

# Stanhope, IA



2015 Urban Forest Management Plan  
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# Executive Summary

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## Overview

This plan was developed to assist the City of Stanhope 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 22% of Stanhope'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 146 trees inventoried.

- Stanhope's trees provide \$30,051 of benefits annually, an average of \$206 a tree
- There are over 22 species of trees
- The top three genera are: Maple 32%, Ash 22%, and Apple 9%
- 36% of trees are in need of some type of management
- 4 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 4 trees needing removal, 0 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\\*](#)
- 10 of the 32 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 do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, or evergreen
- Check ash trees with a visual survey yearly
- With the current budget it could take 21 years to remove ash – Suggestion: request a budget increase and apply for grants to plant replacement trees

## Introduction

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

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

## Inventory

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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

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The data collected for the 146 city trees was entered into the USDA Forest service program as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

### **Annual Benefits**

#### **Annual Energy Benefits**

Trees conserve energy by shading buildings and blocking winds. Stanhope's trees reduce energy related costs by approximately \$7,978 annually (Appendix A, Table 1). These savings are both in Electricity (37.5 MWh) and in Natural Gas (5,232.4 Therms).

#### **Annual Stormwater Benefits**

Stanhope's trees intercept about 421,186 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$11,414 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 Stanhope, it is estimated that trees remove 70.5 lbs of air pollution (ozone (O3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and sulfur dioxide (SO2)) per year with a net value of \$1,406 (Appendix A, Table 3).

#### **Annual Carbon Benefits**

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Stanhope, trees sequester about 83,827 lbs of carbon a year with an associated value of \$629 (Appendix A, Table 5). In addition, the trees store 1,590,519 lbs of carbon, with a yearly benefit of \$11,929 (Appendix A, Table 4).

#### **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. Stanhope receives \$8,685 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, Stanhope's trees provide \$30,051 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 146 trees in Stanhope provide approximately \$206 annually (Appendix A, Table 7).

## **Forest Structure**

### **Species Distribution**

Stanhope has over 22 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by species is as follows:

Green Ash	21.38%
Silver maple	10.34%
Norway maple	8.97%
Apple (Crab)	8.97%
Black maple	6.90%
Northern hackberry	6.21%
Honeylocust	5.52%
Sugar maple	3.45%
Black walnut	3.45%
American basswood	2.76%
Other Species	22.07%

### **Age Class**

Most of Stanhope's trees (24%) are between 18 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. Stanhope's size curve is on the slightly larger side, indicating a slightly older 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 Stanhope indicate that 73% of the trees are in good health, with only 5% of the foliage in poor health, dead or dying (Appendix B, Figure 3). Similarly, 45% of Stanhope's trees are in good health for wood condition (appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 14% of the population. This 14% 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 5).

Crown Cleaning	35	24%
Crown Reduction	13	9%
Tree Removal	4	3%

## Canopy Cover

The total canopy with both private and public trees is 7%, acres. The canopy cover included in the Stanhope inventory includes approximately 43.86 acres (Appendix A, Figure 4).

## Land Use and Location

The majority of Stanhope's city and park trees are in planting strips in single family residential neighborhoods (Appendix A, Figure 6 & Appendix A, Figure7). The following describes the land use and locations for the street and park trees.

### Land Use

Single family residential	67%
Park/vacant/other	29%
Small commercial	2%
Industrial/Large commercial	1%

### Location

Planting strip	55%
Front yard	43%
Cutout (surrounded by pavement)	0.7%

## Recommendations

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### **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

Stanhope has 1 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) and the Priority Task (Appendix B, Figure 5). 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 4 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 5). Of the 4 removals, 0 are ash trees. There are a total of 32 ash trees, and 10 of those have signs and symptoms that have been associated with EAB. In addition, there are 5 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 Stanhope.

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 (32%) (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, or evergreen, as outlined in 6-2.0103 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 6-2.0103 (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 decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

# **PROPOSED WORK SCHEDULE AND ESTIMATED COSTS**

## **YEAR 1**

## **ESTIMATED COSTS**

Remove 2 immediate recommended	\$1,400
Plant 3 trees in open locations	\$450
Inspect ash trees for signs of Emerald Ash Borer	



**YEAR 2**

Remove 2 recommended	\$1,400
*Or saving for ash tree treatment and/or future ash removal	
Plant 2 trees in open locations	\$300
Prune 1/3 of city owned trees	\$800
Inspect ash trees for signs of Emerald Ash Borer	

**YEAR 3**

Removal: 2 trees - removal of any new critical concern trees or ash in poor health	\$1,400
*Or saving for ash tree treatment and/or future ash removal	
Planting and Replacement: 6 trees to be planted in open locations and locations from previous removals	\$450
Visual Survey for signs and symptoms of EAB	

**YEAR 4**

Removal: 1 any new critical concern tree or ash in poor health	\$700
*Or saving for ash tree treatment and/or future ash removal	
Plant 2 trees in open locations	\$300
Prune 1/3 of city owned trees	\$800
Inspect ash trees for signs of Emerald Ash Borer	

**YEAR 5**

Removal: 2 trees - removal of any new critical concern trees or ash in poor health	\$1,400
*Or saving for ash tree treatment and/or future ash removal	
Planting and Replacement: 6 trees to be planted in open locations and locations from previous removals	\$450
Visual Survey for signs and symptoms of EAB	

**YEAR 6**

Removal: 1 any new critical concern tree or ash in poor health	\$700
*Or saving for ash tree treatment and/or future ash removal	
Plant 2 trees in open locations	\$300
Prune 1/3 of city owned trees	\$800
Inspect ash trees for signs of Emerald Ash Borer	

\*Reduction of ash over 6 years: Approximately 6 ash trees removed (approximately 20% of ash). It will take approximately 21 years to remove all ash with the current budget. 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 increased to \$4,533 a year.

## Emerald Ash Borer Plan

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### 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. However, treatment is not recommended if EAB is more than 15 miles away from the community. 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 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](http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml). Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

### **Canopy Replacement**

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 6-2.0103 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, or evergreen.

### **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 non treated ash trees on their property upon arrival of EAB.

### Purposed Budget Increase

EAB could potentially kill all ash trees in Stanhope within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$4,533 a year. Additionally, it is recommended that Stanhope 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 instance, in this treatment scenario, the average ash diameter is 20 inches and at \$15 per inch, about 4 trees could be treated per year (every other year treatment). This would be 8 trees selected for treatment, and Stanhope would still need to find \$19,000 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately \$2,250 a year for treatment and leave \$11,900 for removal. 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 if EAB is found in Stanhope. It is suggested to consider increasing the budget to plan for this.

