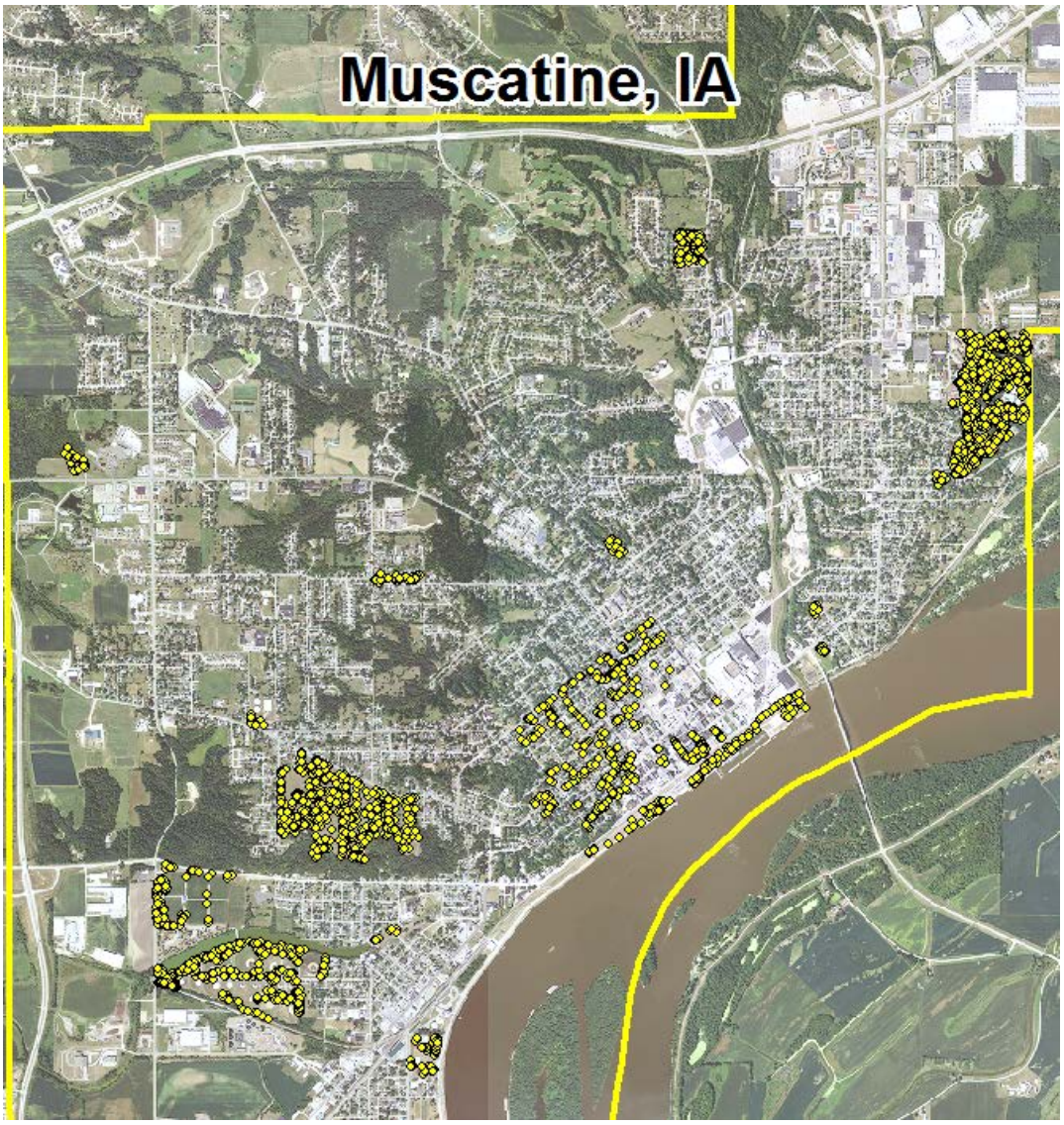
Muscatine, IA



2016 Urban Forest Management Plan
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Executive Summary

Overview

This plan was developed to assist the City of Muscatine 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 10% of Muscatine's city owned trees (ash) will die once EAB becomes established in the community, unless preventative treatment is used. 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 2015, 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 2,703 trees inventoried.

- Muscatine's trees provide $394,304 of benefits annually, an average of $146 a tree
- There are over 72 species of trees
- The top three genera are: Oak 27%, Maple 14%, and Ash 10%
- 28% of trees are in need of some type of management
- 47 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 47 trees needing removal, 6 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*
- 60 of the 283 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that are consistent with the *Approved Street Tree List* and do not include ash or maple
- Check ash trees with a visual survey yearly
- Budget impacts from ash removal – Suggestion: request a budget increase to at least $19,600-$42,450 a year and apply for grants to plant replacement trees

Introduction

This plan was developed to assist Muscatine 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 Muscatine, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Muscatine'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 Muscatine 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 Muscatine's urban forestry goals.

Inventory

In 2015, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. 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 associated with 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 2,703 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. Muscatine's trees reduce energy related costs by approximately $109,064 annually (Appendix A, Table 1). These savings are both in Electricity (517.5 MWh) and in Natural Gas (71,211.4 Therms).

Annual Stormwater Benefits

Muscatine's trees intercept about 5,708,419 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $154,698 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 Muscatine, it is estimated that trees remove 6,318.7 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 $17,478 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Muscatine, trees sequester about 1,036,761 lbs of carbon a year with an associated value of $7,776 (Appendix A, Table 4). In addition, the trees store 20,545,118 lbs of carbon, with a yearly benefit of $154,088 (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. Muscatine receives $106,074 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, Muscatine's trees provide $394,304 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 2,703 trees in Muscatine provide approximately $146 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Muscatine has over 72 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Oak	732	27%
Maple	390	14%
Ash	283	10%
Pine	177	7%
Apple/Crabapple	133	5%
Honeylocust	132	5%
Northern White Cedar	89	3%
Eastern Red Cedar/Juniper	87	3%
Hickory	81	3%
Birch	70	3%
Spruce	61	2%
Linden/Basswood	57	2%
Eastern Redbud	52	2%
Cherry/Plum	52	2%
Hackberry	48	2%
Pear	34	1%
Black Locust	21	1%
Aspen/Cottonwood	20	1%
Black Walnut	18	1%
Mulberry	17	1%
American Sycamore	16	1%
Elm	12	<1%
Sweetgum	11	<1%
Tuliptree	9	<1%
Eastern hemlock	8	<1%
Ginkgo	7	<1%
Catalpa	5	<1%
Lilac	5	<1%
Kentucky Coffeetree	4	<1%
Magnolia	3	<1%
Willow	3	<1%
Ohio Buckeye	2	<1%
Dogwood	2	<1%
Eastern Hophornbeam	2	<1%
American Chestnut	1	<1%
Sumac	1	<1%

Other Large Evergreen	19	1%
Other Small Deciduous	16	1%
Other Large Deciduous	12	<1%
Other Medium Deciduous	9	<1%
Other Medium Evergreen	2	<1%

Age Class

Most of Muscatine's trees (58%) are between 6 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Muscatine's size curve is slightly on the smaller side, indicating a younger than average stand.

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 Muscatine indicate that 81% of the trees are in good health, with only 4% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Additionally, 61% of Muscatine'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	443	16%
Crown Raising	221	8%
Tree Staking	65	2%
Tree Removal	47	2%

Canopy Cover

The total canopy with both private and public trees is 26%, 3,043 acres. The canopy cover included in the Muscatine inventory includes approximately 57 acres (Appendix A, Figure 4). The City's Canopy goal is 30%, in 30 years. To achieve this goal it is estimated that 1,143 trees need to be planted annually.

Land Use and Location

The majority of Muscatine's city and park trees are in front yards (no sidewalk) in park settings (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

Land Use	
Park/vacant/other	88%
Single family residential	10%
Small commercial	2%
Multifamily residential	<1%

Location	
Front yard	85%
Planting strip	11%
Cutout (surrounded by pavement)	2%
Other maintained locations	2%

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

Muscatine has 20 critical concern trees, 7 of which need immediate removal and 13 that need immediate cleaning. 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 trees first. There are 9 trees 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. There are a total of 776 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 47 removals, 5 are ash trees. There are a total of 283 ash trees, and 60 of those have signs and symptoms that have been associated with EAB. In addition, there are 44 trees that are in poor 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 5 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 Muscatine.

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 10% of the urban forest and a single species (i.e. silver maple, sugar maple, white oak, bur oak) not make up more than 5-10% of the total urban forest. Presently, the forest is heavily planted with maple (14%) (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. Tree species that may be planted can be found on the *Approved Street Tree List*, as outlined in section 3-9-9 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 3-9-9 (Appendix C).

Continual Monitoring

Due to the presence 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 decline 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 <u>No Additional Funding</u>

Year 1

Removal: 7 critical concern trees
Clean: 13 critical concern trees
Planting and Replacement: 9 trees to be planted in open locations
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 7 removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 9 trees in open locations from year one removals
Young Tree Pruning & Maintenance:
Routine trimming: Contract to trim 1/3 of the city trees
Visual Survey for signs and symptoms of EAB

Year 3

Removal: 7 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 9 trees to be planted in open locations and locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 4

Removal: 7 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 9 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 7 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 9 trees to be planted in open locations and locations from previous removals
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 6

Removal: 7 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 9 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 48 ash trees removed (approximately 17% of ash) annually. EAB could potentially kill all ash within 4 to 15 years of its arrival.
** To remove all ash trees within 6 years, the budget would need to be $42,450 a year for just ash removals. If the budget were $19,600 a year, all ash could be removed in 13 years.

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 tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. 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 millions of 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.

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? For more information, 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 trees will be replaced. All trees will meet the restrictions in city ordinance 3-9-9 (Appendix C). The new plantings will be a diverse mix, consistent with the *Approved Street Tree List*, and will not include ash or maple.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genera 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 now that EAB has arrived. City Code 3-9-1 states "If the City deems any shade, ornamental, or other tree situated on private property in the City to be diseased or dead, it shall cause to be served a notice upon the owner, in accordance with the most recently enacted Code of Iowa, if known within the City, or if not, then upon the occupant of the lot, to cut down such tree and remove the same and all debris therefrom. Said tree and debris shall be hauled to an area designated or approved by the City and/or the Iowa Department of Water, Air, and Waste Management."

Budget

Current Budget
Total $54,000 over 6 years ($9,000/year)

FY 2016 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $1,500
Watering & Maintenance: $500

FY 2017 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Routine trimming: $1,000
Watering & Maintenance: $200

FY 2018 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $1,500
Watering & Maintenance: $500

FY 2019 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Routine trimming: $1,000
Watering & Maintenance: $200

FY 2020 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $1,500
Watering & Maintenance: $500

FY 2021 Budget
Removal: $7,000
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Routine trimming: $1,000
Watering & Maintenance: $200

*Reduction of ash over 6 years: approximately 45 to 50 ash trees removed (approximately 15% of ash). **It will take approximately 37 years to remove all ash with the current budget.**

Proposed Budget Increase
EAB could potentially kill all ash trees in Muscatine within 4-15 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $42,450 a year. If the

budget were increased to $19,600 a year all ash could be removed within 13 years. Additionally, it is recommended that Muscatine 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.

Another option being considered by many communities is treating a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to spread out the costs and number of trees needing removed all at once. Trunk injection is administered every two years for the life of the tree. If treatment is discontinued, the tree dies. For an example, if the average ash diameter is 20 inches and treatment costs $15 per inch, then treating 10 trees would cost about $3,000 (every other year treatment). This would be 10 trees selected for treatment, and Muscatine would still need to find $900 per tree for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $4,500 every two years for treatment and leave five less trees for removal (for at least two more years). These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees now that EAB has been found in Muscatine. It is suggested to consider increasing the budget to plan for this.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Muscatine

