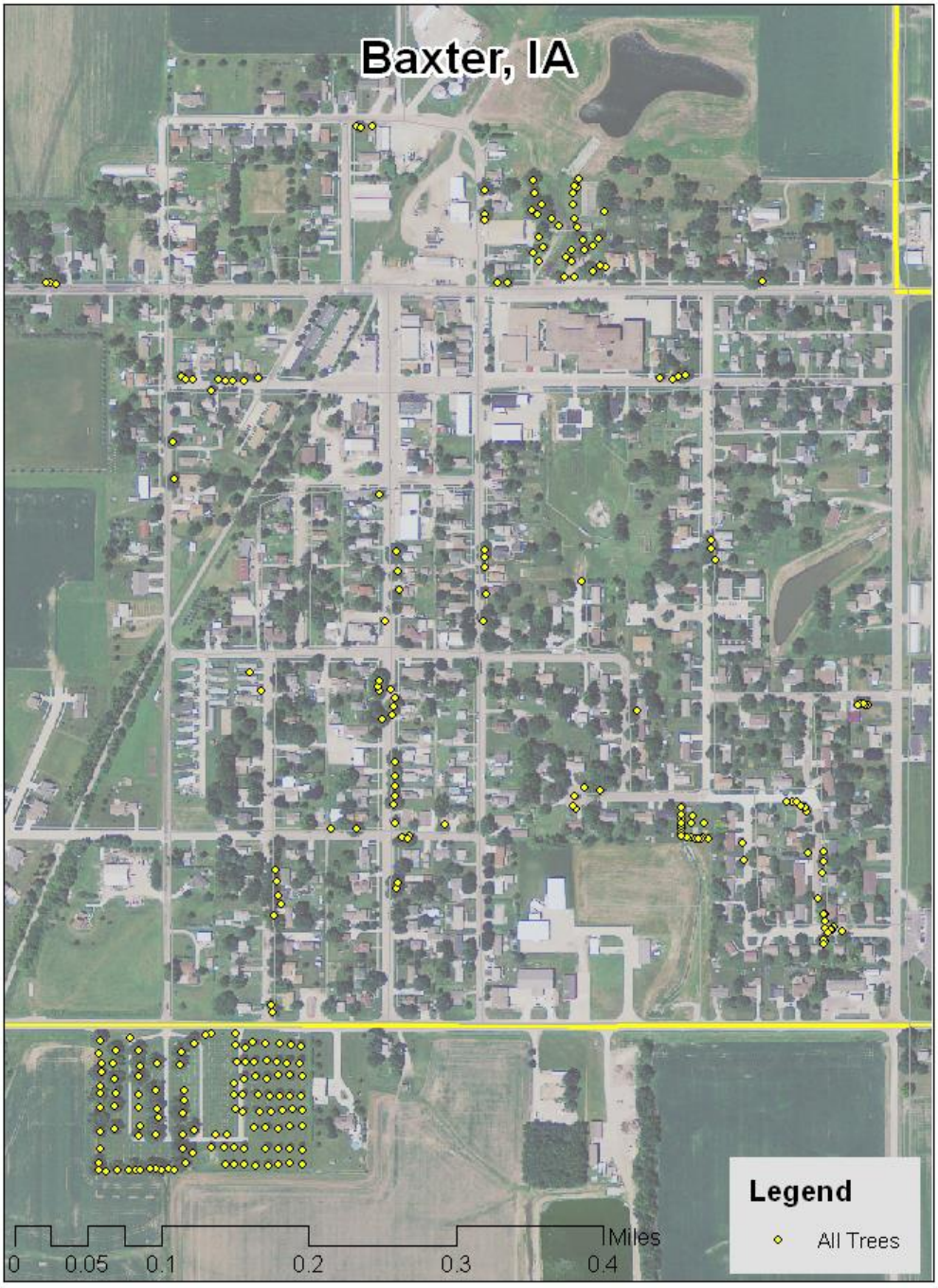
Baxter, IA



2013 Urban Forest Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Baxter with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows a community to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia on wood shipping crates that kills all species of ash trees (this does not include mountain ash). There is a strong possibility that 2.6% of Baxter's city owned trees (ash) will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2012, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street and park trees. Below are some key findings of the 272 trees inventoried.

- Baxter's trees provide $37,105 of benefits annually, an average of $136 a tree
- There are over 25 species of trees
- The top three genus are: Maple 65%, Conifers/Evergreens 15%, and Oak 6%
- 25% of trees are in need of some type of management
- 8 trees are recommended for removal

Recommendations

The core recommendations are detailed in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations as well. Below are some key recommendations.

- Of the 8 trees needing removal, 3 trees are over 24 inches in diameter at 4.5 ft and must be addressed immediately *City ownership of the trees recommended for removal should be verified prior to any removal*
- One of the 7 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the suggested budget it could take 5 years to remove ash and the other 7 trees recommended for removal.
- Suggestion: request a budget of $2,500 annually and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Baxter with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Baxter, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Baxter's infrastructure and one of the greatest assets to the community. The benefits of trees are immense. Trees provide the community with improved air quality, stormwater runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and create a desirable place to live, to name just a few benefits. It is essential that these benefits be maintained for the people of Baxter and future generations through good urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential part of developing management strategies is a comprehensive public tree inventory. The inventory supplies information that will be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet Baxter's urban forestry goals.

Inventory

In 2012, a tree inventory was conducted that included 100% of the city owned right of way trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collectors was written to be compatible with a state-of-the-art software suite called i-Tree. i-Tree was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. The i-Tree suite is a public domain which can be accessed for free.

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft, recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms of EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory Results

The data collected for the 272 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Baxter's trees reduce energy related costs by approximately $ 10,290 annually (Appendix A, Table 1). These savings are both in Electricity (49.7 MWh) and in Natural Gas (6653.4 Therms).

Annual Stormwater Benefits

Baxter's trees intercept about 482,607 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $13,080 of benefits to the city.

Annual Air Quality Benefits

Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants, and emitting volatile organic matter (ozone). In Baxter, it is estimated that trees remove 572.2 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $1,570 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon storage and sequestration reduce the amount of carbon in the atmosphere, mitigating climate change. In Baxter, trees store 1,469,482 lbs of carbon, with a yearly benefit of $11,021 (Appendix A, Table 4). In addition, the trees sequester about 174,947 lbs of carbon a year with an associated value of $1,312 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Baxter receives $10,853 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Baxter's trees provide $37,105 of benefits annually. Benefits of individual trees vary based on size, species, health and

location, but on average each of the 272 trees in Baxter provide approximately $136 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Baxter has over 25 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Sugar Maple	146	53.7%
Other Maple	30	11.0%
Oak	17	6.3%
Spruce	17	6.3%
Eastern red cedar	13	4.8%
Lilac	10	3.7%
Northern white cedar	7	2.6%
Ash	7	2.6%
Pine	5	1.8%
Other deciduous	20	7.4%
Totals	272	100.0%

Age Class

The greatest percentage of Baxter's trees (28%) are between 12 and 18 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, a Bell Curve is preferred and shows the highest amount of trees around 12 to 18 inches in diameter at 4.5 ft. Baxter's size curve is slightly younger than the preferred age class.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Baxter indicate that 90% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 69% of Baxter's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 11% of the population. This 11% is an estimate of trees that need management follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Crown Cleaning	58	21.3%
Crown Raising	0	0%
Tree Staking	1	0.4%

Tree Removal	8	2.9%
Crown Reduction	0	0%

Canopy Cover

The canopy cover of Baxter is approximately 5 acres (Appendix A, Figure 4). Since Baxter occupies about 240 acres, the canopy cover on city land is about 2%.

Land Use	
Single family residential	38.7%
Park/vacant/other	60.5%
Industrial/Large commercial	0%
Small commercial	0.4%
Multifamily residential	0.4%

Location	
Planting strip	19.9%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	80.1%

Recommendations

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead or dying, or that have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorist's vision of pedestrians, vehicles, traffic signs and signals, etc should be removed.