### Works Cited

Census Bureau. 2010. <http://censtats.census.gov/data/IA/1601964290.pdf> (April, 2013)

USDA Forest Service, et al. 2006. i-Tree Software Suite v1.0 User's Manual. Pp. 27-40.

McPherson EG, Simpson JR, Peper PJ, Gardner SL, Vargas KE, Ho J, Maco S, Xiao Q. 2005b. City of Charleston, South Carolina, municipal forest resource analysis. Internal Tech Rep. Davis, CA: U.S. Department of Agriculture, Center for Urban Forest Research. p. 57

Nowak, D.J. and J.F. Dwyer. 2007. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, J. (ed.) Urban and Community Forestry in the Northeast. New York: Springer. Pp. 25-46.

Peper, Paula J.; McPherson, E. Gregory; Simpson, James R.; Vargas, Kelaine E.; Xiao, Qingfu 2009. Lower Midwest community tree guide: benefits, costs, and strategic planting. Gen. Tech. Rep. PSW-GTR-219. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. p.115

## Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Stanhope

### Annual Energy Benefits of Public Trees

12/8/2015

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	9.6	729	1,324.8	1,298	2,027	(N/A)	21.9	25.4	63.34
Silver maple	4.2	318	563.7	552	870	(N/A)	10.3	10.9	58.00
Norway maple	3.8	285	552.2	541	826	(N/A)	8.9	10.4	63.55
Apple	2.0	154	308.1	302	456	(N/A)	8.9	5.7	35.08
Black maple	2.8	216	399.0	391	607	(N/A)	6.8	7.6	60.68
Northern hackberry	2.7	203	392.0	384	587	(N/A)	6.2	7.4	65.22
Honeylocust	2.9	223	379.3	372	594	(N/A)	5.5	7.4	74.28
Black walnut	1.5	113	200.2	196	309	(N/A)	3.4	3.9	61.76
Sugar maple	1.2	95	163.9	161	255	(N/A)	3.4	3.2	51.03
American basswood	1.0	78	153.9	151	229	(N/A)	2.7	2.9	57.17
Broadleaf Evergreen Large Maple	0.8	57	85.1	83	141	(N/A)	2.1	1.8	46.87
Maple	0.0	1	2.2	2	3	(N/A)	2.1	0.0	1.03
Northern catalpa	1.2	94	164.3	161	255	(N/A)	2.1	3.2	84.86
Kentucky coffeetree	0.9	70	131.8	129	199	(N/A)	2.1	2.5	66.38
Broadleaf Deciduous Large	0.8	60	114.3	112	172	(N/A)	2.1	2.2	57.32
Littleleaf linden	0.1	4	8.3	8	12	(N/A)	2.1	0.2	4.07
Paper birch	0.5	40	76.2	75	115	(N/A)	1.4	1.4	57.32
Eastern red cedar	0.2	17	32.9	32	49	(N/A)	1.4	0.6	24.57
American sycamore	0.5	40	76.2	75	115	(N/A)	1.4	1.4	57.32
Scotch pine	0.1	9	19.0	19	27	(N/A)	1.4	0.3	13.58
Spruce	0.3	20	29.3	29	48	(N/A)	1.4	0.6	24.14
Mulberry	0.1	6	12.8	13	18	(N/A)	0.7	0.2	18.19
River birch	0.1	8	16.9	17	24	(N/A)	0.7	0.3	24.47
Amur maple	0.2	14	24.7	24	38	(N/A)	0.7	0.5	38.13
Northern red oak	0.0	0	1.2	1	2	(N/A)	0.7	0.0	1.67
<b>Total</b>	<b>37.5</b>	<b>2,850</b>	<b>5,232.4</b>	<b>5,128</b>	<b>7,978</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>54.64</b>

**Table 2: Annual Stormwater Benefits  
Stanhope**

**Annual Stormwater Benefits of Public Trees**

12/8/2015

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	117,433	3,182	(N/A)	21.9	27.9	99.45
Silver maple	61,358	1,663	(N/A)	10.3	14.6	110.85
Norway maple	40,833	1,107	(N/A)	8.9	9.7	85.12
Apple	9,594	260	(N/A)	8.9	2.3	20.00
Black maple	28,670	777	(N/A)	6.8	6.8	77.70
Northern hackberry	24,692	669	(N/A)	6.2	5.9	74.35
Honeylocust	37,478	1,016	(N/A)	5.5	8.9	126.96
Black walnut	18,746	508	(N/A)	3.4	4.5	101.60
Sugar maple	10,134	275	(N/A)	3.4	2.4	54.92
American basswood	9,683	262	(N/A)	2.7	2.3	65.60
Broadleaf Evergreen Large Maple	7,582	205	(N/A)	2.1	1.8	68.49
Maple	35	1	(N/A)	2.1	0.0	0.32
Northern catalpa	17,069	463	(N/A)	2.1	4.1	154.19
Kentucky coffeetree	10,477	284	(N/A)	2.1	2.5	94.64
Broadleaf Deciduous Large	7,772	211	(N/A)	2.1	1.8	70.21
Littleleaf linden	194	5	(N/A)	2.1	0.0	1.75
Paper birch	5,181	140	(N/A)	1.4	1.2	70.21
Eastern red cedar	3,269	89	(N/A)	1.4	0.8	44.30
American sycamore	5,181	140	(N/A)	1.4	1.2	70.21
Scotch pine	1,191	32	(N/A)	1.4	0.3	16.14
Spruce	3,077	83	(N/A)	1.4	0.7	41.70
Mulberry	264	7	(N/A)	0.7	0.1	7.17
River birch	586	16	(N/A)	0.7	0.1	15.88
Amur maple	667	18	(N/A)	0.7	0.2	18.06
Northern red oak	19	1	(N/A)	0.7	0.0	0.51
<b>Citywide total</b>	<b>421,186</b>	<b>11,414</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>78.18</b>