Annual Energy Benefits of Public Trees

2/1/2016

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	102.6	7,784	14,191.1	13,907	21,691	(N/A)	12.1	19.9	66.13
Green ash	60.7	4,609	8,029.3	7,869	12,478	(N/A)	9.4	11.4	48.93
Northern red oak	33.1	2,509	4,530.7	4,440	6,949	(N/A)	7.2	6.4	35.82
Eastern white pine	22.7	1,727	2,903.5	2,845	4,572	(N/A)	6.3	4.2	27.05
Apple	8.7	659	1,389.3	1,361	2,020	(N/A)	4.9	1.9	15.19
Honeylocust	28.9	2,190	3,893.7	3,816	6,006	(N/A)	4.9	5.5	45.50
Bur oak	26.2	1,987	3,594.7	3,523	5,510	(N/A)	3.7	5.1	55.10
Norway maple	18.5	1,401	2,714.9	2,661	4,061	(N/A)	3.7	3.7	41.02
Northern white cedar	11.1	845	1,473.7	1,444	2,290	(N/A)	3.3	2.1	25.73
Hickory	19.1	1,450	2,638.7	2,586	4,036	(N/A)	3.0	3.7	49.83
Silver maple	28.4	2,152	3,747.5	3,673	5,825	(N/A)	3.0	5.3	72.81
Sugar maple	15.9	1,204	2,082.1	2,040	3,244	(N/A)	2.9	3.0	41.07
Swamp white oak	5.8	439	864.6	847	1,286	(N/A)	2.9	1.2	16.49
Maple	10.0	762	1,386.2	1,358	2,121	(N/A)	2.7	1.9	28.66
River birch	11.6	880	1,657.8	1,625	2,504	(N/A)	2.2	2.3	42.45
Eastern red cedar	6.1	463	900.8	883	1,345	(N/A)	2.1	1.2	23.60
Eastern redbud	4.6	346	722.7	708	1,054	(N/A)	1.9	1.0	20.28
Red maple	7.7	585	1,053.6	1,033	1,618	(N/A)	1.9	1.5	31.11
Northern hackberry	10.0	762	1,400.1	1,372	2,134	(N/A)	1.8	2.0	44.46
Black cherry	4.6	351	751.1	736	1,087	(N/A)	1.7	1.0	23.62
Norway spruce	4.3	323	573.0	562	885	(N/A)	1.1	0.8	29.49
Juniper	2.6	197	388.2	380	577	(N/A)	1.1	0.5	19.24
American basswood	6.5	491	944.9	926	1,417	(N/A)	1.1	1.3	47.24
Littleleaf linden	3.8	292	545.8	535	827	(N/A)	1.0	0.8	30.61
Callery pear	3.4	260	477.4	468	728	(N/A)	0.9	0.7	30.34
White ash	3.4	257	432.1	423	680	(N/A)	0.9	0.6	29.57
Black locust	5.6	424	805.7	790	1,214	(N/A)	0.8	1.1	57.80
Conifer Evergreen Large	1.9	146	241.7	237	383	(N/A)	0.7	0.4	20.13
Quaking aspen	2.2	168	312.2	306	474	(N/A)	0.7	0.4	26.31
Black walnut	4.2	319	571.9	560	880	(N/A)	0.7	0.8	48.86
Spruce	1.1	87	172.0	169	255	(N/A)	0.7	0.2	14.19
Mulberry	2.5	188	370.9	363	551	(N/A)	0.6	0.5	32.43
Broadleaf Deciduous Small	0.7	52	104.7	103	155	(N/A)	0.6	0.1	9.68
Pin oak	3.9	298	513.4	503	801	(N/A)	0.6	0.7	50.09
American sycamore	5.6	423	767.8	752	1,175	(N/A)	0.6	1.1	73.45
Blue spruce	1.3	96	167.5	164	260	(N/A)	0.5	0.2	20.03
Broadleaf Deciduous Large	3.6	274	483.8	474	748	(N/A)	0.4	0.7	62.32
Sweetgum	2.1	157	278.3	273	430	(N/A)	0.4	0.4	39.06
Pear	0.9	68	141.6	139	207	(N/A)	0.4	0.2	20.66
Tulip tree	2.3	171	313.0	307	478	(N/A)	0.3	0.4	53.07
Northern pin oak	2.2	165	285.6	280	445	(N/A)	0.3	0.4	49.42
Broadleaf Deciduous Mediu	1.0	75	150.3	147	222	(N/A)	0.3	0.2	24.65
Birch	1.1	85	167.4	164	249	(N/A)	0.3	0.2	31.12
Eastern hemlock	1.0	75	136.2	133	208	(N/A)	0.3	0.2	26.03
Ginkgo	0.5	38	68.6	67	105	(N/A)	0.3	0.1	15.05
Oak	0.6	42	72.8	71	113	(N/A)	0.3	0.1	16.18
American elm	2.6	194	329.6	323	517	(N/A)	0.2	0.5	86.22
Common chokecherry	0.4	30	64.9	64	93	(N/A)	0.2	0.1	18.67
Lilac	0.1	9	21.7	21	31	(N/A)	0.2	0.0	6.15
Siberian elm	2.0	148	251.0	246	394	(N/A)	0.2	0.4	78.87
Catalpa	1.3	100	177.1	174	274	(N/A)	0.2	0.3	54.80
Black ash	0.8	58	110.6	108	167	(N/A)	0.1	0.2	41.64
Austrian pine	0.6	44	81.8	80	124	(N/A)	0.1	0.1	31.10
Boxelder	0.8	64	109.4	107	171	(N/A)	0.1	0.2	42.69
Kentucky coffeetree	0.0	1	1.9	2	3	(N/A)	0.1	0.0	0.66
Paper birch	0.7	56	92.1	90	146	(N/A)	0.1	0.1	48.59

Willow	0.5	40	81.1	79	120 (N/A)	0.1	0.1	39.93
Eastern cottonwood	0.7	57	101.2	99	156 (N/A)	0.1	0.1	77.98
Amur maple	0.1	7	16.6	16	24 (N/A)	0.1	0.0	11.80
Scotch pine	0.3	22	39.4	39	61 (N/A)	0.1	0.1	30.47
Dogwood	0.1	6	13.5	13	19 (N/A)	0.1	0.0	9.53
Ohio buckeye	0.4	32	64.3	63	95 (N/A)	0.1	0.1	47.66
Red pine	0.2	14	24.1	24	38 (N/A)	0.1	0.0	18.86
Conifer Evergreen Medium	0.1	10	20.4	20	30 (N/A)	0.1	0.0	14.80
Sweetbay	0.1	9	18.3	18	27 (N/A)	0.1	0.0	13.40
Eastern hophornbeam	0.1	11	25.7	25	36 (N/A)	0.1	0.0	18.19
Southern magnolia	0.2	18	24.2	24	41 (N/A)	0.0	0.0	41.29
Ash	0.2	18	29.5	29	47 (N/A)	0.0	0.0	46.78
Plum	0.2	14	24.7	24	38 (N/A)	0.0	0.0	38.13
Sumac	0.1	6	12.8	13	18 (N/A)	0.0	0.0	18.19
Elm	0.0	2	3.7	4	6 (N/A)	0.0	0.0	5.82
American chestnut	0.4	33	59.0	58	91 (N/A)	0.0	0.1	91.02
Total	517.5	39,277	71,211.4	69,787	109,064 (N/A)	100.0	100.0	40.35

Table 2: Annual Stormwater Benefits

Muscatine

Annual Stormwater Benefits of Public Trees

2/1/2016

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	1,331,012	36,070	(N/A)	12.1	23.3	109.97
Green ash	583,544	15,814	(N/A)	9.4	10.2	62.02
Northern red oak	309,418	8,385	(N/A)	7.2	5.4	43.22
Eastern white pine	398,824	10,808	(N/A)	6.3	7.0	63.95
Apple	35,339	958	(N/A)	4.9	0.6	7.20
Honeylocust	260,673	7,064	(N/A)	4.9	4.6	53.52
Bur oak	319,111	8,648	(N/A)	3.7	5.6	86.48
Norway maple	162,616	4,407	(N/A)	3.7	2.8	44.51
Northern white cedar	229,622	6,223	(N/A)	3.3	4.0	69.92
Hickory	187,811	5,090	(N/A)	3.0	3.3	62.84
Silver maple	419,797	11,377	(N/A)	3.0	7.4	142.21
Sugar maple	145,902	3,954	(N/A)	2.9	2.6	50.05
Swamp white oak	39,313	1,065	(N/A)	2.9	0.7	13.66
Maple	64,454	1,747	(N/A)	2.7	1.1	23.60
River birch	98,715	2,675	(N/A)	2.2	1.7	45.34
Eastern red cedar	89,291	2,420	(N/A)	2.1	1.6	42.45
Eastern redbud	19,063	517	(N/A)	1.9	0.3	9.93
Red maple	59,407	1,610	(N/A)	1.9	1.0	30.96
Northern hackberry	67,666	1,834	(N/A)	1.8	1.2	38.20
Black cherry	19,750	535	(N/A)	1.7	0.3	11.64
Norway spruce	91,065	2,468	(N/A)	1.1	1.6	82.26
Juniper	37,538	1,017	(N/A)	1.1	0.7	33.91
American basswood	64,601	1,751	(N/A)	1.1	1.1	58.36
Littleleaf linden	34,986	948	(N/A)	1.0	0.6	35.12
Callery pear	22,886	620	(N/A)	0.9	0.4	25.84
White ash	24,131	654	(N/A)	0.9	0.4	28.43
Black locust	54,493	1,477	(N/A)	0.8	1.0	70.32
Conifer Evergreen Large	31,074	842	(N/A)	0.7	0.5	44.32
Quaking aspen	21,583	585	(N/A)	0.7	0.4	32.49
Black walnut	49,658	1,346	(N/A)	0.7	0.9	74.76
Spruce	12,619	342	(N/A)	0.7	0.2	19.00
Mulberry	11,199	303	(N/A)	0.6	0.2	17.85
Broadleaf Deciduous Small	2,380	64	(N/A)	0.6	0.0	4.03
Pin oak	39,710	1,076	(N/A)	0.6	0.7	67.26
American sycamore	73,913	2,003	(N/A)	0.6	1.3	125.19
Blue spruce	15,343	416	(N/A)	0.5	0.3	31.98
Broadleaf Deciduous Large	42,379	1,148	(N/A)	0.4	0.7	95.71
Sweetgum	16,755	454	(N/A)	0.4	0.3	41.28
Pear	4,083	111	(N/A)	0.4	0.1	11.06
Tulip tree	24,941	676	(N/A)	0.3	0.4	75.10
Northern pin oak	14,822	402	(N/A)	0.3	0.3	44.63
Broadleaf Deciduous Medium	8,386	227	(N/A)	0.3	0.1	25.25
Birch	8,266	224	(N/A)	0.3	0.1	28.00
Eastern hemlock	21,156	573	(N/A)	0.3	0.4	71.67
Ginkgo	3,825	104	(N/A)	0.3	0.1	14.81
Oak	3,497	95	(N/A)	0.3	0.1	13.54
American elm	22,374	606	(N/A)	0.2	0.4	101.06
Common chokecherry	1,840	50	(N/A)	0.2	0.0	9.97
Lilac	417	11	(N/A)	0.2	0.0	2.26

Siberian elm	24,000	650	(N/A)	0.2	0.4	130.08
Catalpa	12,055	327	(N/A)	0.2	0.2	65.34
Black ash	6,345	172	(N/A)	0.1	0.1	42.99
Austrian pine	9,862	267	(N/A)	0.1	0.2	66.81
Boxelder	7,378	200	(N/A)	0.1	0.1	49.99
Kentucky coffeetree	72	2	(N/A)	0.1	0.0	0.48
Paper birch	5,522	150	(N/A)	0.1	0.1	49.88
Willow	4,936	134	(N/A)	0.1	0.1	44.59
Eastern cottonwood	9,830	266	(N/A)	0.1	0.2	133.19
Amur maple	333	9	(N/A)	0.1	0.0	4.51
Scotch pine	5,938	161	(N/A)	0.1	0.1	80.46
Dogwood	272	7	(N/A)	0.1	0.0	3.68
Ohio buckeye	4,350	118	(N/A)	0.1	0.1	58.95
Red pine	2,134	58	(N/A)	0.1	0.0	28.92
Conifer Evergreen Medium	1,511	41	(N/A)	0.1	0.0	20.47
Sweetbay	578	16	(N/A)	0.1	0.0	7.83
Eastern hophornbeam	529	14	(N/A)	0.1	0.0	7.17
Southern magnolia	1,775	48	(N/A)	0.0	0.0	48.11
Ash	1,409	38	(N/A)	0.0	0.0	38.19
Plum	667	18	(N/A)	0.0	0.0	18.06
Sumac	264	7	(N/A)	0.0	0.0	7.17
Elm	172	5	(N/A)	0.0	0.0	4.65
American chestnut	7,239	196	(N/A)	0.0	0.1	196.17
Citywide total	5,708,419	154,698	(N/A)	100.0	100.0	57.23