Hazardous trees

Baxter has 4 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern tree first. There is one tree over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance that do not include trimming. There are 5 additional trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 8 removals, one is an ash tree. There are a total of 7 ash trees, and 4 of those have signs and symptoms that have been

associated with EAB. The remaining trees are in fair to good health. *City ownership of the trees recommended for removal should be verified prior to any removal*

Pruning Cycle

Proper pruning can extend the life and good health of trees, as well as reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, and crown reduction. Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches that are 2 inches in diameter or larger in the case of providing clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. It is recommended that all trees be pruned on a routine schedule every five to seven years. Please refer to the six year maintenance plan for further information.

Planting

Most of the planting over the next 6 years will replace the trees that are removed. It is recommended to plant 1.2 trees for every tree removed, since survival rates will not be 100%. Please refer to the six year maintenance plan at the end of this section. It is not essential that the new trees be planted in the same location of the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in Baxter.

It is important to plant a diverse mix of species in the urban forest to maintain canopy health, since most insects and diseases target a genus (ash) or species (green ash) of trees. Current diversity recommendations advise that a genus (i.e. maple, oak) not make up more than 20% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (65%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreens/conifers, willow, or black walnut. Species recommendations are outlined in the Sample City Ordinance (Appendix C). All trees planted should meet the restrictions in the Sample City Ordinance (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan with No Additional Funding

Years 1 and 2

Removal: 4 critical concern trees
Planting and Replacement: One tree to be planted in open locations
Visual Survey for signs and symptoms of EAB
Watering and maintenance as needed

Years 3 through 6

Removal: 1 or 2 new trees that become a critical concern and any ash trees in poor health
Planting and Replacement: 2 to 7 trees each year in open locations
Routine trimming: Contract to trim 1/3 of the city trees in Years 3, 4, and 6
Visual Survey for signs and symptoms of EAB
Watering and maintenance as needed

EAB could potentially kill all ash within 4 years of its arrival. To remove all ash trees within 6 years, plus plant replacement trees, and do the recommended trimming, the budget would need to be increased to about $2,500 a year.

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal will be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

Treatment of Ash Trees

Chemical treatment can be effective, spreading removal costs out over several years while allowing trees to continue to provide benefits. However, treatment is not recommended if EAB is more than 15 miles away from Baxter. For more information on the cost of treatment strategies visit http://extension.entm.purdue.edu/treecomputer/

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States. Current tools to detect, control, suppress and eradicate this pest are not as robust as the USDA would desire. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

• emerald ash borer
• firewood of all hardwood species (for example ash, oak, maple and hickory)
• nursery stock and green lumber of ash
• any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml.

Canopy Replacement

As budget permits, all removed ash trees will be replaced. All trees will meet the restrictions in sample city ordinance (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, willow, tree of heaven, or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genus other than ash will be prioritized by hazardous or emergency situations only.

Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB. The Sample Tree Ordinance, Code 151.09 states “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests)

on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property."

Budget

Suggested Budget
Total $15,000 over 6 years ($2,500/year average)

FY 2014 Budget
- Removal: $2,000
- Planting: $150
- Watering & Maintenance: $300

FY 2015 Budget
- Removal: $2,000
- Planting: $150
- Watering & Maintenance: $300

FY 2016 Budget
- Removal: $1,000
- Planting: $300
- Routine trimming: $900
- Watering & Maintenance: $300

FY 2017 Budget
- Removal: $1,000
- Planting: $300
- Routine trimming: $900
- Watering & Maintenance: $300

FY 2018 Budget
- Removal: $1,000
- Planting: $1,050
- Watering & Maintenance: $300

FY 2019 Budget
- Removal: $500
- Planting: $600
- Routine trimming: $900
- Watering & Maintenance: $300

Purposed Budget Increase

EAB could potentially kill all ash trees in Baxter within 4 years of its arrival. The suggested budget estimates $500 per tree for removal (15 trees = $7,500), $150 replacement trees (17 = $2,550), a conservative amount of less than $12 per tree for routine pruning ($3,150), and $300 per year for watering and maintenance ($1,800), for a total of $15,000 over six years.

Additionally, it is recommended that Bayard apply for grants to fund replacement trees. Utility Company grants are usually between $500 and $10,000 for community-based, tree-planting projects that include parks, gateways, cemeteries, nature trails, libraries, nursing homes, and schools.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Baxter

Annual Energy Benefits of Public Trees by Species

1/14/2013

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	32.0	2,430	4,260.4	4,175	6,605	(N/A)	53.9	64.2	45.24
Silver maple	4.5	342	584.7	573	915	(N/A)	6.6	8.9	50.83
Eastern red cedar	1.1	81	162.7	159	241	(N/A)	4.8	2.3	18.53
Blue spruce	1.4	106	167.0	164	270	(N/A)	4.1	2.6	24.51
Northern red oak	0.8	59	110.7	108	167	(N/A)	3.7	1.6	16.72
Lilac	0.1	10	22.1	22	31	(N/A)	3.7	0.3	3.13
Red maple	1.3	100	163.7	160	261	(N/A)	3.0	2.5	32.58
Northern white cedar	0.1	10	23.8	23	34	(N/A)	2.2	0.3	5.61
Green ash	1.3	95	171.3	168	263	(N/A)	1.9	2.6	52.56
Norway spruce	0.8	61	107.9	106	166	(N/A)	1.9	1.6	33.26
Norway maple	0.7	56	112.8	111	166	(N/A)	1.5	1.6	41.58
Broadleaf Deciduous	0.1	4	8.8	9	13	(N/A)	1.5	0.1	3.13
Northern hackberry	1.5	112	213.7	209	322	(N/A)	1.5	3.1	80.38
Apple	0.1	11	24.2	24	34	(N/A)	1.5	0.3	8.60
Eastern white pine	0.4	29	43.9	43	72	(N/A)	1.1	0.7	24.14
Other street trees	3.5	265	475.7	466	731	(N/A)	7.4	7.1	36.54
Citywide total	49.7	3,770	6,653.4	6,520	10,290	(N/A)	100.0	100.0	37.97

Table 2: Annual Stormwater Benefits

Baxter

Annual Stormwater Benefits of Public Trees by Species

1/14/2013

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	292,943	7,939	(N/A)	53.9	60.7	54.38
Silver maple	49,804	1,350	(N/A)	6.6	10.3	74.99
Eastern red cedar	15,396	417	(N/A)	4.8	3.2	32.10
Blue spruce	16,986	460	(N/A)	4.1	3.5	41.85
Northern red oak	6,473	175	(N/A)	3.7	1.3	17.54
Lilac	381	10	(N/A)	3.7	0.1	1.03
Red maple	7,940	215	(N/A)	3.0	1.7	26.90
Northern white cedar	1,276	35	(N/A)	2.2	0.3	5.77
Green ash	13,465	365	(N/A)	1.9	2.8	72.99
Norway spruce	19,013	515	(N/A)	1.9	3.9	103.06
Norway maple	6,130	166	(N/A)	1.5	1.3	41.53
Broadleaf Deciduous	152	4	(N/A)	1.5	0.0	1.03
Northern hackberry	14,654	397	(N/A)	1.5	3.0	99.29
Apple	470	13	(N/A)	1.5	0.1	3.19
Eastern white pine	4,616	125	(N/A)	1.1	1.0	41.70
Other street trees	32,908	892	(N/A)	7.4	6.8	44.59
Citywide total	482,607	13,080	(N/A)	100.0	100.0	48.26