**Table 3: Annual Air Quality Benefits  
Stanhope**

**Annual Air Quality Benefits of Public Trees**

12/8/2015

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total Standard (\$)	% of Total Trees	Avg. \$/tree
	O <sub>3</sub>	NO <sub>2</sub>	PM <sub>10</sub>	SO <sub>2</sub>		NO <sub>2</sub>	PM <sub>10</sub>	VOC	SO <sub>2</sub>							
Green ash	15.5	2.5	7.2	0.7	82	45.9	6.7	6.4	43.5	286	0.0	0	128.3	368 (N/A)	21.9	11.49
Silver maple	10.7	1.8	5.3	0.5	58	19.8	2.9	2.8	18.9	124	-5.8	-22	57.0	160 (N/A)	10.3	10.67
Norway maple	9.0	1.6	4.3	0.4	49	18.3	2.6	2.5	17.0	113	-2.1	-8	53.8	154 (N/A)	8.9	11.84
Apple	3.2	0.5	1.5	0.1	17	10.0	1.4	1.4	9.2	61	0.0	0	27.2	78 (N/A)	8.9	6.01
Black maple	7.5	1.3	3.4	0.3	40	13.6	2.0	1.9	12.9	85	-2.4	-9	40.5	115 (N/A)	6.8	11.54
Northern hackberry	3.6	0.6	1.9	0.2	20	13.0	1.9	1.8	12.1	80	0.0	0	35.1	100 (N/A)	6.2	11.16
Honeylocust	7.5	1.2	3.4	0.3	40	13.8	2.0	1.9	13.3	86	-6.1	-23	37.4	103 (N/A)	5.5	12.87
Black walnut	2.6	0.4	1.2	0.1	14	7.1	1.0	1.0	6.7	44	0.0	0	20.1	58 (N/A)	3.4	11.53
Sugar maple	1.1	0.2	0.6	0.0	6	5.9	0.9	0.8	5.6	37	-0.9	-3	14.3	40 (N/A)	3.4	7.91
American basswood	1.1	0.2	0.6	0.0	6	5.0	0.7	0.7	4.7	31	-1.0	-4	12.0	33 (N/A)	2.7	8.34
Broadleaf Evergreen Large	0.6	0.1	0.6	0.1	4	3.4	0.5	0.5	3.4	22	-3.2	-12	6.1	14 (N/A)	2.1	4.77
Maple	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	0.0	0	0.1	0 (N/A)	2.1	0.13
Northern catalpa	3.4	0.5	1.5	0.2	18	5.8	0.9	0.8	5.6	37	0.0	0	18.8	54 (N/A)	2.1	18.15
Kentucky coffeetree	1.3	0.2	0.6	0.1	7	4.5	0.6	0.6	4.2	28	0.0	0	12.0	34 (N/A)	2.1	11.43
Broadleaf Deciduous Large	0.8	0.1	0.4	0.0	4	3.8	0.6	0.5	3.6	24	0.0	0	9.9	28 (N/A)	2.1	9.34
Littleleaf linden	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)	2.1	0.56
Paper birch	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19 (N/A)	1.4	9.34
Eastern red cedar	0.7	0.1	0.5	0.1	4	1.1	0.2	0.1	1.0	7	-1.8	-7	2.0	4 (N/A)	1.4	2.19
American sycamore	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19 (N/A)	1.4	9.34
Scotch pine	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	3	-0.3	-1	1.1	3 (N/A)	1.4	1.48
Spruce	0.3	0.1	0.3	0.0	2	1.2	0.2	0.2	1.2	7	-1.1	-4	2.3	6 (N/A)	1.4	2.82
Mulberry	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)	0.7	2.55
River birch	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3 (N/A)	0.7	3.47
Amur maple	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)	0.7	6.56
Northern red oak	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.1	0 (N/A)	0.7	0.21
Citywide total	70.5	11.8	34.2	3.3	379	180.0	26.2	24.9	170.1	1,119	-24.7	-93	496.3	1,406 (N/A)	100.0	9.63

**Table 4: Annual Carbon Stored  
Stanhope**

**Stored CO2 Benefits of Public Trees**

12/8/2015

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	505,872	3,794	(N/A)	21.9	31.8	118.56
Silver maple	256,955	1,927	(N/A)	10.3	16.2	128.48
Norway maple	149,137	1,119	(N/A)	8.9	9.4	86.04
Apple	49,494	371	(N/A)	8.9	3.1	28.55
Black maple	79,453	596	(N/A)	6.8	5.0	59.59
Northern hackberry	54,027	405	(N/A)	6.2	3.4	45.02
Honeylocust	97,959	735	(N/A)	5.5	6.2	91.84
Black walnut	85,681	643	(N/A)	3.4	5.4	128.52
Sugar maple	31,084	233	(N/A)	3.4	2.0	46.63
American basswood	39,893	299	(N/A)	2.7	2.5	74.80
Broadleaf Evergreen Large	10,785	81	(N/A)	2.1	0.7	26.96
Maple	51	0	(N/A)	2.1	0.0	0.13
Northern catalpa	120,422	903	(N/A)	2.1	7.6	301.05
Kentucky coffeetree	40,003	300	(N/A)	2.1	2.5	100.01
Broadleaf Deciduous Large	25,373	190	(N/A)	2.1	1.6	63.43
Littleleaf linden	386	3	(N/A)	2.1	0.0	0.96
Paper birch	16,915	127	(N/A)	1.4	1.1	63.43
Eastern red cedar	2,204	17	(N/A)	1.4	0.1	8.27
American sycamore	16,915	127	(N/A)	1.4	1.1	63.43
Scotch pine	513	4	(N/A)	1.4	0.0	1.93
Spruce	2,340	18	(N/A)	1.4	0.1	8.78
Mulberry	908	7	(N/A)	0.7	0.1	6.81
River birch	1,101	8	(N/A)	0.7	0.1	8.26
Amur maple	3,037	23	(N/A)	0.7	0.2	22.78
Northern red oak	13	0	(N/A)	0.7	0.0	0.09
Citywide total	1,590,519	11,929	(N/A)	100.0	100.0	81.70