Table 3: Annual Air Quality Benefits

Muscatine

Annual Air Quality Benefits of Public Trees

2/1/2016

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								
White oak	192.7	30.8	88.2	8.6	1,015	491.0	71.4	68.0	464.7	3,055	0.0	0	1,415.5	4,070	(N/A)	12.1	12.41
Green ash	67.0	10.7	33.3	3.0	360	287.4	42.0	40.1	275.2	1,797	0.0	0	758.8	2,157	(N/A)	9.4	8.46
Northern red oak	63.6	11.0	31.2	2.8	344	157.6	23.0	21.9	149.7	982	-91.0	-341	369.9	985	(N/A)	7.2	5.08
Eastern white pine	46.2	9.2	38.0	5.7	304	106.5	15.7	15.0	103.0	668	-190.9	-716	148.2	257	(N/A)	6.3	1.52
Apple	9.3	1.5	4.6	0.4	50	43.2	6.2	5.8	39.3	265	-0.1	0	110.4	315	(N/A)	4.9	2.37
Honeylocust	48.1	7.9	22.5	2.2	256	137.0	20.0	19.1	130.7	855	-35.0	-131	352.6	980	(N/A)	4.9	7.42
Bur oak	46.3	7.4	21.4	2.1	245	125.1	18.2	17.4	118.7	779	0.0	0	356.5	1,024	(N/A)	3.7	10.24
Norway maple	31.5	5.4	15.8	1.4	171	90.0	13.0	12.3	83.7	556	-7.5	-28	245.6	699	(N/A)	3.7	7.06
Northern white cedar	27.4	5.4	22.1	3.4	180	52.6	7.7	7.3	50.5	329	-130.5	-489	46.0	19	(N/A)	3.3	0.22
Hickory	20.3	3.3	10.2	0.9	110	91.4	13.3	12.7	86.6	569	0.0	0	238.7	679	(N/A)	3.0	8.38
Silver maple	76.4	12.9	37.2	3.4	411	133.8	19.6	18.7	128.3	837	-40.3	-151	390.0	1,097	(N/A)	3.0	13.71
Sugar maple	17.6	3.0	9.3	0.8	97	74.8	11.0	10.5	71.8	468	-14.2	-53	184.5	512	(N/A)	2.9	6.48
Swamp white oak	6.0	1.0	3.3	0.3	34	28.3	4.1	3.9	26.3	175	-1.6	-6	71.6	202	(N/A)	2.9	2.59
Maple	11.4	1.9	5.8	0.5	62	48.0	7.0	6.7	45.5	299	-4.3	-16	122.4	345	(N/A)	2.7	4.66
River birch	19.1	3.3	9.6	0.8	104	56.1	8.1	7.7	52.6	348	-4.6	-17	152.7	434	(N/A)	2.2	7.36
Eastern red cedar	18.6	3.7	14.7	2.3	121	29.6	4.3	4.1	27.6	183	-49.3	-185	55.5	119	(N/A)	2.1	2.09
Eastern redbud	5.3	0.9	2.6	0.2	28	22.6	3.2	3.1	20.7	139	0.0	0	58.6	167	(N/A)	1.9	3.22
Red maple	13.0	2.2	6.2	0.6	70	36.7	5.4	5.1	34.9	229	-4.5	-17	99.6	282	(N/A)	1.9	5.42
Northern hackberry	8.2	1.4	4.7	0.4	46	48.2	7.0	6.7	45.5	300	0.0	0	122.2	346	(N/A)	1.8	7.21
Black cherry	5.4	0.9	2.6	0.2	29	23.1	3.3	3.1	20.9	141	0.0	0	59.5	170	(N/A)	1.7	3.70
Norway spruce	10.9	2.2	8.8	1.3	71	20.2	2.9	2.8	19.3	126	-51.2	-192	17.2	5	(N/A)	1.1	0.18
Juniper	7.3	1.4	5.8	0.9	48	12.6	1.8	1.7	11.7	78	-20.6	-77	22.8	48	(N/A)	1.1	1.61
American basswood	8.1	1.4	4.1	0.4	44	31.5	4.5	4.3	29.4	195	-7.1	-27	76.6	212	(N/A)	1.1	7.07
Littleleaf linden	5.6	1.0	2.8	0.2	30	18.6	2.7	2.6	17.4	115	-2.8	-10	48.1	135	(N/A)	1.0	5.00
Callery pear	3.6	0.6	1.9	0.2	20	16.5	2.4	2.3	15.6	102	-0.9	-4	42.1	119	(N/A)	0.9	4.95
White ash	1.6	0.3	1.0	0.1	9	15.8	2.3	2.2	15.3	99	0.0	0	38.6	109	(N/A)	0.9	4.72
Black locust	11.4	2.0	5.6	0.5	62	27.1	3.9	3.7	25.4	168	-2.7	-10	76.9	220	(N/A)	0.8	10.45
Conifer Evergreen Large	3.6	0.7	3.0	0.4	24	9.0	1.3	1.3	8.7	56	-14.9	-56	13.0	24	(N/A)	0.7	1.26
Quaking aspen	2.3	0.4	1.2	0.1	12	10.6	1.5	1.5	10.0	66	0.0	0	27.6	78	(N/A)	0.7	4.36
Black walnut	6.4	1.0	3.0	0.3	34	20.0	2.9	2.8	19.1	125	0.0	0	55.6	159	(N/A)	0.7	8.84
Spruce	1.2	0.2	1.2	0.1	8	5.6	0.8	0.8	5.2	35	-3.9	-15	11.2	28	(N/A)	0.7	1.57
Mulberry	3.6	0.6	1.7	0.2	19	12.1	1.7	1.7	11.2	75	0.0	0	32.8	94	(N/A)	0.6	5.52
Broadleaf Deciduous Small	0.5	0.1	0.3	0.0	3	3.4	0.5	0.5	3.1	21	0.0	0	8.4	24	(N/A)	0.6	1.48
Pin oak	6.8	1.2	3.5	0.3	37	18.5	2.7	2.6	17.8	116	-12.8	-48	40.6	105	(N/A)	0.6	6.58
American sycamore	11.7	1.9	5.3	0.5	62	26.6	3.9	3.7	25.2	166	0.0	0	78.9	227	(N/A)	0.6	14.21

Blue spruce	1.8	0.3	1.5	0.2	12	6.0	0.9	0.8	5.7	37	-5.3	-20	12.0	29 (N/A)	0.5	2.26
Broadleaf Deciduous Large	6.0	1.0	2.8	0.3	32	17.1	2.5	2.4	16.3	107	0.0	0	48.4	139 (N/A)	0.4	11.57
Sweetgum	1.5	0.2	0.8	0.1	8	9.8	1.4	1.4	9.4	61	0.0	0	24.6	69 (N/A)	0.4	6.32
Pear	1.2	0.2	0.6	0.1	7	4.4	0.6	0.6	4.0	27	0.0	0	11.8	34 (N/A)	0.4	3.37
Tulip tree	3.0	0.5	1.5	0.1	16	10.8	1.6	1.5	10.2	67	0.0	0	29.1	83 (N/A)	0.3	9.25
Northern pin oak	2.5	0.4	1.3	0.1	14	10.3	1.5	1.4	9.9	64	-0.6	-2	26.8	76 (N/A)	0.3	8.42
Broadleaf Deciduous Medium	1.5	0.3	0.8	0.1	8	4.8	0.7	0.7	4.5	30	-0.4	-1	12.9	37 (N/A)	0.3	4.09
Birch	1.4	0.2	0.7	0.1	8	5.5	0.8	0.7	5.1	34	-0.4	-1	14.1	40 (N/A)	0.3	5.01
Eastern hemlock	2.5	0.5	2.0	0.3	16	4.7	0.7	0.7	4.5	29	-11.7	-44	4.1	2 (N/A)	0.3	0.21
Ginkgo	1.1	0.2	0.5	0.0	6	2.4	0.3	0.3	2.3	15	-0.3	-1	6.9	20 (N/A)	0.3	2.79
Oak	0.2	0.0	0.1	0.0	1	2.6	0.4	0.4	2.5	16	0.0	0	6.2	17 (N/A)	0.3	2.49
American elm	5.9	1.0	2.8	0.3	32	12.0	1.8	1.7	11.6	75	0.0	0	37.1	107 (N/A)	0.2	17.84
Common chokecherry	0.5	0.1	0.3	0.0	3	2.0	0.3	0.3	1.8	12	0.0	0	5.2	15 (N/A)	0.2	2.97
Lilac	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.6	4	0.0	0	1.5	4 (N/A)	0.2	0.84
Siberian elm	4.8	0.8	2.2	0.2	26	9.2	1.3	1.3	8.9	58	0.0	0	28.7	83 (N/A)	0.2	16.61
Catalpa	1.2	0.2	0.6	0.1	7	6.3	0.9	0.9	6.0	39	0.0	0	16.2	46 (N/A)	0.2	9.20
Black ash	1.2	0.2	0.6	0.1	7	3.7	0.5	0.5	3.5	23	-0.3	-1	10.0	28 (N/A)	0.1	7.11
Austrian pine	1.6	0.3	1.3	0.2	10	2.8	0.4	0.4	2.6	17	-3.8	-14	5.8	13 (N/A)	0.1	3.36
Boxelder	0.8	0.1	0.4	0.0	5	3.9	0.6	0.6	3.8	25	-0.4	-1	9.9	28 (N/A)	0.1	6.96
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.0	0	0.0	0	0.1	0 (N/A)	0.1	0.08
Paper birch	0.5	0.1	0.3	0.0	3	3.4	0.5	0.5	3.3	21	0.0	0	8.6	24 (N/A)	0.1	8.06
Willow	1.0	0.2	0.5	0.0	5	2.6	0.4	0.4	2.4	16	-0.2	-1	7.2	21 (N/A)	0.1	6.84
Eastern cottonwood	1.9	0.3	0.8	0.1	10	3.6	0.5	0.5	3.4	22	0.0	0	11.0	32 (N/A)	0.1	15.94
Amur maple	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.1	1.63
Scotch pine	0.7	0.1	0.6	0.1	5	1.4	0.2	0.2	1.3	9	-2.8	-10	1.8	3 (N/A)	0.1	1.45
Dogwood	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3 (N/A)	0.1	1.33
Ohio buckeye	0.9	0.2	0.5	0.0	5	2.1	0.3	0.3	1.9	13	-0.2	-1	6.0	17 (N/A)	0.1	8.52
Red pine	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.7	4 (N/A)	0.1	2.15
Conifer Evergreen Medium	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3 (N/A)	0.1	1.53
Sweetbay	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	4	0.0	0	1.5	4 (N/A)	0.1	2.06
Eastern hophornbeam	0.1	0.0	0.1	0.0	1	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5 (N/A)	0.1	2.55
Southern magnolia	0.1	0.0	0.1	0.0	1	1.0	0.2	0.1	1.0	7	-0.5	-2	2.1	5 (N/A)	0.0	5.49
Ash	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8 (N/A)	0.0	7.92
Plum	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.3	7 (N/A)	0.0	6.56
Sumac	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3 (N/A)	0.0	2.55
Elm	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1 (N/A)	0.0	0.87
American chestnut	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19 (N/A)	0.0	19.04
Citywide total	864.5	146.8	457.5	48.2	4,776	2,472.8	359.9	343.0	2,344.9	15,398	-718.9	-2,696	6,318.7	17,478 (N/A)	100.0	6.47

Table 4: Annual Carbon Stored

Muscatine

Stored CO2 Benefits of Public Trees

2/1/2016

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	6,393,966	47,955	(N/A)	12.1	31.1	146.20
Green ash	2,219,045	16,643	(N/A)	9.4	10.8	65.27
Northern red oak	1,355,136	10,164	(N/A)	7.2	6.6	52.39
Eastern white pine	464,370	3,483	(N/A)	6.3	2.3	20.61
Apple	155,670	1,168	(N/A)	4.9	0.8	8.78
Honeylocust	606,617	4,550	(N/A)	4.9	3.0	34.47
Bur oak	1,554,388	11,658	(N/A)	3.7	7.6	116.58
Norway maple	523,627	3,927	(N/A)	3.7	2.5	39.67
Northern white cedar	332,263	2,492	(N/A)	3.3	1.6	28.00
Hickory	658,344	4,938	(N/A)	3.0	3.2	60.96
Silver maple	1,819,708	13,648	(N/A)	3.0	8.9	170.60
Sugar maple	511,575	3,837	(N/A)	2.9	2.5	48.57
Swamp white oak	105,751	793	(N/A)	2.9	0.5	10.17
Maple	137,410	1,031	(N/A)	2.7	0.7	13.93
River birch	318,153	2,386	(N/A)	2.2	1.5	40.44
Eastern red cedar	59,875	449	(N/A)	2.1	0.3	7.88
Eastern redbud	86,723	650	(N/A)	1.9	0.4	12.51
Red maple	145,594	1,092	(N/A)	1.9	0.7	21.00
Northern hackberry	117,457	881	(N/A)	1.8	0.6	18.35
Black cherry	89,664	672	(N/A)	1.7	0.4	14.62
Norway spruce	130,228	977	(N/A)	1.1	0.6	32.56
Juniper	24,029	180	(N/A)	1.1	0.1	6.01
American basswood	295,666	2,217	(N/A)	1.1	1.4	73.92
Littleleaf linden	121,119	908	(N/A)	1.0	0.6	33.64
Callery pear	60,635	455	(N/A)	0.9	0.3	18.95
White ash	50,978	382	(N/A)	0.9	0.2	16.62
Black locust	188,570	1,414	(N/A)	0.8	0.9	67.35
Conifer Evergreen La	35,955	270	(N/A)	0.7	0.2	14.19
Quaking aspen	80,056	600	(N/A)	0.7	0.4	33.36
Black walnut	211,662	1,587	(N/A)	0.7	1.0	88.19
Spruce	6,888	52	(N/A)	0.7	0.0	2.87
Mulberry	56,490	424	(N/A)	0.6	0.3	24.92
Broadleaf Deciduous	9,204	69	(N/A)	0.6	0.0	4.31
Pin oak	181,484	1,361	(N/A)	0.6	0.9	85.07
American sycamore	396,016	2,970	(N/A)	0.6	1.9	185.63
Blue spruce	9,533	71	(N/A)	0.5	0.0	5.50
Broadleaf Deciduous	203,468	1,526	(N/A)	0.4	1.0	127.17
Sweetgum	48,135	361	(N/A)	0.4	0.2	32.82
Pear	19,957	150	(N/A)	0.4	0.1	14.97
Tulip tree	97,924	734	(N/A)	0.3	0.5	81.60
Northern pin oak	41,260	309	(N/A)	0.3	0.2	34.38
Broadleaf Deciduous	25,424	191	(N/A)	0.3	0.1	21.19
Birch	23,626	177	(N/A)	0.3	0.1	22.15
Eastern hemlock	29,708	223	(N/A)	0.3	0.1	27.85
Ginkgo	15,696	118	(N/A)	0.3	0.1	16.82
Oak	6,985	52	(N/A)	0.3	0.0	7.48
American elm	119,854	899	(N/A)	0.2	0.6	149.82
Common chokecherry	8,914	67	(N/A)	0.2	0.0	13.37
Lilac	1,291	10	(N/A)	0.2	0.0	1.94
Siberian elm	117,539	882	(N/A)	0.2	0.6	176.31
Catalpa	40,032	300	(N/A)	0.2	0.2	60.05
Black ash	20,106	151	(N/A)	0.1	0.1	37.70
Austrian pine	12,877	97	(N/A)	0.1	0.1	24.14
Boxelder	23,139	174	(N/A)	0.1	0.1	43.39
Kentucky coffeetree	49	0	(N/A)	0.1	0.0	0.09