Table 3: Annual Air Quality Benefits

Baxter

Annual Air Quality Benefits of Public Trees by Species

1/14/2013

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Sugar maple	34.8	5.9	18.3	1.5	191	151.6	22.2	21.1	145.0	947	-28.1	-105	372.5	1,033	(N/A)	53.9	7.08
Silver maple	7.1	1.2	3.7	0.3	39	21.2	3.1	3.0	20.4	133	-4.2	-16	55.8	156	(N/A)	6.6	8.67
Eastern red cedar	2.8	0.6	2.2	0.3	18	5.2	0.8	0.7	4.9	32	-8.4	-32	9.1	19	(N/A)	4.8	1.46
Blue spruce	2.1	0.4	1.8	0.3	14	6.4	1.0	0.9	6.3	41	-6.1	-23	13.1	32	(N/A)	4.1	2.89
Northern red oak	1.2	0.2	0.6	0.1	7	3.7	0.5	0.5	3.5	23	-1.7	-7	8.6	23	(N/A)	3.7	2.32
Lilac	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.5	4	(N/A)	3.7	0.41
Red maple	1.5	0.2	0.7	0.1	8	6.1	0.9	0.9	6.0	39	-0.6	-2	15.9	45	(N/A)	3.0	5.57
Northern white cedar	0.0	0.0	0.1	0.0	0	0.7	0.1	0.1	0.6	4	-0.3	-1	1.3	3	(N/A)	2.2	0.56
Green ash	1.6	0.3	0.8	0.1	9	6.0	0.9	0.8	5.7	37	0.0	0	16.0	46	(N/A)	1.8	9.14
Norway spruce	2.3	0.5	1.8	0.3	15	3.8	0.6	0.5	3.6	24	-11.6	-44	1.8	-5	(N/A)	1.8	-0.96
Norway maple	1.1	0.2	0.6	0.0	6	3.6	0.5	0.5	3.3	22	-0.3	-1	9.6	27	(N/A)	1.5	6.81
Broadleaf Deciduous	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.2	2	0.0	0	0.6	2	(N/A)	1.5	0.41
Northern hackberry	2.3	0.4	1.2	0.1	12	7.2	1.0	1.0	6.7	44	0.0	0	19.8	57	(N/A)	1.5	14.20
Apple	0.1	0.0	0.0	0.0	0	0.7	0.1	0.1	0.6	4	0.0	0	1.7	5	(N/A)	1.5	1.17
Eastern white pine	0.5	0.1	0.4	0.1	3	1.8	0.3	0.3	1.8	11	-1.6	-6	3.5	8	(N/A)	1.1	2.82
Other street trees	5.0	0.9	2.7	0.3	28	16.6	2.4	2.3	15.8	104	-4.4	-17	41.6	115	(N/A)	7.4	5.74
Citywide total	62.5	10.9	35.0	3.4	351	235.6	34.4	32.8	225.0	1,471	-67.5	-253	572.2	1,570	(N/A)	100.0	5.79

Table 4: Annual Carbon Stored

Baxter

Stored CO2 Benefits of Public Trees by Species

1/14/2013

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	990,474	7,429	(N/A)	53.9	67.4	50.88
Silver maple	163,898	1,229	(N/A)	6.6	11.2	68.29
Eastern red cedar	9,377	70	(N/A)	4.8	0.6	5.41
Blue spruce	12,301	92	(N/A)	4.1	0.8	8.39
Northern red oak	25,440	191	(N/A)	3.7	1.7	19.08
Lilac	958	7	(N/A)	3.7	0.1	0.72
Red maple	17,135	129	(N/A)	3.0	1.2	16.06
Northern white	229	2	(N/A)	2.2	0.0	0.29
Green ash	51,176	384	(N/A)	1.9	3.5	76.76
Norway spruce	30,218	227	(N/A)	1.9	2.1	45.33
Norway maple	18,092	136	(N/A)	1.5	1.2	33.92
Broadleaf	383	3	(N/A)	1.5	0.0	0.72
Northern	33,744	253	(N/A)	1.5	2.3	63.27
Apple	1,441	11	(N/A)	1.5	0.1	2.70
Eastern white pine	3,511	26	(N/A)	1.1	0.2	8.78
Other street trees	50,397	833	(N/A)	7.4	7.6	41.67
Citywide total	1,469,482	11,021	(N/A)	100.0	100.0	40.67

Table 5: Annual Carbon Sequestered

Baxter

Annual CO_2 Benefits of Public Trees by Species

1/14/2013

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	62,128	466	-4,754	-28	-36	53,701	403	111,046	833	(N/A)	53.9	63.5	5.70
Silver maple	14,939	112	-787	-4	-6	7,556	57	21,705	163	(N/A)	6.6	12.4	9.04
Eastern red cedar	539	4	-45	-3	0	1,800	13	2,291	17	(N/A)	4.8	1.3	1.32
Blue spruce	998	7	-59	-2	0	2,341	18	3,278	25	(N/A)	4.1	1.9	2.23
Northern red oak	1,185	9	-122	-2	-1	1,298	10	2,359	18	(N/A)	3.7	1.4	1.77
Lilac	233	2	-5	-2	0	214	2	441	3	(N/A)	3.7	0.3	0.33
Red maple	2,341	18	-82	-2	-1	2,215	17	4,472	34	(N/A)	3.0	2.6	4.19
Northern white cedar	108	1	-1	-1	0	227	2	333	2	(N/A)	2.2	0.2	0.42
Green ash	3,090	23	-246	-1	-2	2,098	16	4,942	37	(N/A)	1.9	2.8	7.41
Norway spruce	821	6	-145	-1	-1	1,338	10	2,013	15	(N/A)	1.9	1.2	3.02
Norway maple	1,388	10	-87	-1	-1	1,232	9	2,532	19	(N/A)	1.5	1.5	4.75
Broadleaf Deciduous	93	1	-2	-1	0	86	1	176	1	(N/A)	1.5	0.1	0.33
Northern hackberry	1,969	15	-162	-1	-1	2,476	19	4,282	32	(N/A)	1.5	2.5	8.03
Apple	228	2	-7	-1	0	236	2	456	3	(N/A)	1.5	0.3	0.85
Eastern white pine	347	3	-17	-1	0	649	5	979	7	(N/A)	1.1	0.6	2.45
Other street trees	8,331	62	-533	-4	-4	5,849	44	13,643	102	(N/A)	7.4	7.8	5.12
Citywide total	98,736	741	-7,054	-53	-53	83,317	625	174,947	1,312	(N/A)	100.0	100.0	4.84

Table 6: Annual Social and Aesthetic Benefits

Baxter

Annual Aesthetic/Other Benefits of Public Trees by Species

1/14/2013

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Sugar maple	6,880	(N/A)	53.9	63.4	47.12
Silver maple	1,335	(N/A)	6.6	12.3	74.17
Eastern red cedar	224	(N/A)	4.8	2.1	17.22
Blue spruce	278	(N/A)	4.1	2.6	25.23
Northern red oak	107	(N/A)	3.7	1.0	10.67
Lilac	10	(N/A)	3.7	0.1	1.05
Red maple	338	(N/A)	3.0	3.1	42.22
Northern white cedar	41	(N/A)	2.2	0.4	6.83
Green ash	257	(N/A)	1.9	2.4	51.47
Norway spruce	94	(N/A)	1.9	0.9	18.84
Norway maple	139	(N/A)	1.5	1.3	34.64
Broadleaf Deciduous	4	(N/A)	1.5	0.0	1.05
Northern hackberry	252	(N/A)	1.5	2.3	63.01
Apple	13	(N/A)	1.5	0.1	3.14
Eastern white pine	97	(N/A)	1.1	0.9	32.32
Other street trees	786	(N/A)	7.4	7.2	39.29
Citywide total	10,853	(N/A)	100.0	100.0	40.05

Table 7: Summary of Benefits in Dollars

Baxter

Total Annual Benefits of Public Trees by Species ($)