**Table 5: Annual Carbon Sequestered**

Stanhope

**Annual CO<sub>2</sub> Benefits of Public Trees**

12/8/2015

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	23,163	174	-2,428	-103	-1	0	0	20,632	155 (N/A)	21.9	27.2	4.84
Silver maple	18,453	138	-1,233	-49	0	0	0	17,171	129 (N/A)	10.3	22.7	8.59
Norway maple	4,140	31	-716	-42	0	0	0	3,382	25 (N/A)	8.9	4.5	1.95
Apple	3,440	26	-238	-27	0	0	0	3,175	24 (N/A)	8.9	4.2	1.83
Black maple	4,617	35	-381	-27	0	0	0	4,208	32 (N/A)	6.8	5.6	3.16
Northern hackberry	3,282	25	-259	-25	0	0	0	2,997	22 (N/A)	6.2	4.0	2.50
Honeylocust	7,429	56	-470	-22	0	0	0	6,937	52 (N/A)	5.5	9.2	6.50
Black walnut	3,383	25	-411	-16	0	0	0	2,955	22 (N/A)	3.4	3.9	4.43
Sugar maple	2,205	17	-149	-12	0	0	0	2,044	15 (N/A)	3.4	2.7	3.07
American basswood	2,716	20	-191	-12	0	0	0	2,513	19 (N/A)	2.7	3.3	4.71
Broadleaf Evergreen Large	1,256	9	-52	-6	0	0	0	1,198	9 (N/A)	2.1	1.6	2.99
Maple	8	0	0	-1	0	0	0	7	0 (N/A)	2.1	0.0	0.02
Northern catalpa	1,617	12	-578	-14	0	0	0	1,025	8 (N/A)	2.1	1.4	2.56
Kentucky coffeetree	2,373	18	-192	-10	0	0	0	2,172	16 (N/A)	2.1	2.9	5.43
Broadleaf Deciduous Large	1,979	15	-122	-8	0	0	0	1,849	14 (N/A)	2.1	2.4	4.62
Littleleaf linden	137	1	-3	-1	0	0	0	133	1 (N/A)	2.1	0.2	0.33
Paper birch	1,319	10	-81	-5	0	0	0	1,233	9 (N/A)	1.4	1.6	4.62
Eastern red cedar	43	0	-11	-4	0	0	0	28	0 (N/A)	1.4	0.0	0.11
American sycamore	1,319	10	-81	-5	0	0	0	1,233	9 (N/A)	1.4	1.6	4.62
Scotch pine	105	1	-2	-2	0	0	0	100	1 (N/A)	1.4	0.1	0.38
Spruce	231	2	-11	-4	0	0	0	216	2 (N/A)	1.4	0.3	0.81
Mulberry	114	1	-4	-1	0	0	0	108	1 (N/A)	0.7	0.1	0.81
River birch	224	2	-5	-1	0	0	0	217	2 (N/A)	0.7	0.3	1.63
Amur maple	268	2	-15	-2	0	0	0	251	2 (N/A)	0.7	0.3	1.88
Northern red oak	5	0	0	0	0	0	0	5	0 (N/A)	0.7	0.0	0.03
Citywide total	83,827	629	-7,636	-400	-3	0	0	75,791	568 (N/A)	100.0	100.0	3.89



Table 6: Annual Social and Aesthetic Benefits

Stanhope

**Annual Aesthetic/Other Benefits of Public Trees**

12/8/2015

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	1,804	(N/A)	21.9	20.8	56.37
Silver maple	1,440	(N/A)	10.3	16.6	95.98
Norway maple	372	(N/A)	8.9	4.3	28.59
Apple	203	(N/A)	8.9	2.3	15.60
Black maple	545	(N/A)	6.8	6.3	54.54
Northern hackberry	463	(N/A)	6.2	5.3	51.45
Honeylocust	1,945	(N/A)	5.5	22.4	243.06
Black walnut	265	(N/A)	3.4	3.1	52.99
Sugar maple	255	(N/A)	3.4	2.9	50.97
American basswood	212	(N/A)	2.7	2.4	53.08
Broadleaf Evergreen Large	292	(N/A)	2.1	3.4	97.24
Maple	0	(N/A)	2.1	0.0	0.04
Northern catalpa	115	(N/A)	2.1	1.3	38.28
Kentucky coffeetree	189	(N/A)	2.1	2.2	62.96
Broadleaf Deciduous Large	173	(N/A)	2.1	2.0	57.69
Littleleaf linden	24	(N/A)	2.1	0.3	7.93
Paper birch	115	(N/A)	1.4	1.3	57.69
Eastern red cedar	14	(N/A)	1.4	0.2	6.84
American sycamore	115	(N/A)	1.4	1.3	57.69
Scotch pine	31	(N/A)	1.4	0.4	15.42
Spruce	65	(N/A)	1.4	0.7	32.32
Mulberry	6	(N/A)	0.7	0.1	6.40
River birch	26	(N/A)	0.7	0.3	26.22
Amur maple	15	(N/A)	0.7	0.2	15.48
Northern red oak	2	(N/A)	0.7	0.0	1.54
Citywide total	8,685	(N/A)	100.0	100.0	59.49

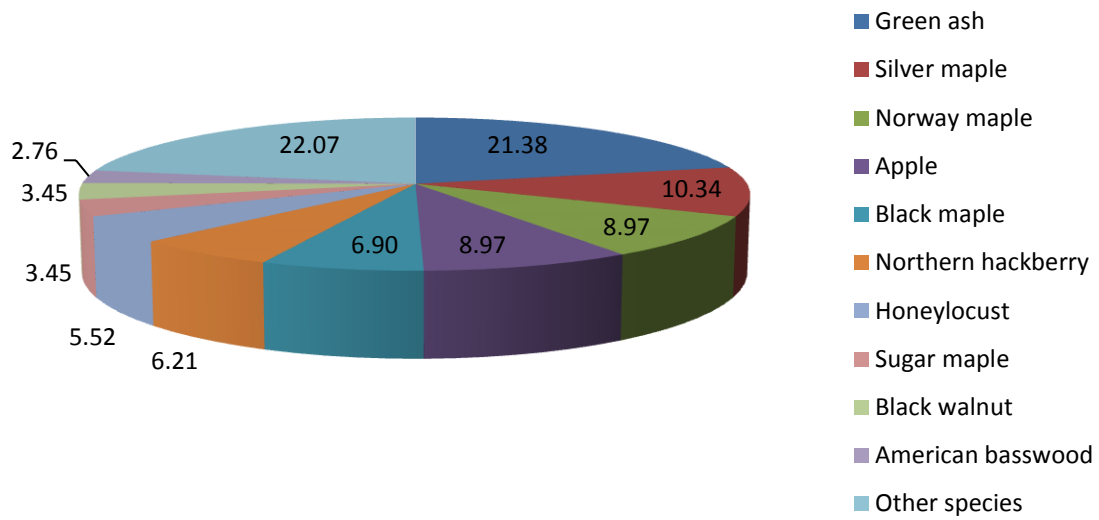
**Table 7: Summary of Benefits in Dollars**

**Stanhope**

**Total Annual Benefits of Public Trees by Species (\$)**

12/8/2015

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Green ash	2,027	155	368	3,182	1,804	7,536	(N/A)	25.1
Silver maple	870	129	160	1,663	1,440	4,261	(N/A)	14.2
Norway maple	826	25	154	1,107	372	2,484	(N/A)	8.3
Apple	456	24	78	260	203	1,021	(N/A)	3.4
Black maple	607	32	115	777	545	2,076	(N/A)	6.9
Northern hackberry	587	22	100	669	463	1,842	(N/A)	6.1
Honeylocust	594	52	103	1,016	1,945	3,709	(N/A)	12.3
Black walnut	309	22	58	508	265	1,162	(N/A)	3.9
Sugar maple	255	15	40	275	255	839	(N/A)	2.8
American basswood	229	19	33	262	212	756	(N/A)	2.5
Broadleaf Evergreen La Maple	141	9	14	205	292	661	(N/A)	2.2
Maple	3	0	0	1	0	5	(N/A)	0.0
Northern catalpa	255	8	54	463	115	894	(N/A)	3.0
Kentucky coffeetree	199	16	34	284	189	723	(N/A)	2.4
Broadleaf Deciduous La	172	14	28	211	173	598	(N/A)	2.0
Littleleaf linden	12	1	2	5	24	44	(N/A)	0.1
Paper birch	115	9	19	140	115	398	(N/A)	1.3
Eastern red cedar	49	0	4	89	14	156	(N/A)	0.5
American sycamore	115	9	19	140	115	398	(N/A)	1.3
Scotch pine	27	1	3	32	31	94	(N/A)	0.3
Spruce	48	2	6	83	65	204	(N/A)	0.7
Mulberry	18	1	3	7	6	35	(N/A)	0.1
River birch	24	2	3	16	26	72	(N/A)	0.2
Amur maple	38	2	7	18	15	80	(N/A)	0.3
Northern red oak	2	0	0	1	2	4	(N/A)	0.0
<b>Citywide Total</b>	<b>7,978</b>	<b>568</b>	<b>1,406</b>	<b>11,414</b>	<b>8,685</b>	<b>30,051</b>	<b>(N/A)</b>	<b>100.0</b>