Paper birch	15,801	119	(N/A)	0.1	0.1	39.50
Willow	16,481	124	(N/A)	0.1	0.1	41.20
Eastern cottonwood	64,440	483	(N/A)	0.1	0.3	241.65
Amur maple	1,086	8	(N/A)	0.1	0.0	4.07
Scotch pine	6,685	50	(N/A)	0.1	0.0	25.07
Dogwood	922	7	(N/A)	0.1	0.0	3.46
Ohio buckeye	15,381	115	(N/A)	0.1	0.1	57.68
Red pine	1,427	11	(N/A)	0.1	0.0	5.35
Conifer Evergreen M	568	4	(N/A)	0.1	0.0	2.13
Sweetbay	1,816	14	(N/A)	0.1	0.0	6.81
Eastern hophornbeam	1,816	14	(N/A)	0.1	0.0	6.81
Southern magnolia	1,851	14	(N/A)	0.0	0.0	13.88
Ash	3,624	27	(N/A)	0.0	0.0	27.18
Plum	3,037	23	(N/A)	0.0	0.0	22.78
Sumac	908	7	(N/A)	0.0	0.0	6.81
Elm	185	1	(N/A)	0.0	0.0	1.39
American chestnut	39,259	294	(N/A)	0.0	0.2	294.44
Citywide total	20,545,118	154,088	(N/A)	100.0	100.0	57.01

Table 5: Annual Carbon Sequestered

Muscatine

Annual CO Benefits of Public Trees

2/1/2016

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
White oak	235,020	1,763	-30,691	-1,133	-8	0	0	203,196	1,524 (N/A)	12.1	21.8	4.65
Green ash	133,955	1,005	-10,651	-612	-5	0	0	122,692	920 (N/A)	9.4	13.2	3.61
Northern red oak	33,111	248	-6,505	-417	-3	0	0	26,189	196 (N/A)	7.2	2.8	1.01
Eastern white pine	22,990	172	-2,229	-406	-3	0	0	20,355	153 (N/A)	6.3	2.2	0.90
Apple	13,667	103	-749	-134	-1	0	0	12,784	96 (N/A)	4.9	1.4	0.72
Honeylocust	73,996	555	-2,922	-242	-2	0	0	70,832	531 (N/A)	4.9	7.6	4.02
Bur oak	56,943	427	-7,461	-290	-2	0	0	49,192	369 (N/A)	3.7	5.3	3.69
Norway maple	28,281	212	-2,521	-197	-1	0	0	25,563	192 (N/A)	3.7	2.7	1.94
Northern white cedar	5,538	42	-1,595	-252	-2	0	0	3,691	28 (N/A)	3.3	0.4	0.31
Hickory	45,691	343	-3,160	-197	-1	0	0	42,334	318 (N/A)	3.0	4.5	3.92
Silver maple	126,990	952	-8,735	-322	-2	0	0	117,933	885 (N/A)	3.0	12.7	11.06
Sugar maple	30,831	231	-2,465	-165	-1	0	0	28,201	212 (N/A)	2.9	3.0	2.68
Swamp white oak	10,737	81	-525	-67	-1	0	0	10,144	76 (N/A)	2.9	1.1	0.98
Maple	15,819	119	-660	-97	-1	0	0	15,062	113 (N/A)	2.7	1.6	1.53
River birch	13,969	105	-1,529	-126	-1	0	0	12,314	92 (N/A)	2.2	1.3	1.57
Eastern red cedar	1,052	8	-287	-108	-1	0	0	657	5 (N/A)	2.1	0.1	0.09
Eastern redbud	7,503	56	-417	-66	0	0	0	7,021	53 (N/A)	1.9	0.8	1.01
Red maple	14,482	109	-699	-74	-1	0	0	13,708	103 (N/A)	1.9	1.5	1.98
Northern hackberry	9,204	69	-564	-87	-1	0	0	8,552	64 (N/A)	1.8	0.9	1.34
Black cherry	6,818	51	-430	-69	-1	0	0	6,319	47 (N/A)	1.7	0.7	1.03
Norway spruce	3,120	23	-625	-87	-1	0	0	2,407	18 (N/A)	1.1	0.3	0.60
Juniper	508	4	-115	-48	0	0	0	344	3 (N/A)	1.1	0.0	0.09
American basswood	18,542	139	-1,419	-75	-1	0	0	17,047	128 (N/A)	1.1	1.8	4.26
Littleleaf linden	11,227	84	-585	-48	0	0	0	10,594	79 (N/A)	1.0	1.1	2.94
Callery pear	6,097	46	-291	-33	0	0	0	5,773	43 (N/A)	0.9	0.6	1.80
White ash	6,955	52	-245	-33	0	0	0	6,676	50 (N/A)	0.9	0.7	2.18
Black locust	6,207	47	-905	-61	0	0	0	5,241	39 (N/A)	0.8	0.6	1.87
Conifer Evergreen Large	1,796	13	-173	-35	0	0	0	1,589	12 (N/A)	0.7	0.2	0.63
Quaking aspen	4,943	37	-384	-27	0	0	0	4,532	34 (N/A)	0.7	0.5	1.89
Black walnut	9,880	74	-1,016	-45	0	0	0	8,819	66 (N/A)	0.7	0.9	3.67
Spruce	1,052	8	-33	-22	0	0	0	997	7 (N/A)	0.7	0.1	0.42
Mulberry	4,098	31	-271	-32	0	0	0	3,794	28 (N/A)	0.6	0.4	1.67
Broadleaf Deciduous Smal	1,072	8	-44	-11	0	0	0	1,016	8 (N/A)	0.6	0.1	0.48
Pin oak	13,611	102	-871	-41	0	0	0	12,699	95 (N/A)	0.6	1.4	5.95
American sycamore	11,511	86	-1,901	-62	0	0	0	9,548	72 (N/A)	0.6	1.0	4.48
Blue spruce	867	6	-46	-21	0	0	0	800	6 (N/A)	0.5	0.1	0.46
Broadleaf Deciduous Larg	7,541	57	-977	-38	0	0	0	6,526	49 (N/A)	0.4	0.7	4.08
Sweetgum	4,675	35	-231	-21	0	0	0	4,423	33 (N/A)	0.4	0.5	3.02
Pear	761	6	-96	-15	0	0	0	650	5 (N/A)	0.4	0.1	0.49
Tulip tree	5,483	41	-470	-24	0	0	0	4,989	37 (N/A)	0.3	0.5	4.16
Northern pin oak	3,641	27	-198	-19	0	0	0	3,424	26 (N/A)	0.3	0.4	2.85
Broadleaf Deciduous Medi	1,841	14	-124	-11	0	0	0	1,706	13 (N/A)	0.3	0.2	1.42
Birch	1,971	15	-114	-12	0	0	0	1,845	14 (N/A)	0.3	0.2	1.73
Eastern hemlock	498	4	-143	-23	0	0	0	333	2 (N/A)	0.3	0.0	0.31
Ginkgo	25	0	-75	-8	0	0	0	-59	0 (N/A)	0.3	0.0	-0.06
Oak	1,151	9	-34	-6	0	0	0	1,111	8 (N/A)	0.3	0.1	1.19
American elm	3,075	23	-575	-24	0	0	0	2,476	19 (N/A)	0.2	0.3	3.09
Common chokecherry	782	6	-43	-6	0	0	0	733	5 (N/A)	0.2	0.1	1.10
Lilac	207	2	-6	-3	0	0	0	198	1 (N/A)	0.2	0.0	0.30
Siberian elm	3,717	28	-564	-21	0	0	0	3,131	23 (N/A)	0.2	0.3	4.70
Catalpa	3,067	23	-192	-13	0	0	0	2,862	21 (N/A)	0.2	0.3	4.29
Black ash	834	6	-97	-9	0	0	0	729	5 (N/A)	0.1	0.1	1.37
Austrian pine	630	5	-62	-12	0	0	0	556	4 (N/A)	0.1	0.1	1.04
Boxelder	2,226	17	-111	-9	0	0	0	2,105	16 (N/A)	0.1	0.2	3.95
Kentucky coffeetree	10	0	0	-1	0	0	0	9	0 (N/A)	0.1	0.0	0.02
Paper birch	1,550	12	-76	-7	0	0	0	1,468	11 (N/A)	0.1	0.2	3.67
Willow	448	3	-79	-7	0	0	0	362	3 (N/A)	0.1	0.0	0.91
Eastern cottonwood	1,139	9	-309	-9	0	0	0	821	6 (N/A)	0.1	0.1	3.08
Amur maple	152	1	-5	-2	0	0	0	145	1 (N/A)	0.1	0.0	0.54
Scotch pine	375	3	-32	-5	0	0	0	337	3 (N/A)	0.1	0.0	1.26
Dogwood	123	1	-4	-1	0	0	0	117	1 (N/A)	0.1	0.0	0.44
Ohio buckeye	224	2	-74	-5	0	0	0	145	1 (N/A)	0.1	0.0	0.54
Red pine	168	1	-7	-3	0	0	0	158	1 (N/A)	0.1	0.0	0.59
Conifer Evergreen Mediun	77	1	-3	-2	0	0	0	72	1 (N/A)	0.1	0.0	0.27
Sweetbay	163	1	-9	-2	0	0	0	152	1 (N/A)	0.1	0.0	0.57
Eastern hophornbeam	228	2	-9	-2	0	0	0	217	2 (N/A)	0.1	0.0	0.81
Southern magnolia	143	1	-9	-2	0	0	0	132	1 (N/A)	0.0	0.0	0.99

Ash	386	3	-17	-2	0	0	0	367	3 (N/A)	0.0	0.0	2.75
Plum	268	2	-15	-2	0	0	0	251	2 (N/A)	0.0	0.0	1.88
Sumac	114	1	-4	-1	0	0	0	108	1 (N/A)	0.0	0.0	0.81
Elm	74	1	-1	-1	0	0	0	73	1 (N/A)	0.0	0.0	0.55
American chestnut	912	7	-188	-5	0	0	0	719	5 (N/A)	0.0	0.1	5.39
Citywide total	1,036,761	7,776	-98,675	-6,078	-46	0	0	932,008	6,990 (N/A)	100.0	100.0	2.59

Table 6: Annual Social and Aesthetic Benefits

Muscatine

Annual Aesthetic/Other Benefits of Public Trees

2/1/2016

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
White oak	17,859	(N/A)	12.1	16.8	54.45
Green ash	12,159	(N/A)	9.4	11.5	47.68
Northern red oak	2,748	(N/A)	7.2	2.6	14.17
Eastern white pine	5,437	(N/A)	6.3	5.1	32.17
Apple	769	(N/A)	4.9	0.7	5.78
Honeylocust	16,283	(N/A)	4.9	15.4	123.36
Bur oak	4,647	(N/A)	3.7	4.4	46.47
Norway maple	2,827	(N/A)	3.7	2.7	28.55
Northern white cedar	1,237	(N/A)	3.3	1.2	13.89
Hickory	4,068	(N/A)	3.0	3.8	50.22
Silver maple	9,461	(N/A)	3.0	8.9	118.26
Sugar maple	3,417	(N/A)	2.9	3.2	43.26
Swamp white oak	1,255	(N/A)	2.9	1.2	16.09
Maple	2,485	(N/A)	2.7	2.3	33.58
River birch	1,455	(N/A)	2.2	1.4	24.66
Eastern red cedar	363	(N/A)	2.1	0.3	6.37
Eastern redbud	430	(N/A)	1.9	0.4	8.26
Red maple	1,981	(N/A)	1.9	1.9	38.09
Northern hackberry	1,690	(N/A)	1.8	1.6	35.20
Black cherry	393	(N/A)	1.7	0.4	8.53
Norway spruce	619	(N/A)	1.1	0.6	20.62
Juniper	240	(N/A)	1.1	0.2	7.99
American basswood	1,398	(N/A)	1.1	1.3	46.61
Littleleaf linden	1,232	(N/A)	1.0	1.2	45.64
Callery pear	642	(N/A)	0.9	0.6	26.77
White ash	1,035	(N/A)	0.9	1.0	45.02
Black locust	589	(N/A)	0.8	0.6	28.06
Conifer Evergreen Large	427	(N/A)	0.7	0.4	22.50
Quaking aspen	554	(N/A)	0.7	0.5	30.79
Black walnut	809	(N/A)	0.7	0.8	44.97
Spruce	310	(N/A)	0.7	0.3	17.22
Mulberry	240	(N/A)	0.6	0.2	14.13
Broadleaf Deciduous Small	58	(N/A)	0.6	0.1	3.65
Pin oak	1,104	(N/A)	0.6	1.0	69.00
American sycamore	860	(N/A)	0.6	0.8	53.73
Blue spruce	303	(N/A)	0.5	0.3	23.32
Broadleaf Deciduous Large	616	(N/A)	0.4	0.6	51.30
Sweetgum	469	(N/A)	0.4	0.4	42.61
Pear	43	(N/A)	0.4	0.0	4.29
Tulip tree	461	(N/A)	0.3	0.4	51.22
Northern pin oak	360	(N/A)	0.3	0.3	40.02
Broadleaf Deciduous Medium	189	(N/A)	0.3	0.2	21.04
Birch	215	(N/A)	0.3	0.2	26.83
Eastern hemlock	132	(N/A)	0.3	0.1	16.48
Ginkgo	4	(N/A)	0.3	0.0	0.61
Oak	157	(N/A)	0.3	0.1	22.40
American elm	406	(N/A)	0.2	0.4	67.63
Common chokecherry	46	(N/A)	0.2	0.0	9.14