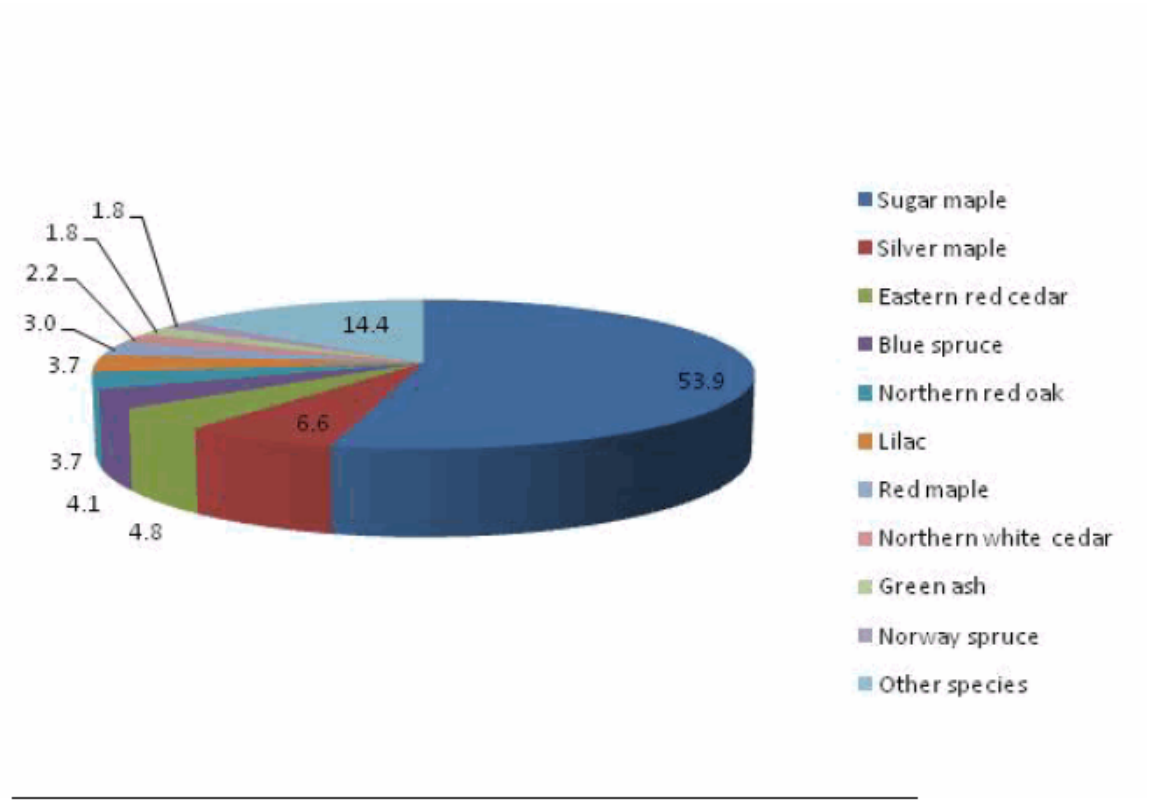
1/14/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Sugar maple	6,605	833	1,033	7,939	6,880	23,290	(±0)	62.8
Silver maple	915	163	156	1,350	1,335	3,919	(±0)	10.6
Eastern red cedar	241	17	19	417	224	918	(±0)	2.5
Blue spruce	270	25	32	460	278	1,064	(±0)	2.9
Northern red oak	167	18	23	175	107	490	(±0)	1.3
Lilac	31	3	4	10	10	60	(±0)	0.2
Red maple	261	34	45	215	338	892	(±0)	2.4
Northern white cedar	34	2	3	35	41	115	(±0)	0.3
Green ash	263	37	46	365	257	968	(±0)	2.6
Norway spruce	166	15	-5	515	94	786	(±0)	2.1
Norway maple	166	19	27	166	139	517	(±0)	1.4
Broadleaf Deciduous	13	1	2	4	4	24	(±0)	0.1
Northern hackberry	322	32	57	397	252	1,060	(±0)	2.9
Apple	34	3	5	13	13	68	(±0)	0.2
Eastern white pine	72	7	8	125	97	310	(±0)	0.8
Other street trees	731	102	115	892	786	2,626	(±0)	7.1
Citywide Total	10,290	1,312	1,570	13,080	10,853	37,105	(±0)	100.0

Baxter

Species Distribution of Public Trees (%)

1/14/2013



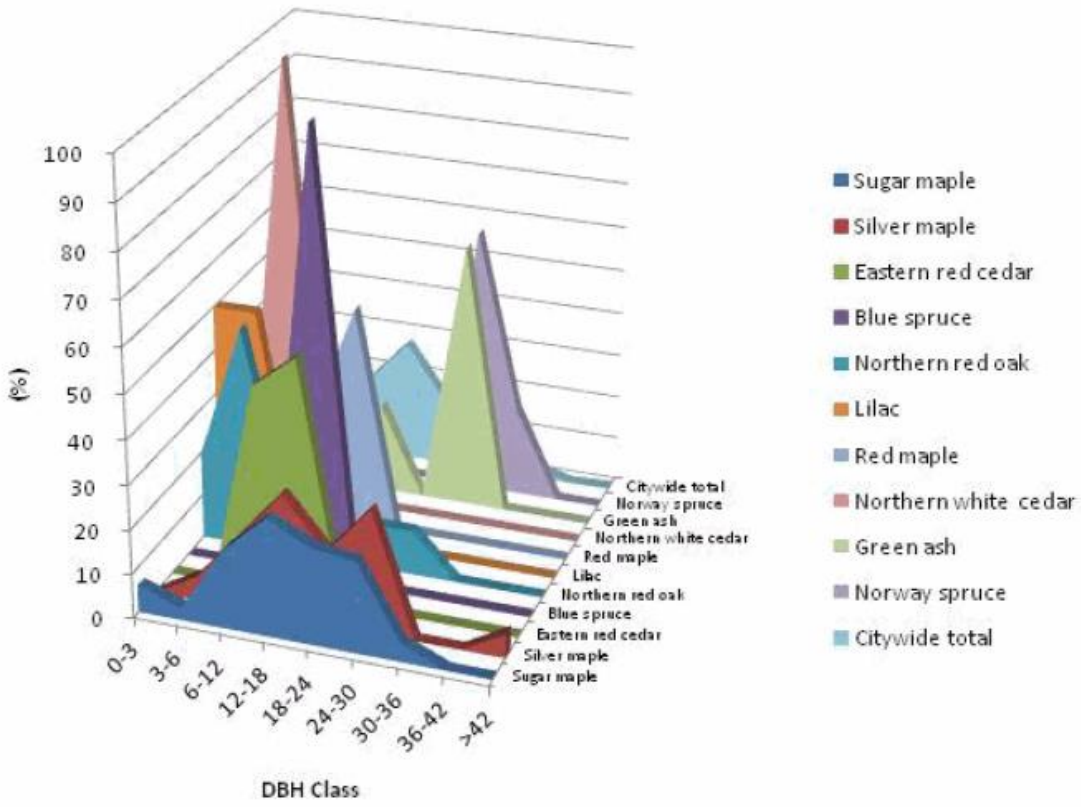
Species	Percent
Sugar maple	53.9
Silver maple	6.6
Eastern red cedar	4.8
Blue spruce	4.1
Northern red oak	3.7
Lilac	3.7
Red maple	3.0
Northern white cedar	2.2
Green ash	1.8
Norway spruce	1.8
Other species	14.4
Total	100.0

Figure 1: Species Distribution

Baxter

Relative Age Distribution of Top 10 Public Tree Species (%)