**Figure 1: Species Distribution**

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

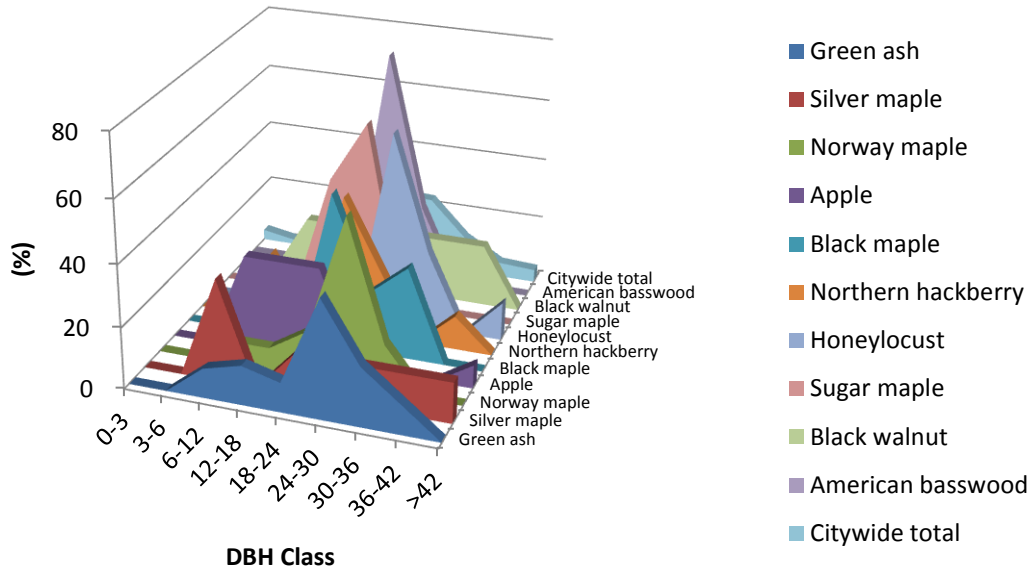


Figure 2: Relative Age Class

## Leaf Condition

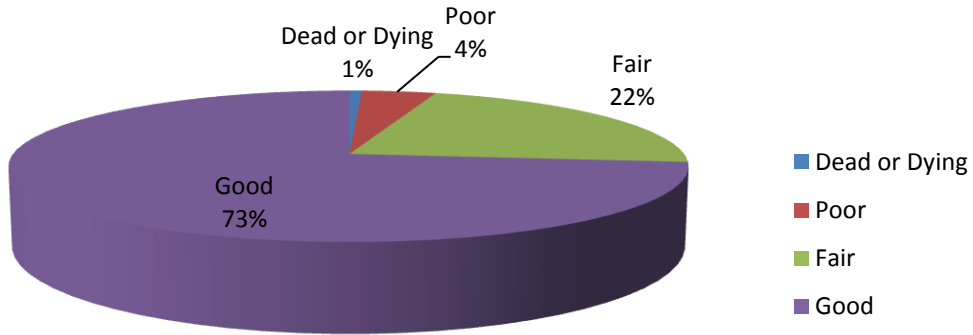


Figure 3: Foliage Condition

## Wood Condition

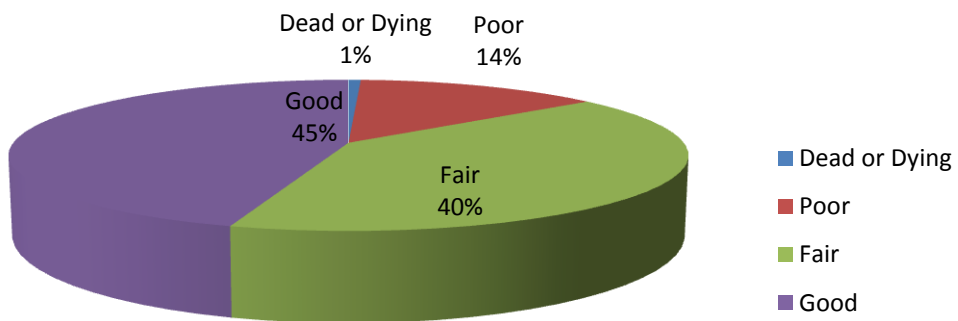


Figure 4: Wood Condition

# Canopy Cover

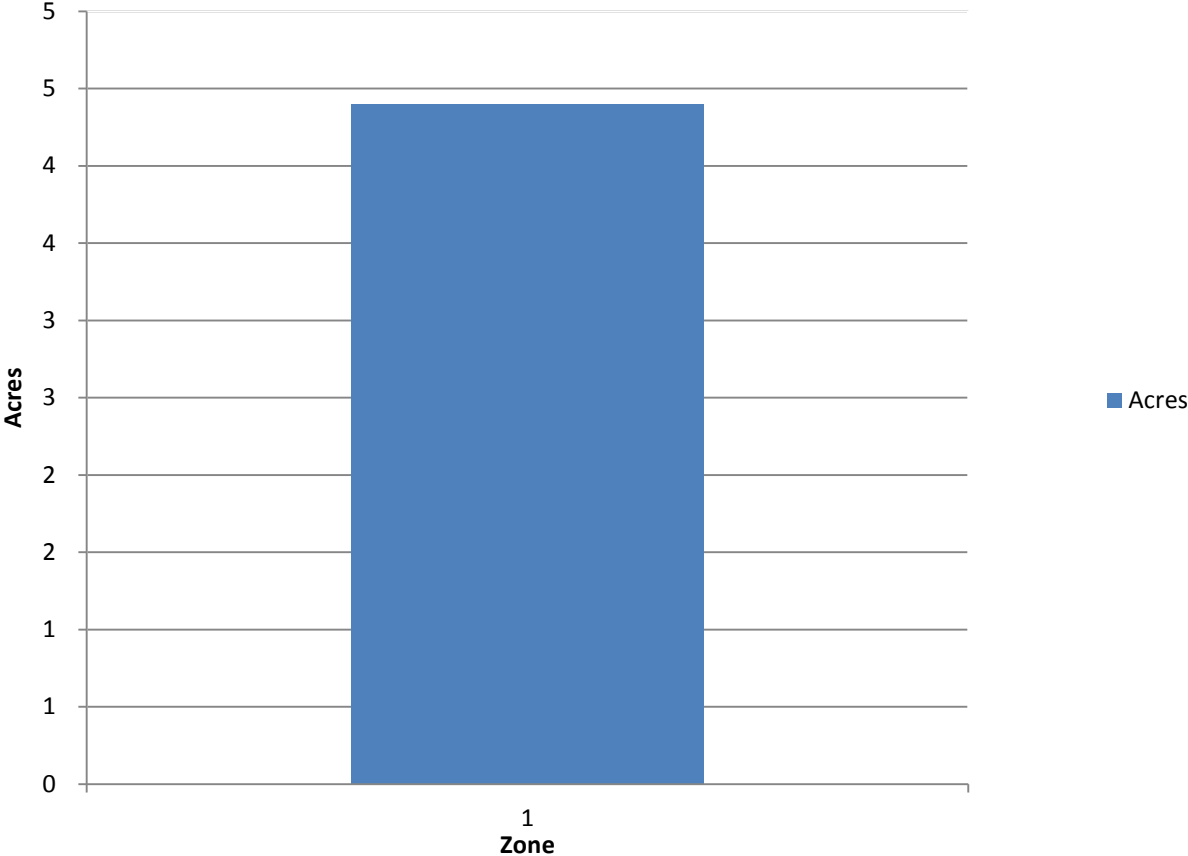


Figure 5: Canopy Cover in Acres

## Land use Public Trees by Zone (%)

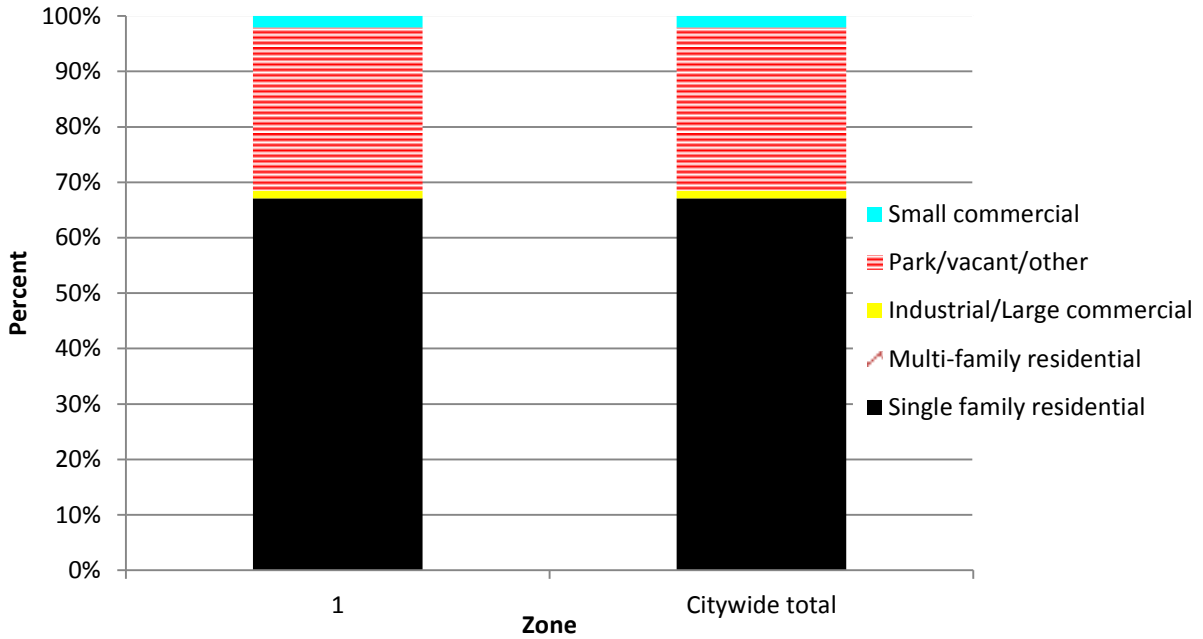


Figure 6: Land Use of city/park trees

## Location Public Trees by Zone (%)

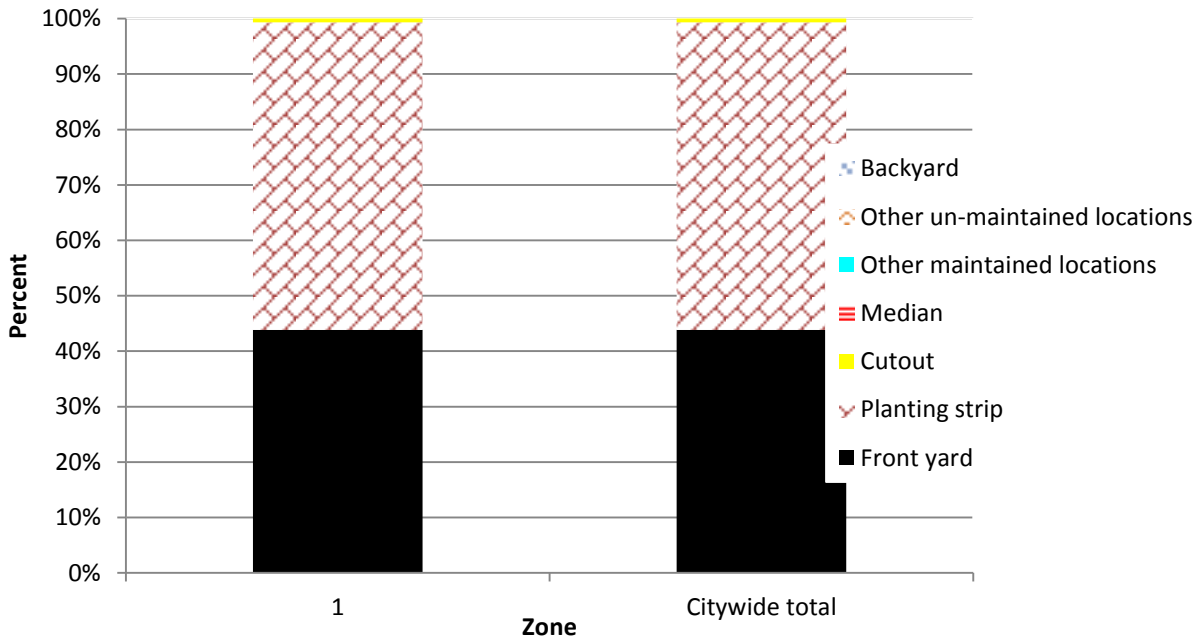


Figure 7: Location of city/park trees

## Appendix B: ArcGIS Mapping

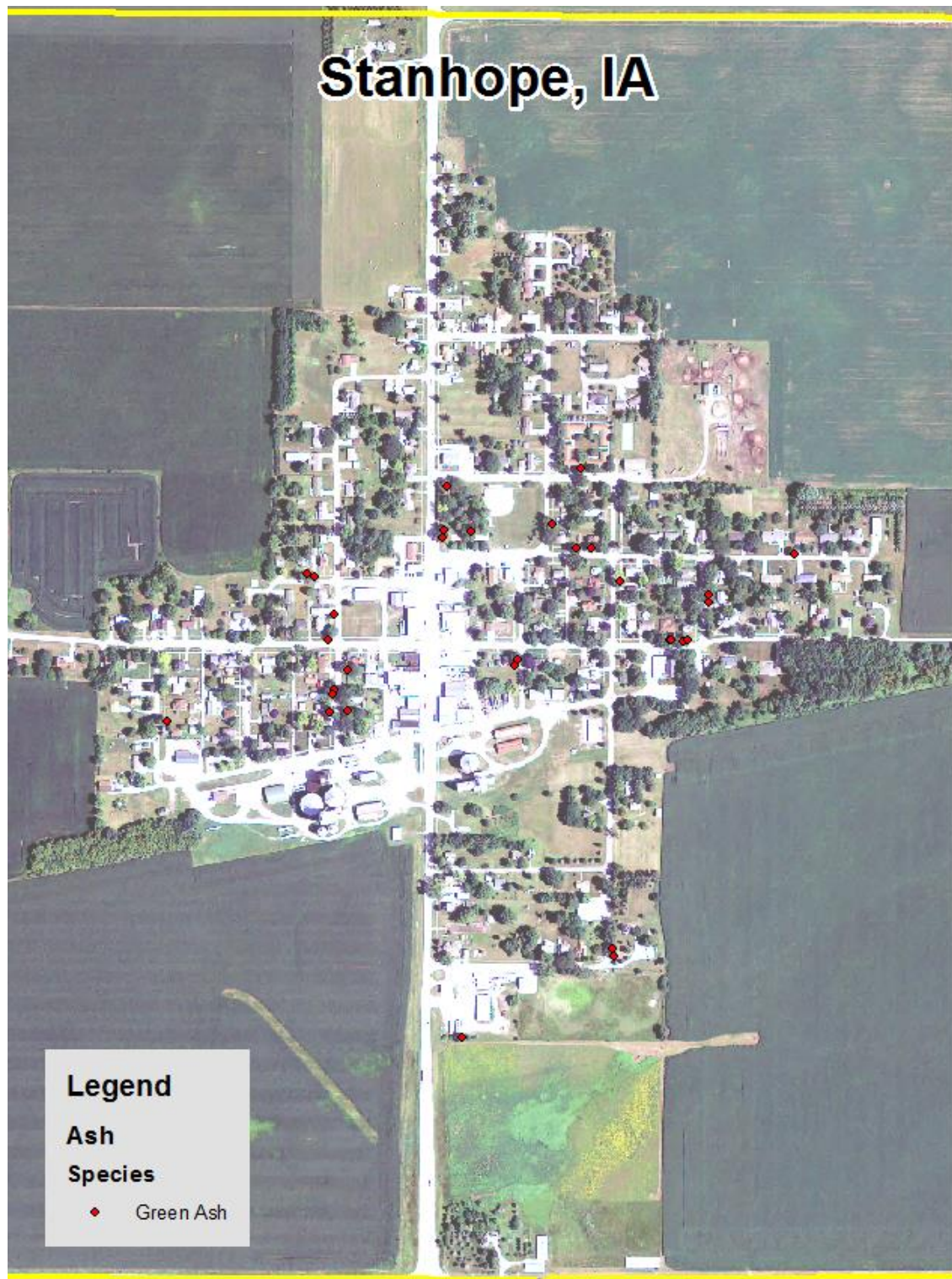


Figure 1: Location of Ash Trees



# Stanhope, IA



Figure 2: Location of EAB symptoms



# Stanhope, IA



Figure 3: Location of Poor Condition Trees





Figure 4: Location of Trees with Recommended Maintenance



# Stanhope, IA

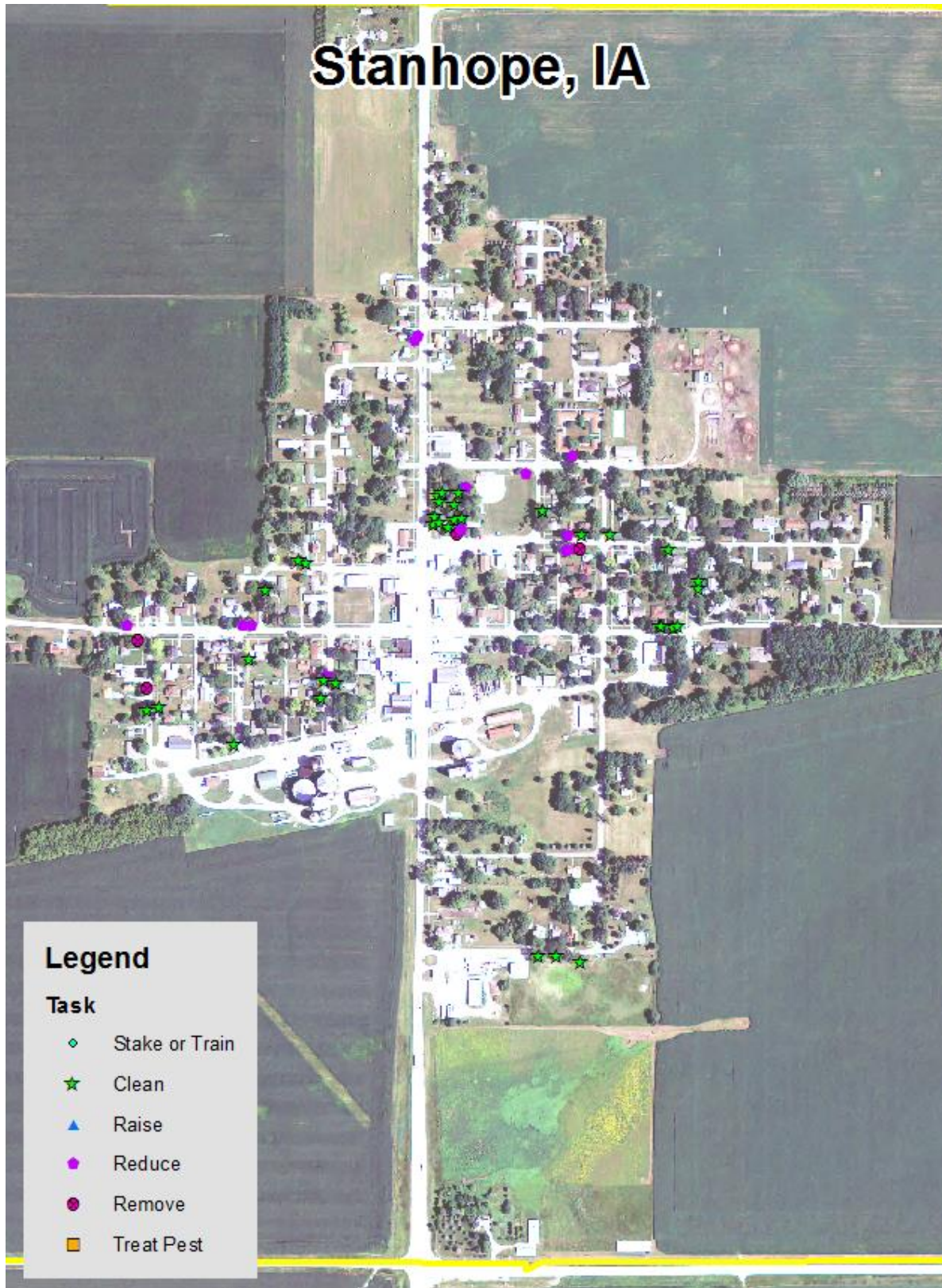


Figure 5: Maintenance Tasks \*City ownership of the trees recommended for removal should be verified prior to any removal\*

## Appendix C: Stanhope Tree Ordinances

STANHOPE, IOWA

VI-13

TITLE VI - COMMUNITY DEVELOPMENT AND ENVIRONMENT  
CHAPTER 2- TREES

### ARTICLE 1 GENERAL PROVISIONS

6-2.0101 PURPOSE. The purpose of this chapter is to beautify and preserve the appearance of the city by regulating and providing for the planting, care and removal of trees.

6-2.0102 DEFINITIONS. For use in this chapter, the following terms are defined:

1. "Parking": shall mean that part of the street, avenue or highway in the city not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

2. "Superintendent": shall mean the superintendent of streets or such other person as may be designated by the council.