Lilac	11 (N/A)	0.2	0.0	2.12
Siberian elm	237 (N/A)	0.2	0.2	47.35
Catalpa	273 (N/A)	0.2	0.3	54.54
Black ash	92 (N/A)	0.1	0.1	22.90
Austrian pine	73 (N/A)	0.1	0.1	18.18
Boxelder	182 (N/A)	0.1	0.2	45.50
Kentucky coffeetree	21 (N/A)	0.1	0.0	5.26
Paper birch	149 (N/A)	0.1	0.1	49.80
Willow	52 (N/A)	0.1	0.0	17.48
Eastern cottonwood	86 (N/A)	0.1	0.1	43.13
Amur maple	8 (N/A)	0.1	0.0	4.23
Scotch pine	94 (N/A)	0.1	0.1	47.08
Dogwood	6 (N/A)	0.1	0.0	3.22
Ohio buckeye	26 (N/A)	0.1	0.0	13.11
Red pine	48 (N/A)	0.1	0.0	23.87
Conifer Evergreen Medium	42 (N/A)	0.1	0.0	21.08
Sweetbay	9 (N/A)	0.1	0.0	4.38
Eastern hophornbeam	13 (N/A)	0.1	0.0	6.40
Southern magnolia	35 (N/A)	0.0	0.0	34.98
Ash	39 (N/A)	0.0	0.0	39.16
Plum	15 (N/A)	0.0	0.0	15.48
Sumac	6 (N/A)	0.0	0.0	6.40
Elm	15 (N/A)	0.0	0.0	14.73
American chestnut	58 (N/A)	0.0	0.1	58.34
Citywide total	106,074 (N/A)	100.0	100.0	39.24

Table 7: Summary of Benefits in Dollars

Muscatine

Total Annual Benefits of Public Trees by Species ($)

2/1/2016

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
White oak	21,691	1,524	4,070	36,070	17,859	81,215	(N/A)	20.6
Green ash	12,478	920	2,157	15,814	12,159	43,528	(N/A)	11.0
Northern red oak	6,949	196	985	8,385	2,748	19,264	(N/A)	4.9
Eastern white pine	4,572	153	257	10,808	5,437	21,226	(N/A)	5.4
Apple	2,020	96	315	958	769	4,158	(N/A)	1.1
Honeylocust	6,006	531	980	7,064	16,283	30,865	(N/A)	7.8
Bur oak	5,510	369	1,024	8,648	4,647	20,198	(N/A)	5.1
Norway maple	4,061	192	699	4,407	2,827	12,186	(N/A)	3.1
Northern white cedar	2,290	28	19	6,223	1,237	9,796	(N/A)	2.5
Hickory	4,036	318	679	5,090	4,068	14,190	(N/A)	3.6
Silver maple	5,825	885	1,097	11,377	9,461	28,643	(N/A)	7.3
Sugar maple	3,244	212	512	3,954	3,417	11,339	(N/A)	2.9
Swamp white oak	1,286	76	202	1,065	1,255	3,885	(N/A)	1.0
Maple	2,121	113	345	1,747	2,485	6,810	(N/A)	1.7
River birch	2,504	92	434	2,675	1,455	7,161	(N/A)	1.8
Eastern red cedar	1,345	5	119	2,420	363	4,252	(N/A)	1.1
Eastern redbud	1,054	53	167	517	430	2,221	(N/A)	0.6
Red maple	1,618	103	282	1,610	1,981	5,593	(N/A)	1.4
Northern hackberry	2,134	64	346	1,834	1,690	6,068	(N/A)	1.5
Black cherry	1,087	47	170	535	393	2,232	(N/A)	0.6
Norway spruce	885	18	5	2,468	619	3,995	(N/A)	1.0
Juniper	577	3	48	1,017	240	1,885	(N/A)	0.5
American basswood	1,417	128	212	1,751	1,398	4,906	(N/A)	1.2
Littleleaf linden	827	79	135	948	1,232	3,221	(N/A)	0.8
Callery pear	728	43	119	620	642	2,153	(N/A)	0.5
White ash	680	50	109	654	1,035	2,528	(N/A)	0.6
Black locust	1,214	39	220	1,477	589	3,539	(N/A)	0.9
Conifer Evergreen Large	383	12	24	842	427	1,688	(N/A)	0.4
Quaking aspen	474	34	78	585	554	1,725	(N/A)	0.4
Black walnut	880	66	159	1,346	809	3,260	(N/A)	0.8
Spruce	255	7	28	342	310	943	(N/A)	0.2
Mulberry	551	28	94	303	240	1,217	(N/A)	0.3
Broadleaf Deciduous Sn	155	8	24	64	58	309	(N/A)	0.1
Pin oak	801	95	105	1,076	1,104	3,182	(N/A)	0.8
American sycamore	1,175	72	227	2,003	860	4,337	(N/A)	1.1
Blue spruce	260	6	29	416	303	1,015	(N/A)	0.3
Broadleaf Deciduous La	748	49	139	1,148	616	2,700	(N/A)	0.7
Sweetgum	430	33	69	454	469	1,455	(N/A)	0.4
Pear	207	5	34	111	43	399	(N/A)	0.1
Tulip tree	478	37	83	676	461	1,735	(N/A)	0.4
Northern pin oak	445	26	76	402	360	1,308	(N/A)	0.3
Broadleaf Deciduous M	222	13	37	227	189	688	(N/A)	0.2
Birch	249	14	40	224	215	741	(N/A)	0.2
Eastern hemlock	208	2	2	573	132	918	(N/A)	0.2
Ginkgo	105	0	20	104	4	232	(N/A)	0.1
Oak	113	8	17	95	157	391	(N/A)	0.1
American elm	517	19	107	606	406	1,655	(N/A)	0.4
Common chokecherry	93	5	15	50	46	209	(N/A)	0.1

Lilac	31	1	4	11	11	58 (N/A)	0.0
Siberian elm	394	23	83	650	237	1,388 (N/A)	0.4
Catalpa	274	21	46	327	273	941 (N/A)	0.2
Black ash	167	5	28	172	92	464 (N/A)	0.1
Austrian pine	124	4	13	267	73	482 (N/A)	0.1
Boxelder	171	16	28	200	182	596 (N/A)	0.2
Kentucky coffeetree	3	0	0	2	21	26 (N/A)	0.0
Paper birch	146	11	24	150	149	480 (N/A)	0.1
Willow	120	3	21	134	52	329 (N/A)	0.1
Eastern cottonwood	156	6	32	266	86	547 (N/A)	0.1
Amur maple	24	1	3	9	8	45 (N/A)	0.0
Scotch pine	61	3	3	161	94	321 (N/A)	0.1
Dogwood	19	1	3	7	6	36 (N/A)	0.0
Ohio buckeye	95	1	17	118	26	258 (N/A)	0.1
Red pine	38	1	4	58	48	149 (N/A)	0.0
Conifer Evergreen Medi	30	1	3	41	42	116 (N/A)	0.0
Sweetbay	27	1	4	16	9	56 (N/A)	0.0
Eastern hophornbeam	36	2	5	14	13	70 (N/A)	0.0
Southern magnolia	41	1	5	48	35	131 (N/A)	0.0
Ash	47	3	8	38	39	135 (N/A)	0.0
Plum	38	2	7	18	15	80 (N/A)	0.0
Sumac	18	1	3	7	6	35 (N/A)	0.0
Elm	6	1	1	5	15	27 (N/A)	0.0
American chestnut	91	5	19	196	58	370 (N/A)	0.1
Citywide Total	109,064	6,990	17,478	154,698	106,074	394,304 (N/A)	100.0