1/14/2013



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Sugar maple	6.2	2.7	17.8	26.7	21.9	20.5	4.1	0.0	0.0
Silver maple	0.0	5.6	16.7	27.8	16.7	27.8	0.0	0.0	5.6
Eastern red cedar	0.0	0.0	46.2	53.8	0.0	0.0	0.0	0.0	0.0
Blue spruce	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Northern red oak	20.0	50.0	10.0	0.0	10.0	10.0	0.0	0.0	0.0
Lilac	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red maple	0.0	25.0	25.0	50.0	0.0	0.0	0.0	0.0	0.0
Northern white cedar	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green ash	0.0	20.0	0.0	20.0	0.0	60.0	0.0	0.0	0.0
Norway spruce	0.0	0.0	20.0	0.0	0.0	60.0	20.0	0.0	0.0
Citywide total	7.7	11.1	17.3	27.7	14.8	17.7	3.3	0.0	0.4

Figure 2: Relative Age Class

Baxter

Functional (Foliage) Condition of Public Trees by Species (%)

1/14/2013

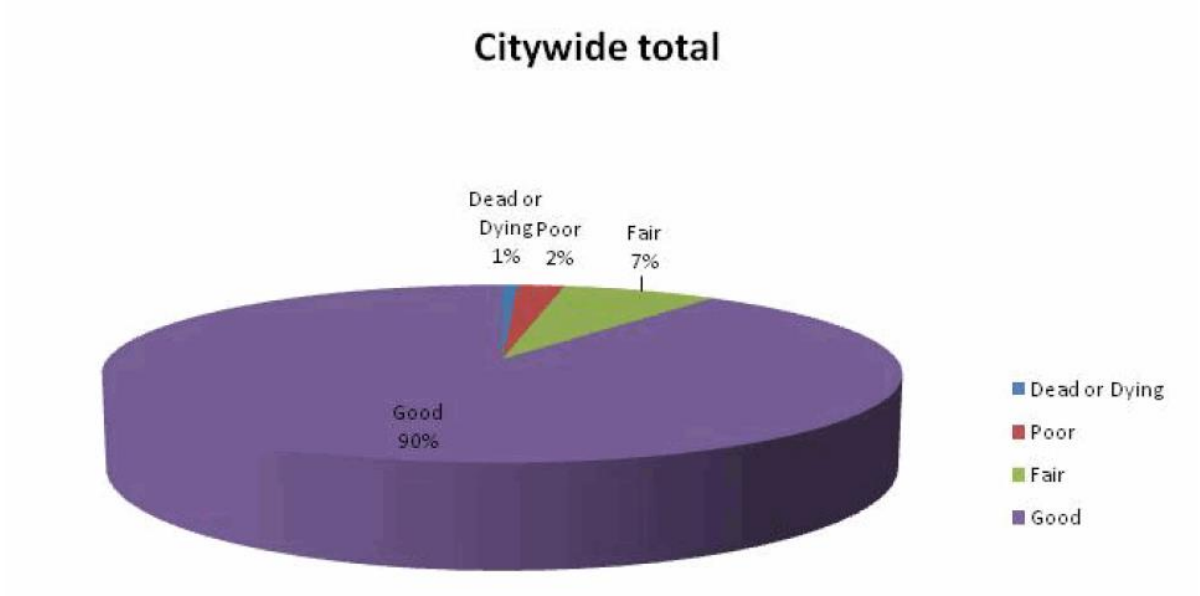


Figure 3: Foliage Condition

Baxter

Structural (Woody) Condition of Public Trees by Species (%)

1/14/2013

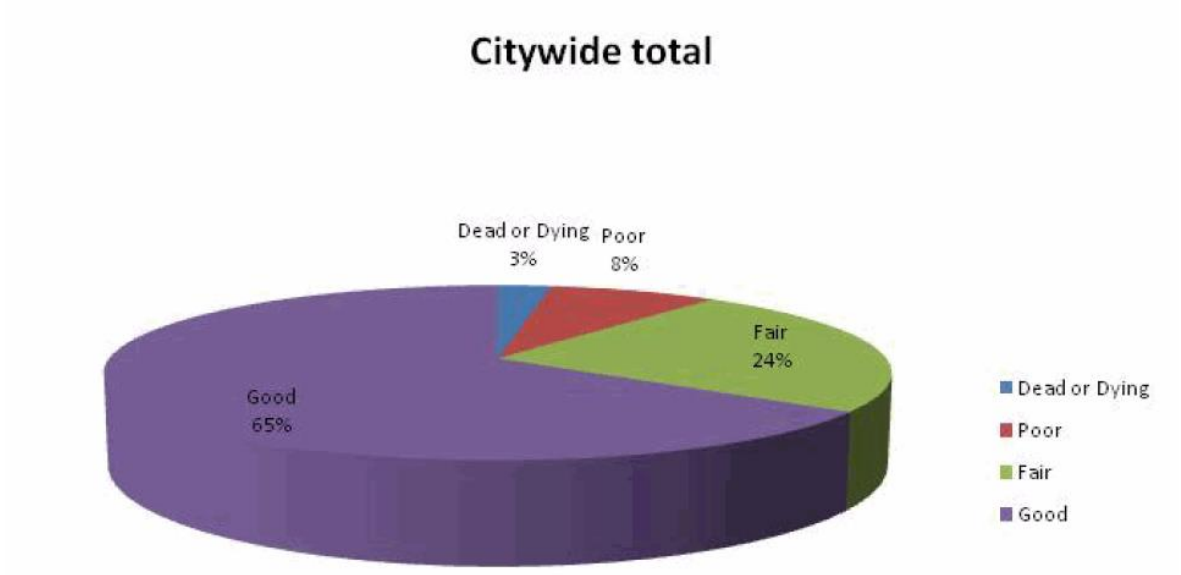
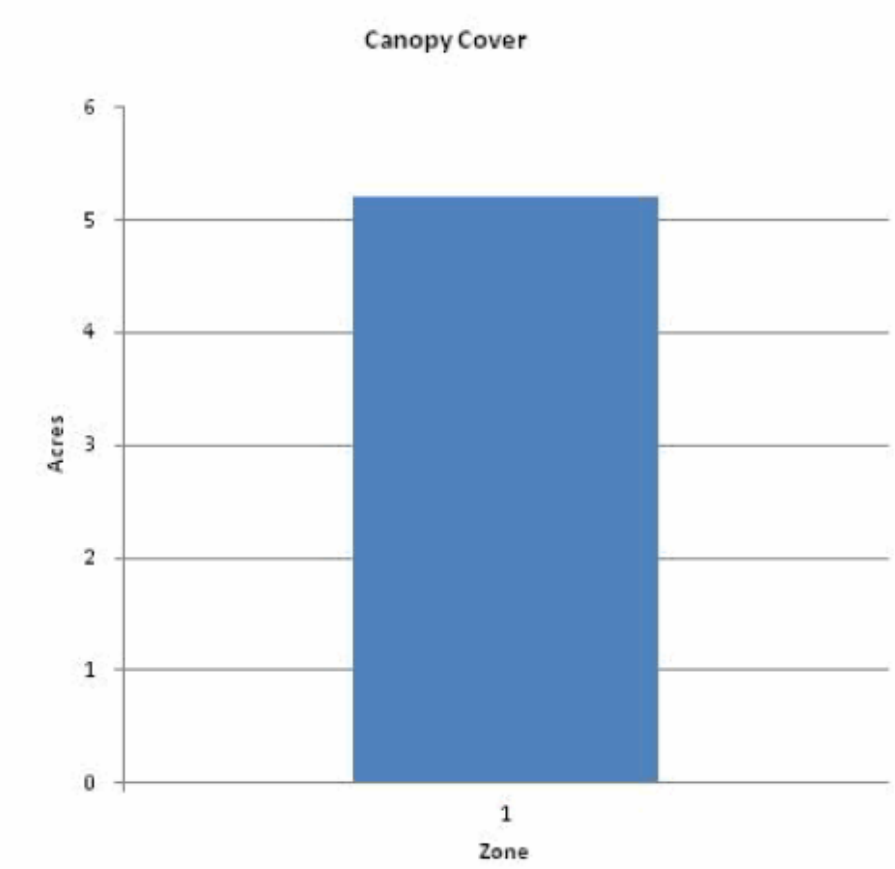