6-2.0103 PLANTING RESTRICTIONS. No tree shall be planted in any street or parking except in accordance with the following:

1. Alignment. All trees hereafter planted in any street shall be planted in the parking midway between the outer line of the sidewalk and the curb. In the event a curb line is not established, trees shall be planted on a line ten (10) feet from the property line.

2. Spacing. Trees shall not be planted on the parking if it is less than nine (9) feet in width, or contains less

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than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet to street intersections (property lines extended) and ten (10) feet to driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb.

3. Prohibited Trees. No person shall hereinafter plant in any street, any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, boxelder, chinese elm, or evergreens.

6-2.0104 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks.

(Code of Iowa, 1977, Sec. 364.12 [2c])

6-2.0105 ASSESSMENT. If the abutting property owner fails to trim the trees as required in this chapter, the city may serve notice on the abutting property owner requiring him to do so within five (5) days. If he fails to trim the trees 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.

(Code of Iowa, 1977, Sec. 364.12 [2d & e])

6-2.0106 TRIMMING TREES TO BE SUPERVISED. It shall be unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the city.

6-2.0107 REMOVAL OF TREES. The superintendent shall remove, on the order of the council, any tree on the streets of the city which interferes with the making of improvements or with travel thereon. He shall additionally remove any trees on the street,