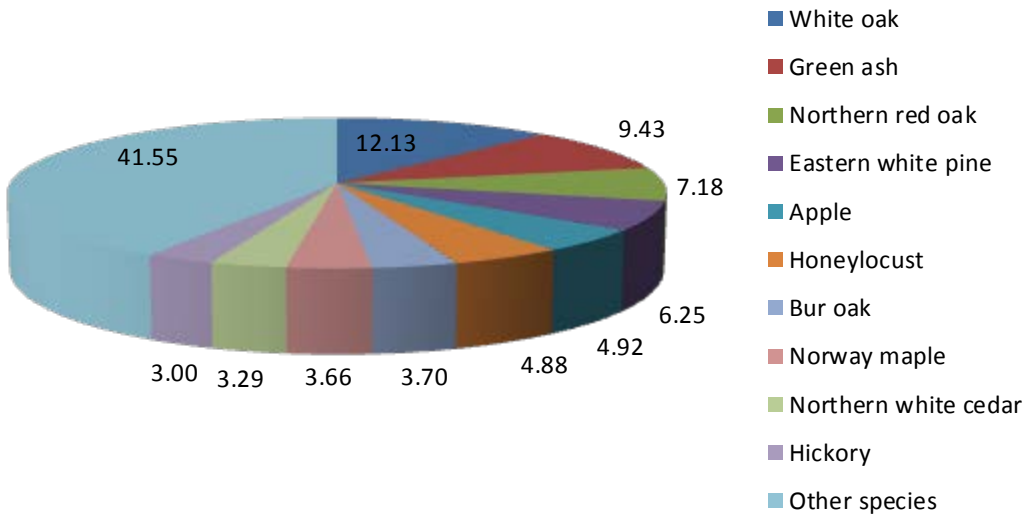

Figure 1: Species Distribution

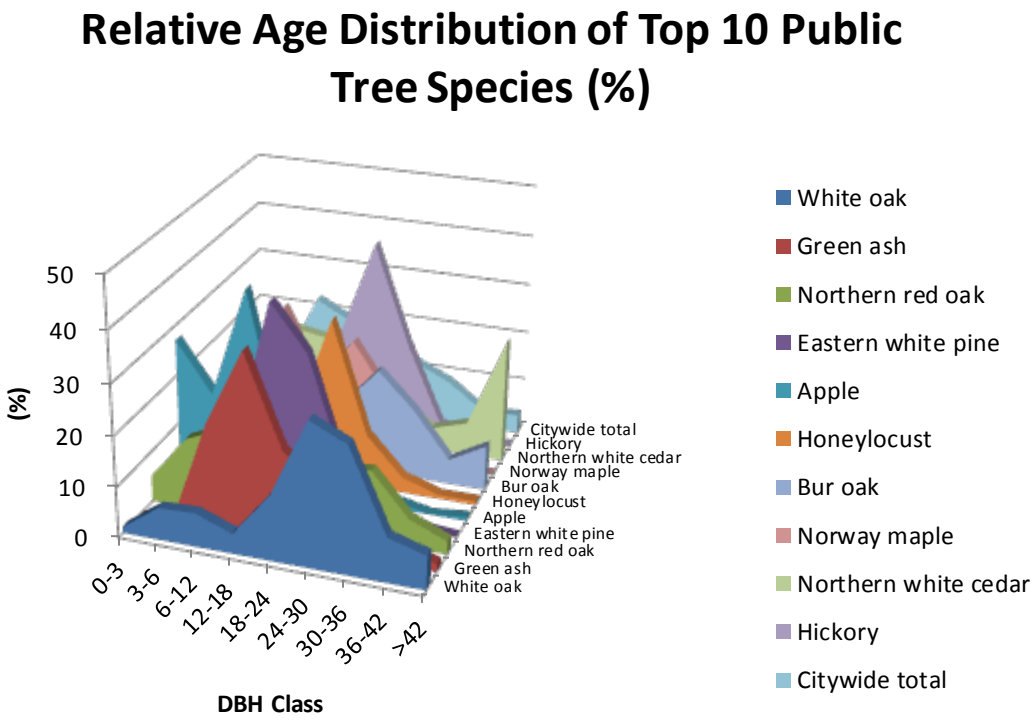

Figure 2: Relative Age Class

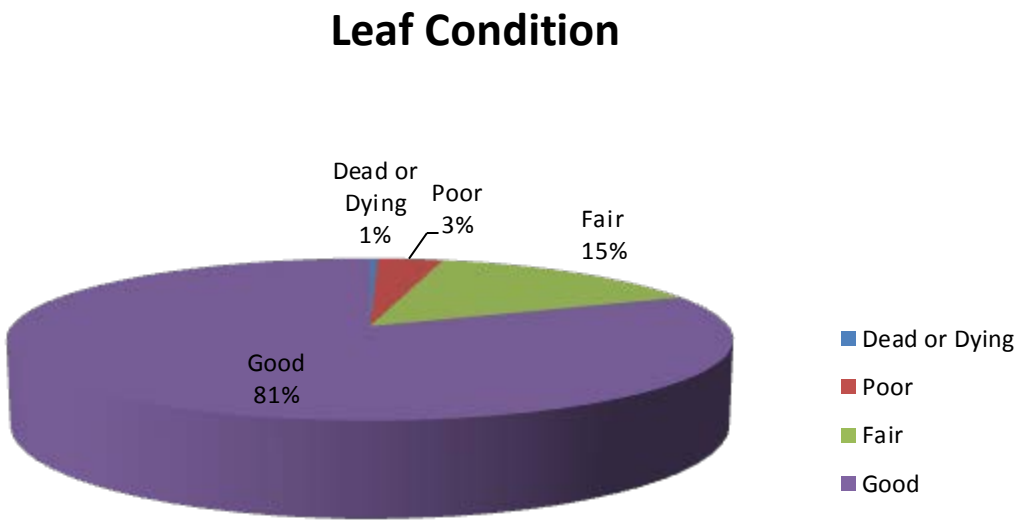

Figure 3: Foliage Condition

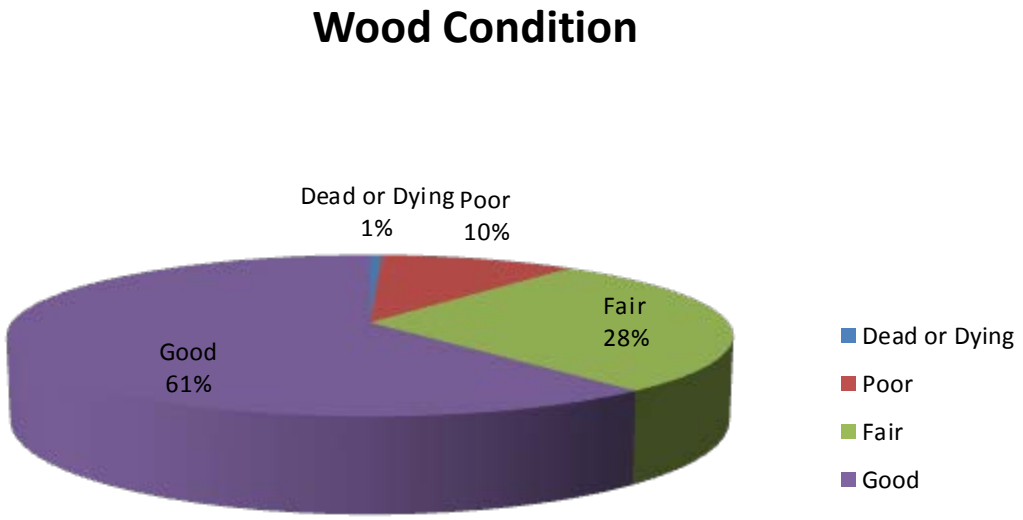

Figure 4: Wood Condition

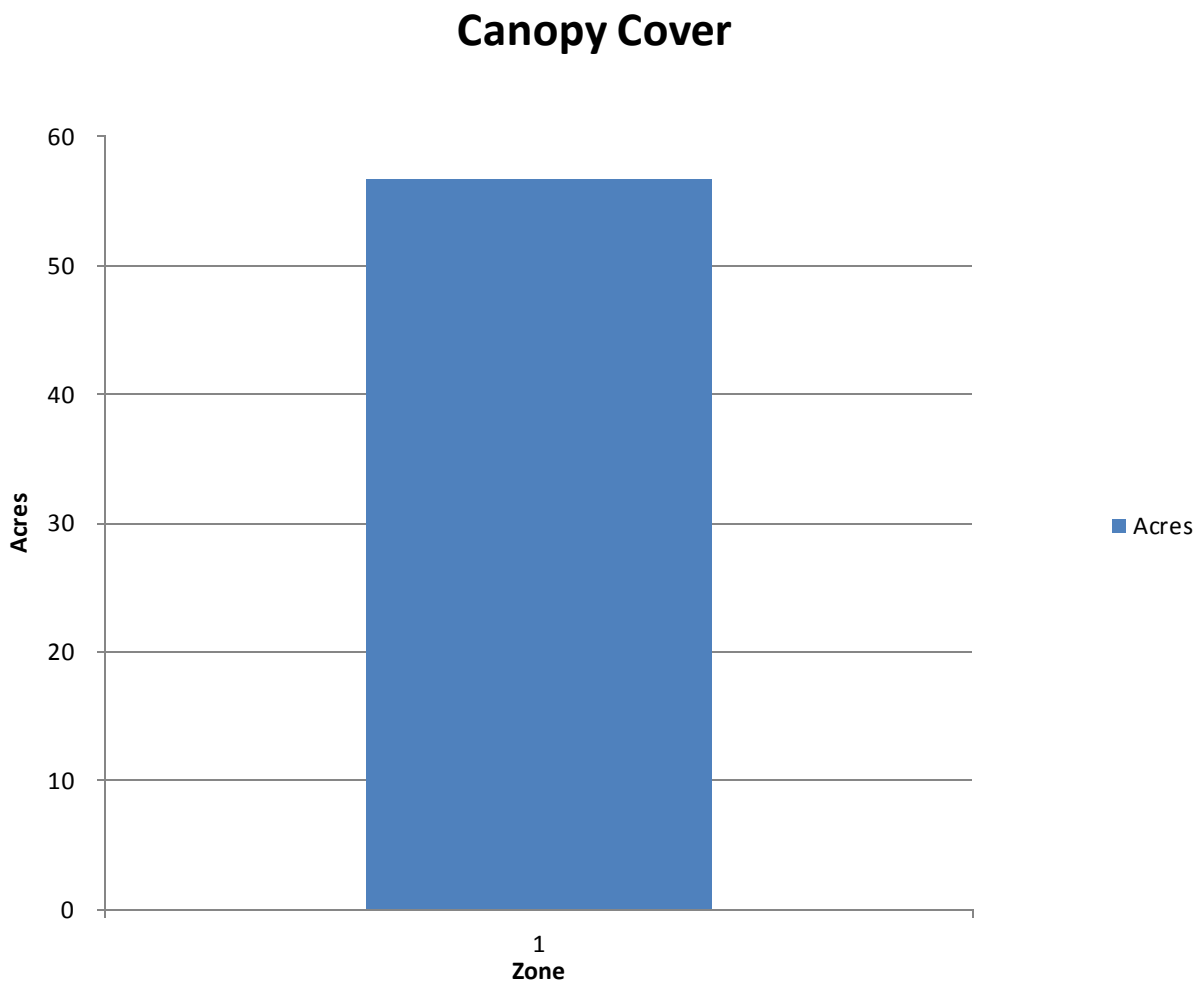

Figure 5: Canopy Cover in Acres

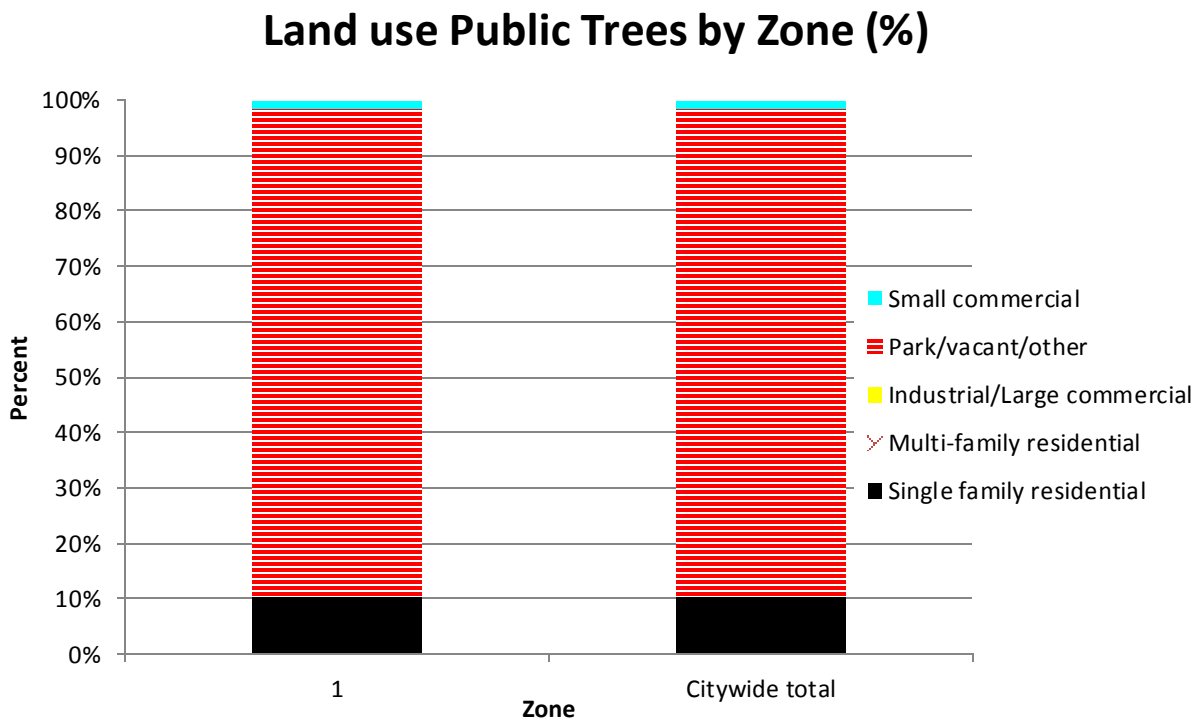

Figure 6: Land Use of city/park trees

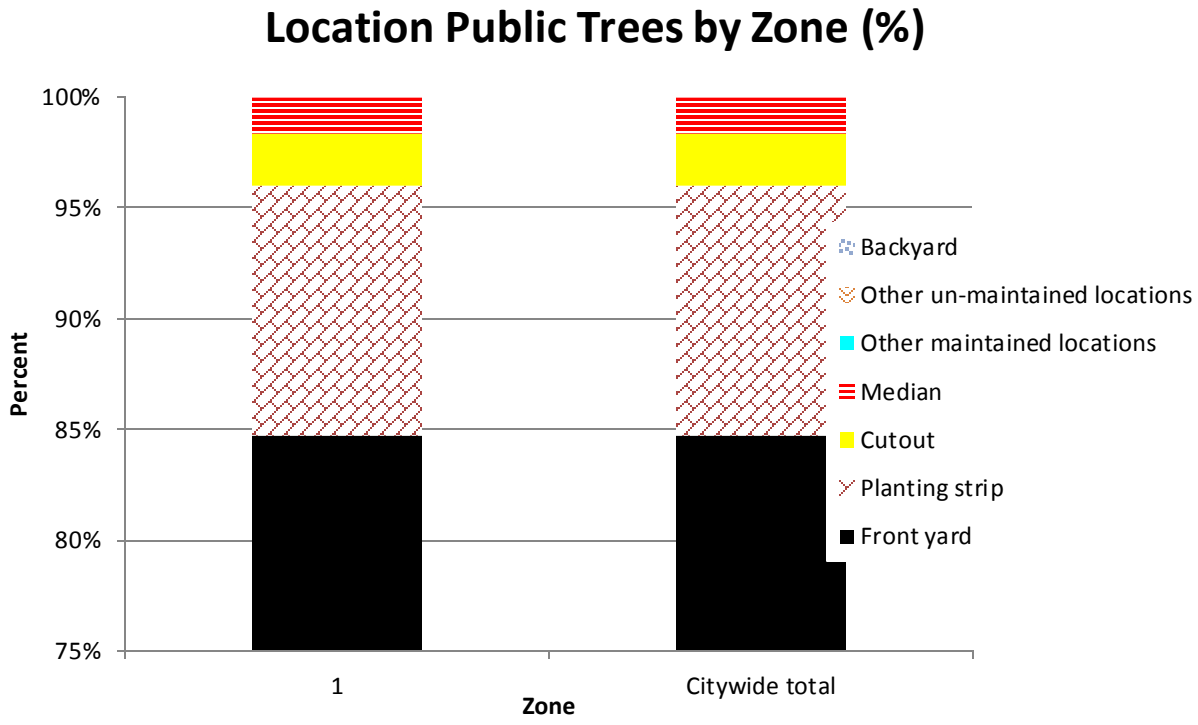

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

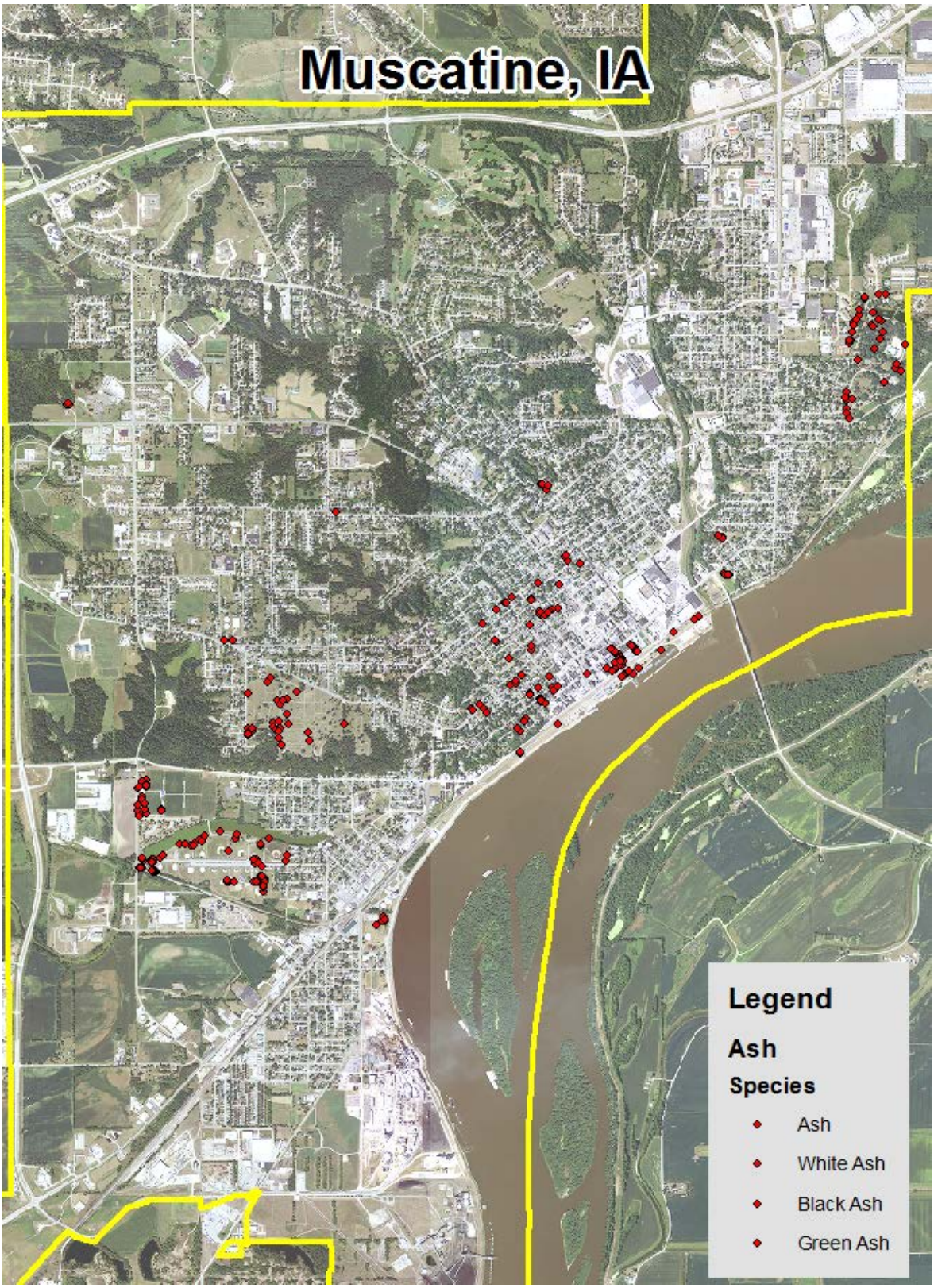

Figure 1: Location of Ash Trees

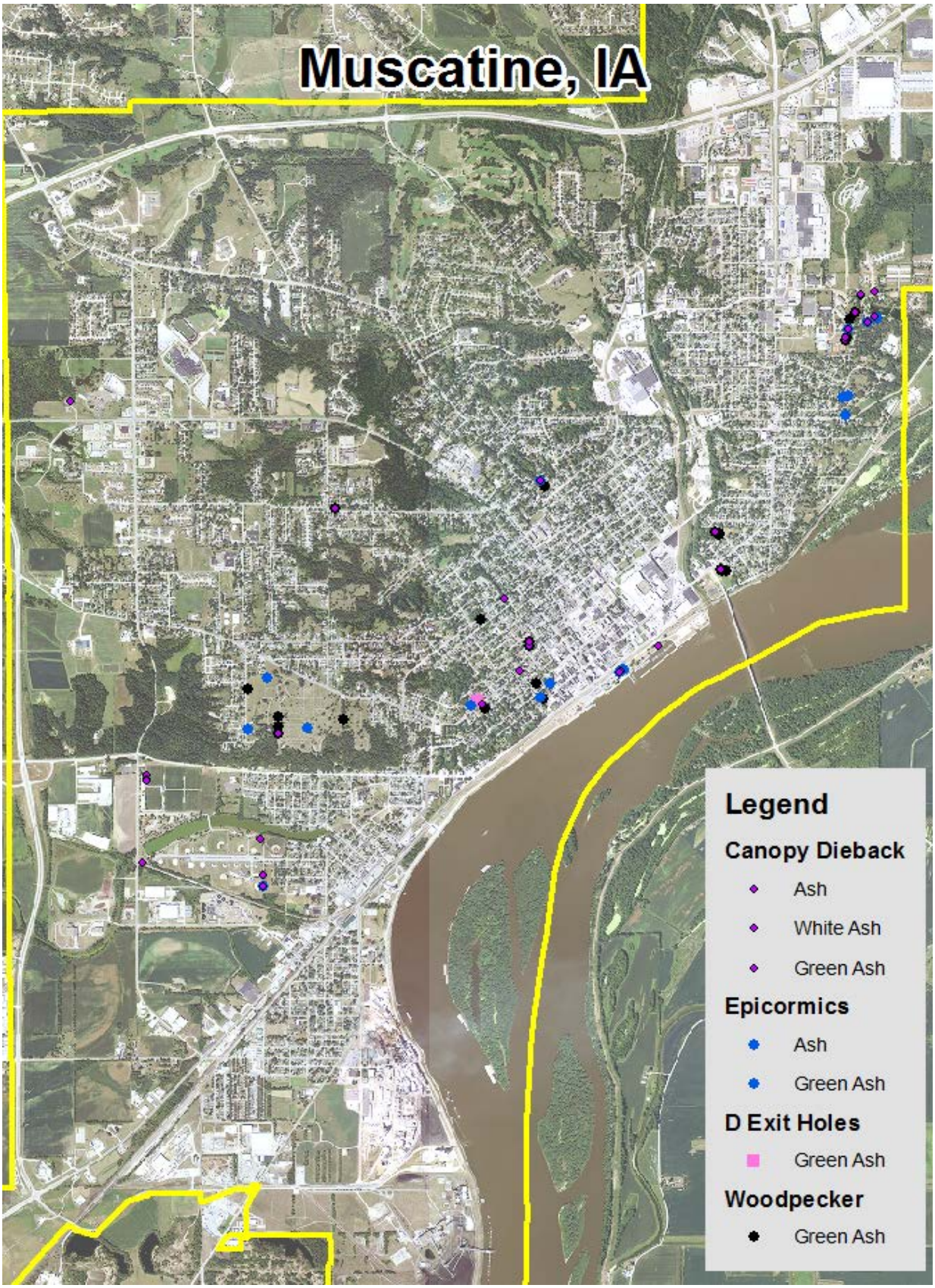

Figure 2: Location of EAB symptoms

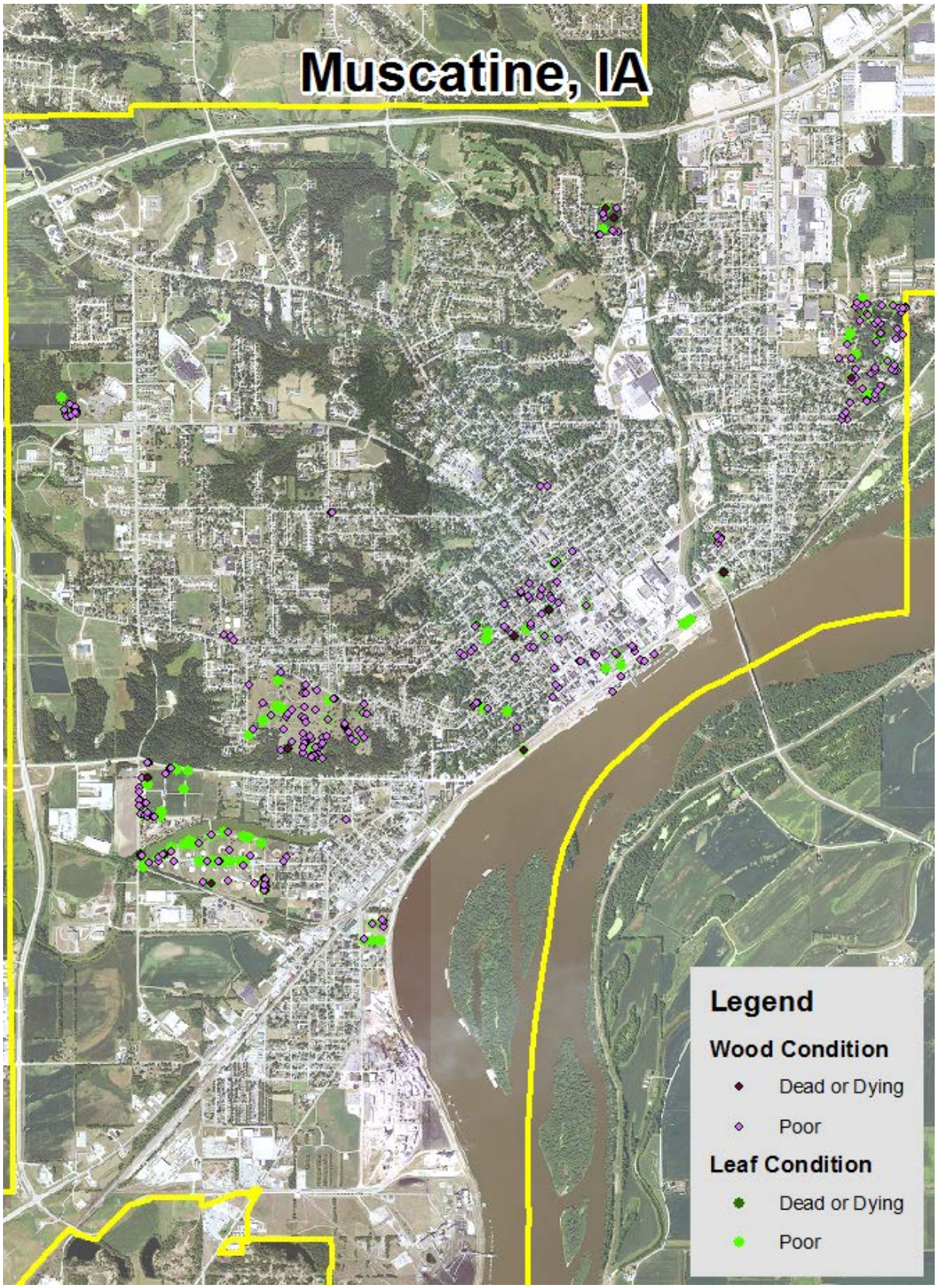

Figure 3: Location of Poor Condition Trees

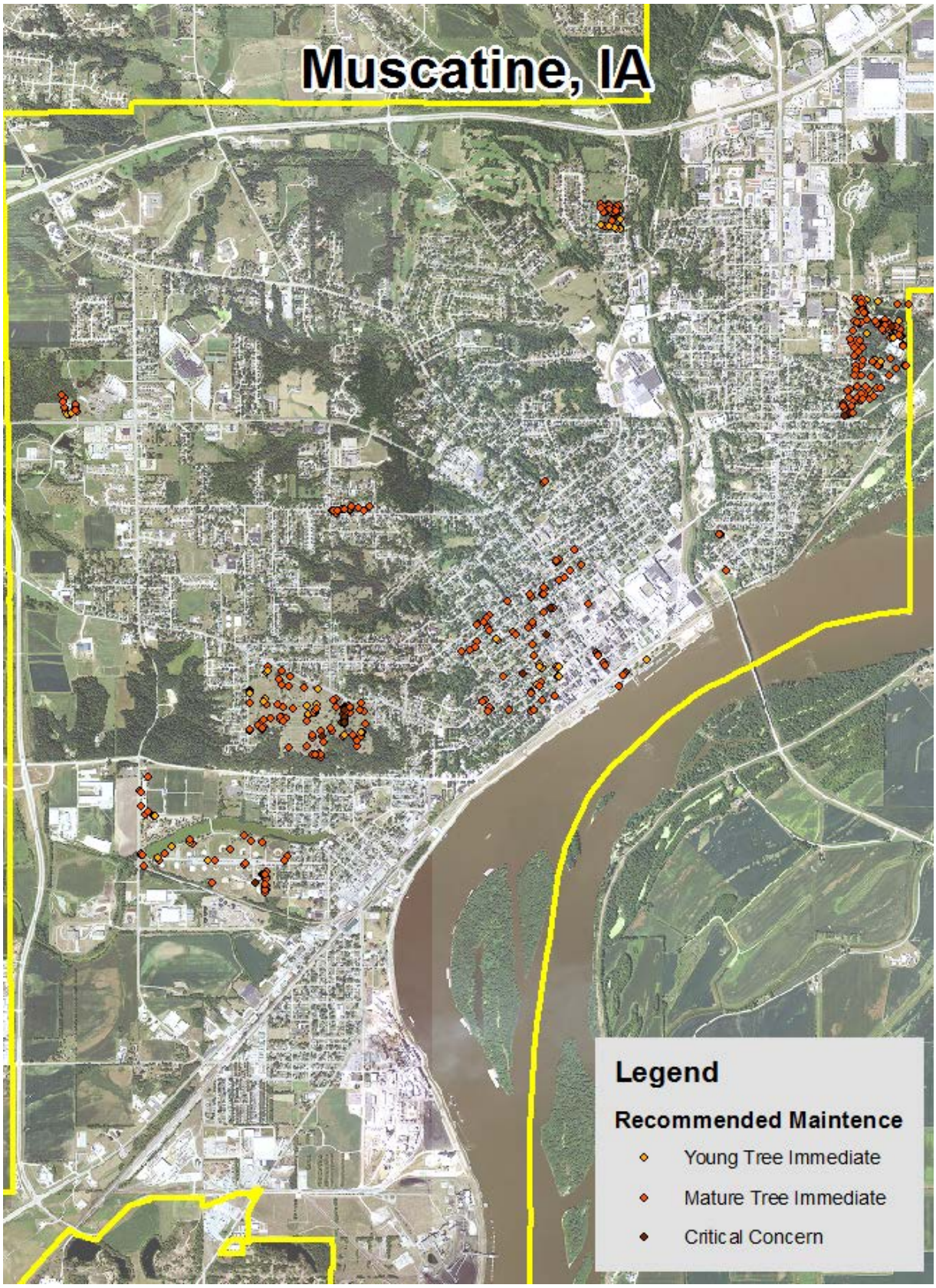

Figure 4: Location of Trees with Recommended Maintenance

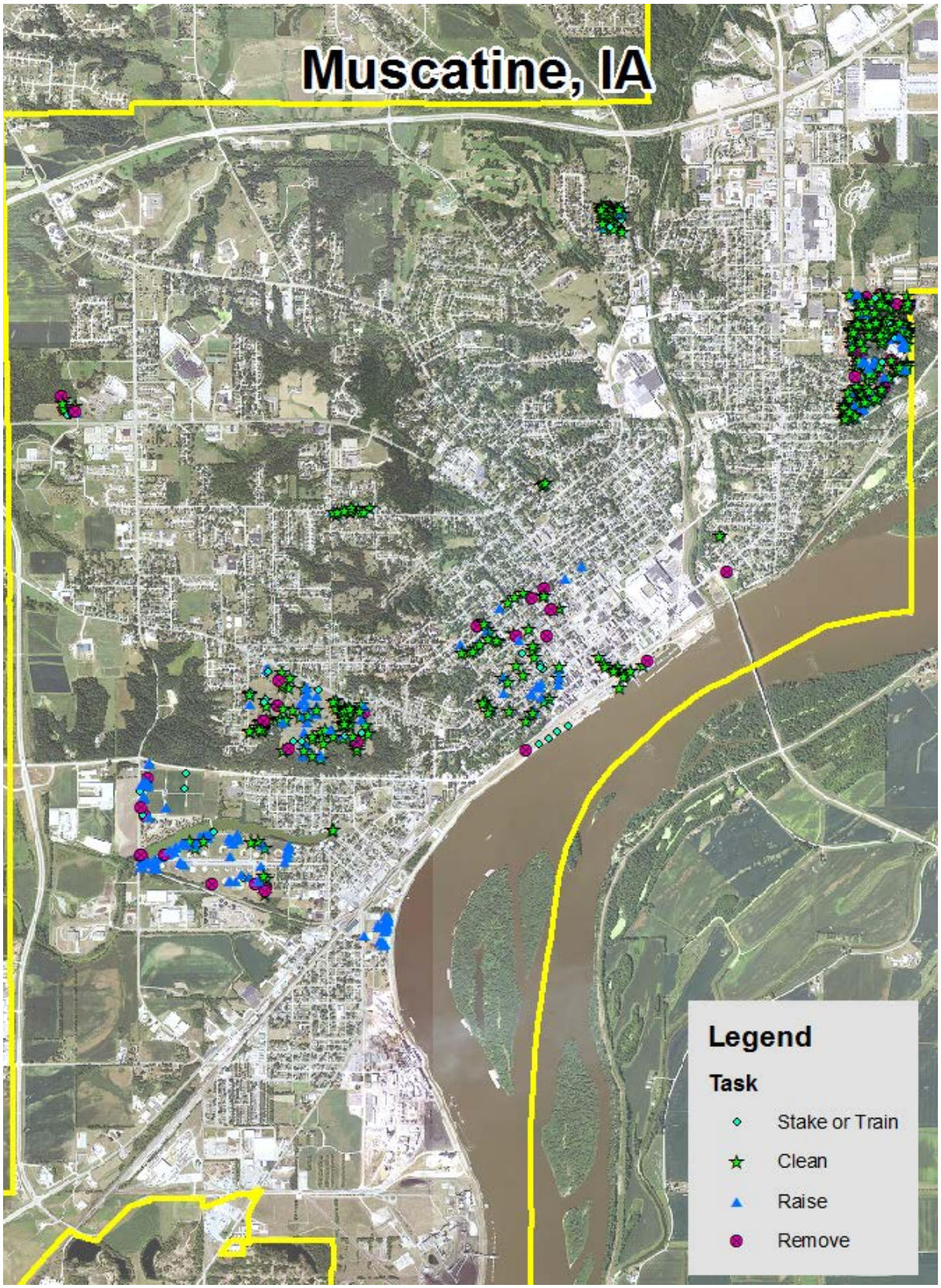

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Muscatine Tree Ordinances

Title 3 – Public Ways and Property
Chapter 9 – Trees and Shrubs
SECTIONS:
3-9-1 Removal and Trimming of Dangerous Tree; Compliance
3-9-2 Abutting Property Owners
3-9-3 Notice to Trim; Failure to Comply
3-9-4 Trimming by City; Recovery of Cost
3-9-5 Liability Insurance; Tree Removal
3-9-6 Obstructing Streets; Barricades
3-9-7 Removal of Debris
3-9-8 Street Trees (Existing)
3-9-9 Street Trees (New)
3-9-10 New Street Trees (City Program)
3-9-11 Injuring; Defacing; Removing
3-9-12 Reserved

3-9-1 Removal and Trimming of Dangerous Tree; Compliance.
A. If the City deems any shade, ornamental, or other tree situated on private property in the City to be diseased or dead, it shall cause to be served a notice upon the owner, in accordance with the most recently enacted Code of Iowa, if known within the City, or if not, then upon the occupant of the lot, to cut down such tree and remove the same and all debris therefrom. Said tree and debris shall be hauled to an area designated or approved by the City and/or the Iowa Department of Water, Air, and Waste Management.
(Code of Iowa, Section 364.12[2][c])
B. If such notice is not complied with within ten (10) days, the City shall cause such tree to be cut down or removed and the cost of cutting down and removing it shall be certified to the County Treasurer and be assessed against the real estate in the same manner as a property tax.
(Code of Iowa, Section 364.12[2][e])
C. All diseased trees shall be sprayed, if required by the City, at the site of their cutting down or removal before being hauled or transported through the City to an approved disposal site.
(Code of Iowa, Section 364.12[2][c])
D. The General Manager of any utility shall have the authority to trim any tree which interferes with utility property and equipment, after notification and approval by the City.
E. The City shall have authority to trim any tree, located on private property, which interferes with the proper distribution of light from street lights or signs following notification to the property owner in accordance with Sections 3-9-3 and 3-9-4 of this Chapter.

3-9-2 Abutting Property Owners. Any person owning any real estate within the City with trees located upon said real estate or located in the street right-of-way (including parking) adjacent to said real estate, shall trim such trees in such manner that no overhanging branches thereof