Figure 4: Wood Condition

Baxter

Canopy Cover of Public Trees (Acres)

1/14/2013



Zone	Acres	% of Total Canopy Cover
1	5	100.0
Citywide total	5	100.0

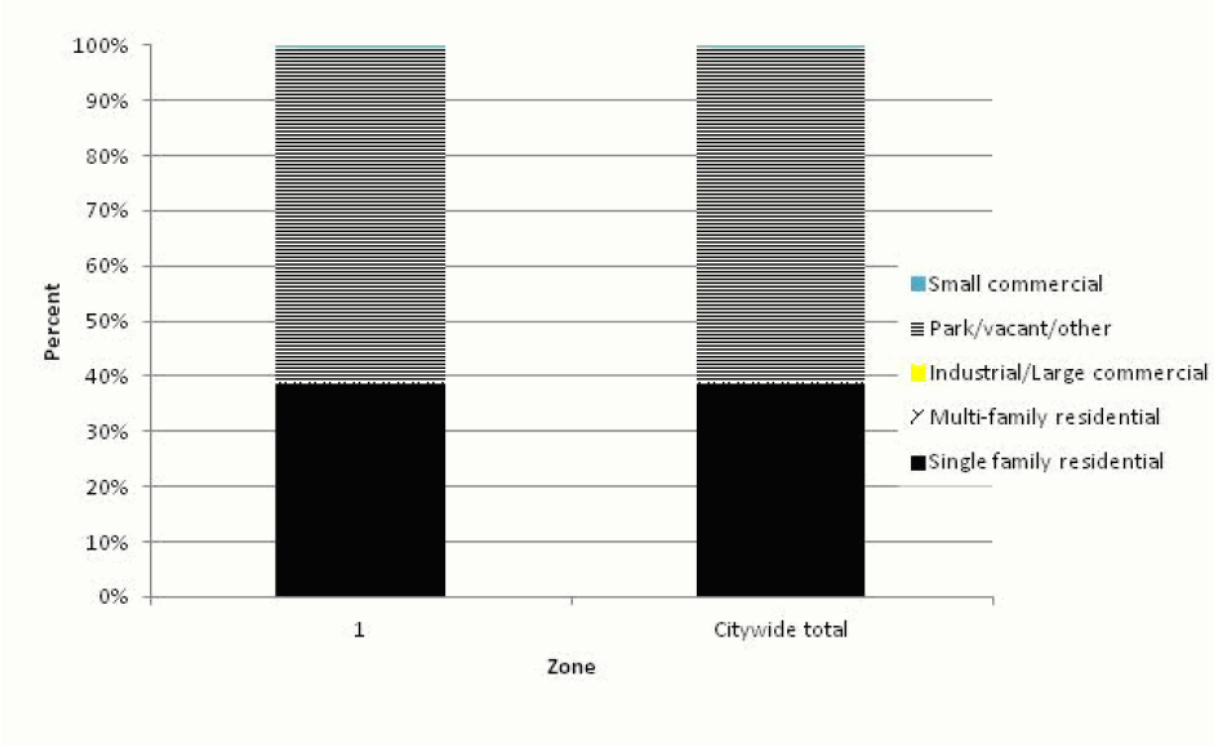
	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide	0	0	5		

Figure 5: Canopy Cover in Acres

Baxter

Land Use of Public Trees by Zone (%)

1/14/2013



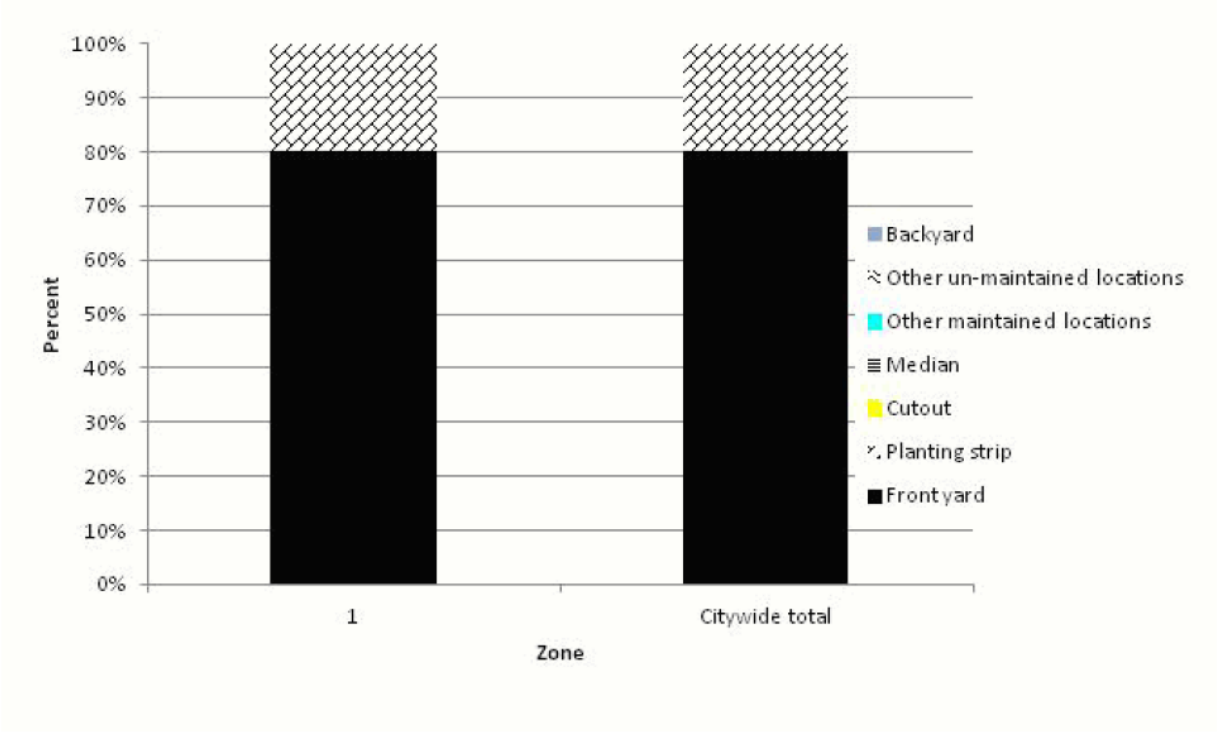
Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	38.7	0.4	0.0	60.5	0.4
Citywide total	38.7	0.4	0.0	60.5	0.4

Figure 6: Land Use of city/park trees

Baxter

Location of Public Trees by Zone (%)

1/14/2013



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	80.1	19.9	0.0	0.0	0.0	0.0	0.0
Citywide total	80.1	19.9	0.0	0.0	0.0	0.0	0.0

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms


Baxter, IA
Legend
Wood Condition
Dead or Dying
Poor
Leaf Condition
Dead or Dying
Poor
Miles
0
0.05
0.1
0.2
0.3
0.4