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not on private property, which have become diseased, or which constitute a danger to the public, or which may otherwise be declared a nuisance.

(Code of Iowa, 1977, Sec. 364.12 [2c] & 372.13 [4])

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TITLE VI - COMMUNITY DEVELOPMENT AND ENVIRONMENT  
CHAPTER 2- TREES

ARTICLE 2  
DUTCH ELM DISEASE CONTROL

6-2.0201 TREES SUBJECT TO REMOVAL. The council having determined that the health of the elm trees within the city is threatened by a fatal disease known as the Dutch Elm Disease hereby declares the following shall be removed:

(Code of Iowa, 1977, Sec. 364.12 [3b])

1. Living or Standing Trees. Any living or standing elm tree or part thereof infected with the Dutch Elm Disease fungus or which harbors any of the elm bark beetles, that is scolytus multistriatus (eichb.) or hylurgopinus rufipes (marsh.).

2. Dead Trees. Any dead elm tree or part thereof including logs, branches, stumps, firewood or other elm material from which the bark has not been removed and burned or sprayed with an effective elm bark beetle destroying insecticide.

6-2.0202 DUTY TO REMOVE. No person, firm or corporation shall permit any tree or material as defined in Section 1 of this article to remain on the premises owned, controlled or occupied by him within the city.

(Code of Iowa, 1977, Sec. 364.12 [3b])

6-2.0203 INSPECTION. The superintendent shall inspect or cause to be inspected all premises and places within the city to determine whether any condition as defined in Section 1 of this article exists thereon, and shall also inspect or cause to be inspected any elm trees reported or suspected to be infected

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with the Dutch Elm Disease or any elm bark bearing material reported or suspected to be infected with the elm bark beetles.

6-2.0204 REMOVAL FROM CITY PROPERTY. If the superintendent upon inspection or examination, in person or by some qualified person acting for him, shall determine that any condition as herein defined exists in or upon any public street, alley, park or any public place, including the strip between the curb and the lot line of private property, within the city and that the danger of other elm trees within the city is imminent, he shall immediately cause it to be removed and burned or otherwise correct the same in such manner as to destroy or prevent as fully as possible the spread of Dutch Elm Disease or the insect pests or vectors known to carry such disease fungus.

6-2.0205 REMOVAL FROM PRIVATE PROPERTY. If the superintendent upon inspection or examination, in person or by some qualified person acting for him, shall determine with reasonable certainty that any condition as herein defined exists in or upon private premises and that the danger to other elm trees within the city is imminent, he shall immediately notify by certified mail the owner, occupant or person in charge of such property, to correct such condition within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt thereof, the council may cause the nuisance to be removed and the cost assessed against the property as provided in Article 2, Chapter 1, of Title III.

(Code of Iowa, 1977, Sec. 364.12 [3b & h])

If the superintendent is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected with Dutch Elm Disease, he is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens.

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If you need accommodations because of disability to access the services of this Agency, please contact the Director at 515-725-8200.