shall in any way obstruct any such street or sidewalk below the height of ten feet (10') above the surface of the sidewalk and fourteen feet (14') from the surface of the street.
(Code of Iowa, Section 364.12[2][c])

3-9-3 Notice to Trim; Failure to Comply. Any person or owner of property as described in this Chapter who shall have been served by the City with a notice by Certified Mail, and shall not comply with the notice within ten (10) days of the receipt of the notice, shall be guilty of a misdemeanor and subject to penalty as provided in the Schedule of Penalties in Appendix A to this Code of Ordinances.

3-9-4 Trimming by City; Recovery of Cost. When the owner or occupant of real property in the City having trees upon or in front of the same, the branches of which overhang the street or any part thereof, and having had notice to trim the same and fails or refuses to comply therewith for more than ten (10) days after service of notice, then it shall be lawful for the City to trim such trees to the height provided in Section 3-9-2 of this Chapter and certify the cost of the same to the County Treasurer to be assessed against the real estate in the same manner as a property tax.
(Code of Iowa, Section 364.12[2][e])

3-9-5 Liability Insurance; Tree Removal. All persons and/or corporations engaged in removal of trees within the City right-of-way shall obtain a license therefor. The licensee must pay the fee and present a copy of an insurance policy for liability insurance in the amounts set by resolution of the City Council and listed in the Schedule of Permit and Licensing Requirements contained in Appendix B to this Code of Ordinances.

3-9-6 Obstructing Streets; Barricades.
A. Before any street or thoroughfare can be shut off or blocked in any way for tree removal, permission must be granted by the City.
B. Streets when barricaded or shut off must be barricaded by proper barricades appropriately marked and readily seen by all.
C. All persons, and/or corporations barricading any street or thoroughfare for the purpose of trimming or removing any tree shall first notify the City of Muscatine Police and Fire Departments stating the location and time period that such street or thoroughfare will be closed.
D. No street or thoroughfare shall be closed for the purpose of removing any tree unless the required permit is secured as provided in this Chapter.

3-9-7 Removal of Debris. Removal of debris, stumps, logs, etc. shall be made upon or in trucks and no hauling shall be allowed hanging from outside by booms or dragging from such vehicle.

3-9-8 Street Trees (Existing).
A. All existing trees located within the public right-of-way as of the effective date of this Section shall be the responsibility of the adjacent property owner.

a. Exception. Any street tree which is diseased, dead, or otherwise poses an immediate threat to the public health and welfare shall be the responsibility of the City.
(Code of Iowa, Section 364.12[2][c])
B. It shall be the duty and right of the adjacent property owner to trim, remove, treat, or otherwise maintain all existing street trees in a manner that promotes the public health, safety, and welfare and in accordance with the provisions of this Chapter.
(Code of Iowa, Section 364.12[2][c])