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

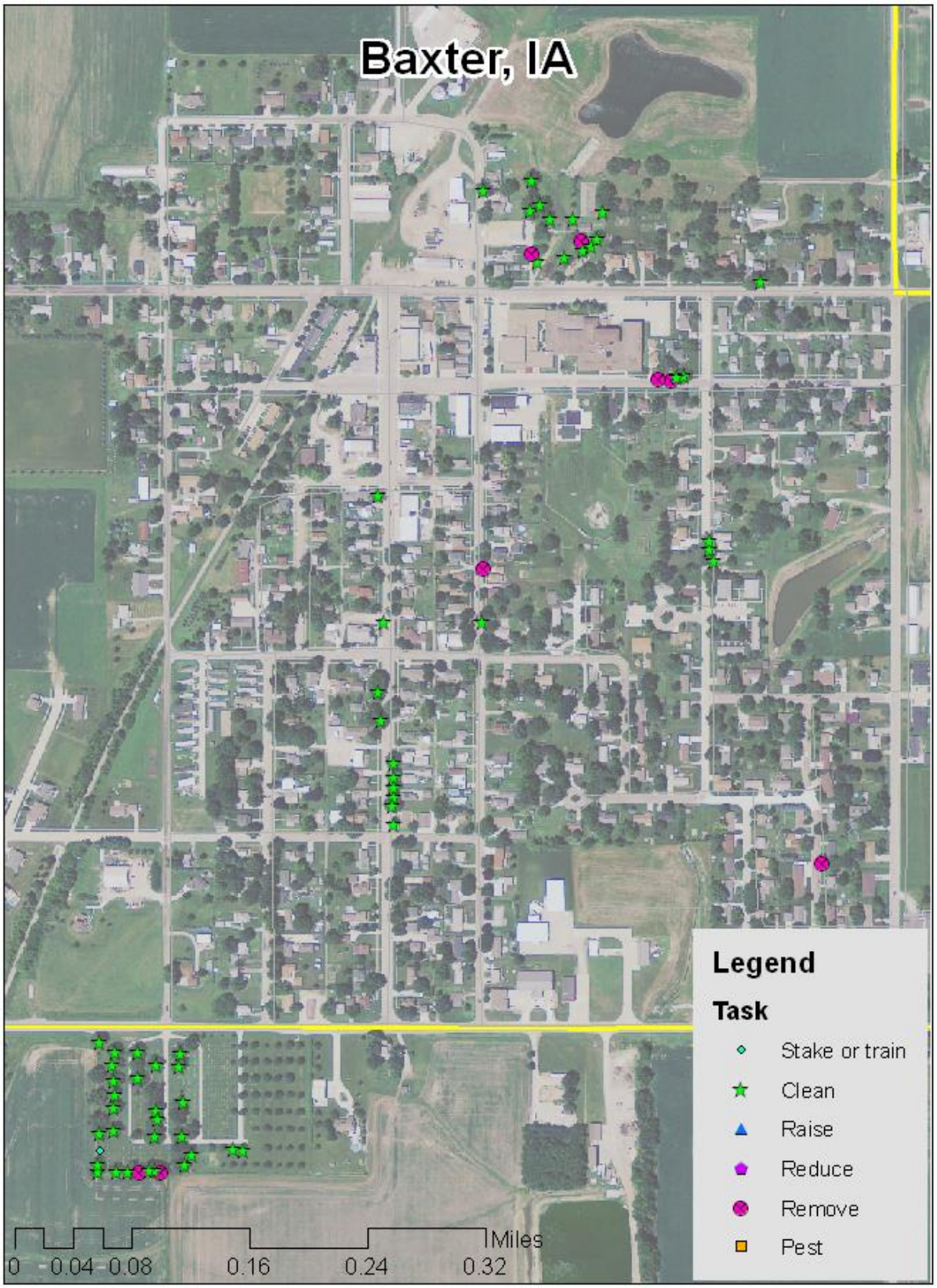


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Sample Tree Ordinances

Sample Tree Ordinance

CHAPTER 151

TREES

151.01 PURPOSE. The purpose of this chapter is to beautify and preserve the appearance of the City by requiring street trees to be uniformly located and maintained. The primary responsibility for maintaining street trees is placed upon the abutting property owner or his agent, and the Street Superintendent shall supervise any extensive trimming or cutting of said trees.

151.02 DEFINITIONS. For use in these chapters the following terms are defined:

1. "City Arboricultural Specifications and Standards of Practice" means the document containing the detailed performance standards and specifications to be used in carrying out the provisions of this chapter.

2. "City property" means and includes the property owned by or leased to the City.

3. "Contractor" means any person, business who receives compensation for the performance of work done.

4. "Forestry Improvement Committee" means the duly established committee responsible to study, investigate, counsel and develop a written plan for the care, preservation, trimming, planting, replanting, removal or disposition of trees and shrubs within the City.

5. "In the City streets" means the property included in that area located within any area platted as a City or public street.

6. "Maintain" or "maintenance," when used in reference to trees, means and includes pruning, spraying, mulching, fertilizing, cultivating, supporting, treating for disease or injury or any other similar act which promotes the life, growth, health or beauty of trees.

7. "Parkway" means that portion of the public right-of way between the curb or the edge of the traveled portion of the street and the adjacent property line used for the purpose of planting and maintaining City street trees.

8. "Private tree" means any and all trees growing on private property.

9. "Property owner" means a person owning private property in the City, as shown by the County Auditor's Plat of Manchester.

10. "Public property" means any and all property located within the confines of the City and owned by the City or held in the name of the City by any of the departments, commissions or agencies within the City Government.

11. "Public tree" means any and all trees growing on the public property including but not limited to street right-of-ways.

12. "Right-of-way" means a parcel of land intended to be occupied for streets, sidewalks, utilities and other public purposes.

13. "Shrubs" means woody vegetation usually growing with multiple stems and a height less than ten (10) feet.

14. "Topping" means heading, stubbing, rounding, tipping or "dehorning" which means the drastic removal of large branches, severely cutting back limbs to stubs larger than three (3) inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree.

15. "Trees" means woody vegetation usually growing with a single stem and a height over ten (10) feet.

151.03 AUTHORITY OF CITY GENERALLY. The City shall have jurisdiction over all trees and other planting on the streets, highways, alleys, parkways and City grounds within the City in order to provide orderly tree trimming and removal, to protect the health of all trees from disease and to require trees and planting to be maintained in a manner not dangerous to public safety.

151.04 TRIMMING OR REMOVAL. Nothing in this chapter shall be construed so as to give or recognize any property or vested rights in and to any trees heretofore or hereafter planted on any street or avenue in the City; the City expressly reserves and asserts its rights at any time to trim or remove or cause to be trimmed or removed any tree now or hereafter planted on any street or avenue parkway whenever the Street Superintendent deems such trimming or removal advisable for the purpose of street improvements, or to eliminate hazardous situations or for the needs of travel of traffic without compensation to the abutting property owners.

151.05 SUPERVISORY AUTHORITY OF STREET SUPERINTENDENT. The Street Superintendent shall be responsible for the enforcement of provisions of this chapter and the supervision of all work by City employees or contractors in the trimming, removal, maintenance, or planting of trees and other plantings on the streets, highways, alleys, parkways, and other City property. No person shall interfere or cause any person to interfere with any work being done under the provisions of this chapter by any employee of the City or by any person doing work for the City.

151.06 PLANTING RESTRICTIONS. No tree shall be planted in any parking or public right-of-way except in accordance with the following: No person shall plant a tree within the parking or public right-of-way without first obtaining a permit therefore, which shall show the type of tree to be planted and the placement of the tree. The application form for such permit is available at City Hall. The application for a permit shall not be considered by the Street Superintendent unless and until the applicant has staked the exact location for the proposed street tree and has obtained permission to dig in such exact location from all concerned utilities. The approval of the permit shall be at the discretion of the Street Superintendent, taking into account the provisions of this chapter, the City Tree Plan and the best interests of the community. The permit shall expire six months from date of issue. The tree planting must comply with the City Arboricultural Specifications and Standards of Practice. There will be no fee for this permit.

151.07 ARBORICULTURAL SPECIFICATIONS AND STANDARDS OF PRACTICE.

1. Establishment. There is hereby established an Arboricultural Specifications and Standards of Practice document of and for the City. This document includes but is not limited to: (i) species of street trees allowed and banned; (ii) the spacing between street trees and distances from fixed objects; (iii) proximity of street trees to utility lines; and (iv) topping.

2. Authority. The performance standards and specifications contained within the City Arboricultural Specifications and Standards of Practice shall be considered a part of this chapter and made subject to all its provisions.

151.08 TREES ON PUBLIC PROPERTY.

1. Permits. No person except the City or a person hired by the City shall plant or remove any tree on City property without first filing an application and obtaining a permit from the City. The person receiving the permit shall abide by the Arboricultural Specifications and Standards of Practice as adopted by the City. The City shall have the authority to require any permit holder to show adequate insurance coverage to cover potential damages that occur during the execution of the work. In the case of the property owner doing the work, proof of homeowner personal liability insurance may be required. If the property owner has hired another person or contractor to do the work, the contractor shall provide the City with a certificate of insurance. The certificates shall show the following minimum required limits of coverage of Commercial General Liability Insurance with limits of not less than $500,000 per occurrence and Worker's Compensation Insurance coverage at statutory limits on any and all employees. A public utility shall also be required to obtain a permit to trim or remove any tree on any street or other public place. The work shall be limited to the actual necessities of the service of the company in the area specified on the permit. This work shall be done in accordance with the Arboricultural Specifications and Standards of Practice as established for the City. The City may assign an inspector to supervise the provisions of the permit. The cost of the service shall be charged to the public utility. In the event severe weather has caused a tree to damage utility lines, the utility company or the City (or authorized agent) may trim or remove trees necessary to repair the damaged utility lines without first obtaining a permit. A permit should be obtained before any additional trimming not required for repair of the utility line is done.

2. Planting.

A. Tree Species. The City Forestry Improvement Committee shall develop and maintain a list of desirable trees for planting in the right-of-way as part of the City's Arboricultural Specifications and Standards of Practice. The Forestry Improvement Committee shall also establish and maintain a list of trees not suitable for planting.

B. Spacing. In order to promote the healthy and vigorous growth of street trees, their spacing shall be in accordance with the City's Arboricultural Specifications and Standards of Practice.

C. Utilities. In order to minimize obstructions and conflicts, the placement of street trees under, over, adjacent to or near utility lines shall be limited as specified in the City's Arboricultural Specifications and Standards of Practice.

D. Distance from Curb and Sidewalk. In order to promote the healthy and vigorous growth of street trees, certain distances as specified in the City's Arboricultural Specifications and Standards of Practice from curbs, sidewalks, driveways and intersections shall be maintained.

E. Excavation and Construction. In order to promote and ensure the healthy and vigorous growth of street trees, any excavation, filling or construction occurring within

an area specified in the City's Arboricultural Specifications and Standards of Practice of a street tree is prohibited unless a permit is obtained from the City.

F. Storage. The depositing, placement, storage or maintenance of any stone, brick, sand, concrete or other material within the drip line of a tree which may impede the free passage of water, air or fertilizer to the roots of any street tree is prohibited without obtaining a permit.

3. Maintenance. Due to the existence of City street trees, the resulting tree-lined streets provide both aesthetic and monetary value to the property owner; therefore, the primary care and maintenance of street and parkway trees shall be the responsibility of the adjacent homeowner. Persons shall maintain trees and plants in the parkway on which their property abuts at the same standard of care imposed on persons growing trees and plants on private property. It shall be the duty of any person growing a tree or other plant on private property abutting a street or public place:

A. To keep all private trees and planting extending over any street or alley trimmed up to a height of not less than fourteen (14) feet except that a height of not less than seven (7) feet shall be permitted over the sidewalk area, and also to keep said space clear of debris. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

B. Not to plant any tree or other plant which would cause a public danger or a nuisance.

C. To treat in an accepted manner or remove any tree or plant diseased or insect-ridden as to constitute a hazard to other trees or plants or to constitute a nuisance to the health, welfare and safety of the community.

D. Removal. If in the opinion of the City, removal of a street tree becomes necessary, the adjacent property shall be notified as specified in the City's Arboricultural Specifications and Standards of Practice. In the event the adjacent property requests the removal of a street tree or shrub the City does not consider the removal necessary, the property owner may appeal the Street Superintendent's decision to the Forestry Improvement Committee as outlined in Section 151.10 of this chapter.

E. Traffic Control. In the event the planting, maintenance or removal of any tree requires equipment or material to be located on or fall onto the street right-of-way, the permit holder shall provide for traffic control. All traffic control shall conform to the requirements and specifications of the current edition of the *Manual of Uniform Traffic Control Devices* (MUTCD). In all cases, the disruption of smooth traffic flow shall be kept to a minimum. Additional warning devices or precautionary measures may be necessary to control pedestrian traffic.

F. Protection. No person shall:

(1) Damage, cut, carve, nail, bolt or set fire to any street tree;

(2) Attach any rope, chain or wire cable to any street tree;

(3) Attach advertising posters or any other contrivance to any street tree; or

(4) Allow any harmful gaseous, liquid, chemical or solid substance to come in contact with any street tree.

G. Tree Topping. It is unlawful as a normal practice for any person or City department to top any street tree, park tree or other tree on public property. Trees severely damaged by storms or other causes or certain trees under utility wires or other obstructions where other pruning practices are impractical may be exempted from this section at the determination of the Street Superintendent.

151.09 TREES ON PRIVATE PROPERTY.

1. Maintenance. The property owner is responsible for the maintenance and care of any tree located on private property. Certain regulations apply to trees whose branches, limbs, roots or other parts extend into or over the street right-of-way. The property owner is responsible for ensuring private trees are trimmed to sufficient height to allow free passage of pedestrians and vehicular travel and so they will not obstruct or shade streetlights, traffic lights, signs or any traffic control devices or the view of any street intersection. Detailed information is contained in the City's Arboricultural Specifications and Standards of Practice. Whenever the City is notified or becomes aware of a dead tree or broken or dead branch or limb in any private tree which is in imminent danger of falling and thereby injuring any individual or causing property damage to adjacent property, the Street Superintendent may declare the tree, branch or limb a hazard and order the property owner to remove the hazard in an expedient manner. If the property owner fails to remove the hazard, the Street Superintendent may cause the hazard to be removed. For purposes of removing the hazard, City crews or City agents shall be allowed on private property. Attempts should be made to notify the property owner before entering onto private property.

2. Traffic Control. In the event the planting, maintenance or removal of any private tree requires equipment or material to be located on or fall onto the street right-of-way, the homeowner or the homeowner's agent shall provide for traffic control. All traffic control shall conform to the requirements and specifications of the current edition of the *Manual of Uniform Traffic Control Devices* (MUTCD). In all cases the disruption of smooth traffic flow shall be kept to a minimum. Additional warning devices or precautionary measures may be necessary to control pedestrian traffic.

151.10 ENFORCEMENT.

1. Appeals. A person may appeal the issuance or denial of a permit authorized by this chapter or an order of the Street Superintendent providing for the non-emergency removal of a tree or shrub pursuant to the following procedure:

A. Within 10 days of receiving the decision the Street Superintendent, notice of appeal shall be given to the Street Superintendent and Forestry Improvement Committee in writing. The notice of appeal shall state the nature of the objection and request a hearing. Hearing shall be held before the Forestry Improvement Committee within 20 days of the filing of the notice of appeal. Following hearing, the Forestry Improvement Committee shall, within ten (10) days, provide a written decision concerning the issues raised by the notice of appeal.

B. A person may appeal the decision of the Forestry Improvement Committee to the City Council by filing a written notice with the City Clerk within seven (7) days after issuance of the decision of the Forestry Improvement Committee. The notice of appeal shall specify the nature of the objection to the decision of the Forestry Improvement Committee, and shall include a summary of the factual basis supporting the appeal, as well as a request for hearing before the City Council. The hearing shall be held before the City Council within 20 days after the notice of appeal being filed with the City Clerk.

The City Council shall, within 10 days after hearing the appeal, issue a decision. The decision of the City Council shall constitute a final decision.

2. Interference. No person shall hinder, prevent, delay or otherwise interfere with the City or any assistants in the execution or enforcement of this chapter.

3. Penalties. Any person violating or failing to comply with the provisions of this chapter shall be considered in violation, and provisions for the City to abate the nuisance shall be made as specified in Chapter 50 of this Code of Ordinances.