C. Any person or corporation removing any existing street tree shall obtain a permit to do so from the City in accordance with the Schedule of Permit and Licensing Requirements contained in Appendix B to this Code of Ordinances for the purpose of maintaining a citywide inventory. The Tree Removal Permit shall be provided at no charge to the applicant.
D. Nothing contained in this Chapter shall be construed so as to prevent the immediate removal and/or trimming by officers of the City of any tree from the streets, when in the judgment of the City, such removal or trimming is necessary for the purpose of making street improvements or to eliminate obstructions of public signs which, by design, promote safety of persons or property.

3-9-9 Street Trees (New).
A. As of the effective date of this Section, all proposals to plant trees in the public right-of-way shall require a permit from the City in accordance the Schedule of Permit and Licensing Requirements contained in Appendix B to this Code of Ordinances.
B. The permit application provided by the City shall state the applicant's name, address, type of tree to be planted, exact location, and any additional information that may be needed by the City to determine whether the application should or should not be approved.
C. The application shall be recommended for approval or disapproval by the City prior to issuance. Failure to secure a positive recommendation by the City shall constitute a denial of the application.
D. Permit Requirements:
1. The permit shall state that the applicant agrees to plant the street tree(s) in accordance with the requirements of this Chapter.
2. The permit shall state that the applicant will plant a specific type of tree which shall be an approved species for street trees; a list of which shall be provided to the applicant upon request.
3. The permit shall state that once the street tree is planted, it becomes the property of the City of Muscatine and the applicant agrees to relinquish all interest in said tree. The permit shall state that the owner agrees to donate the tree to the City, at the applicant's expense, and that the applicant agrees to adhere to the provisions of Title 3, Chapter 9, Section 8 of this Code.
4. The permit shall include a provision which indemnifies the City from any and all claims for damage to private and public property as a result of the permit to plant a street tree.

3-9-10 New Street Trees (City Program).
A. The City may, at its discretion and with the approval of the City Council, initiate a program for the purpose of planting, maintaining, trimming, and removal of new street trees.
B. It shall be the policy of the City to notify abutting property owners before planting any

street tree in front of any residential structure in the City.
C. The owner of the abutting property shall be required to sign a permit in accordance with Chapter 9, except the tree will be planted by the City at no expense to the abutting residential property owner.

3-9-11 Injuring; Defacing; Removing. Any person who shall willfully, maliciously, or negligently, in any manner, injure, deface, remove, or destroy any street tree or boxing placed around the same, or any shrub upon any public grounds and right of ways shall be deemed guilty of a misdemeanor, and shall reimburse the City for any costs incurred by such action if directed to do so by the Iowa District Court for Muscatine County.