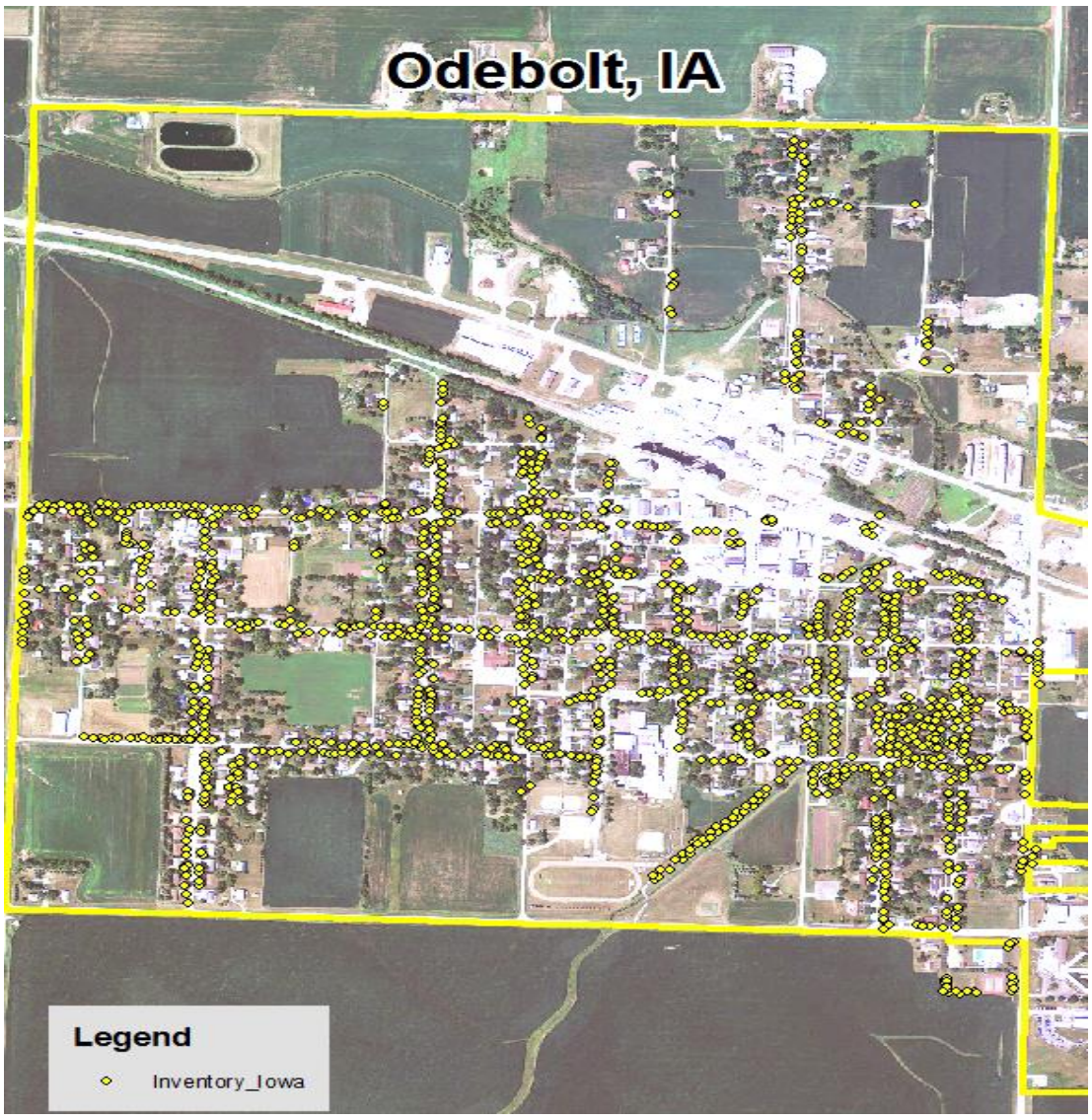
ODEBOLT, IA



2016 Urban Forest Management Plan
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Table of Contents

Executive Summary

Overview

This plan was developed to assist the city of Odebolt 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 21% of Odebolt'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 1,413 trees inventoried.

- Odebolt's trees provide $336,805 of benefits annually, an average of $238 a tree
- There are over 30 species of trees
- The top three genera are: Maple 35%, Hackberry 24%, and Ash 21%
- 40% of trees are in need of some type of management
- 34 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 34 trees needing removal, 15 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*
- 40 of the 293 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, evergreen, willow, black walnut, or fruit-bearing trees.
- Check ash trees with a visual survey yearly
- With the current budget of $10,000 it would take at least 20 years to remove ash – Suggestion: request a budget increase to $20,000 annually and apply for grants to plant replacement trees

Introduction

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

Trees are an important component of Odebolt'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, storm water 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 Odebolt 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 Odebolt's urban forestry goals.

Inventory

In 2015, a tree inventory was conducted that included 100% of city-owned park and street trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

To quantify the urban forest structure and benefits, specific data is collected for each tree. This data includes: location, land use, species, diameter at 4.5 ft., recommended maintenance and 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 1,413 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. Odebolt's trees reduce energy related costs by approximately $89,401 annually (Appendix A, Table 1). These savings are both in Electricity (422.4 MWh) and in Natural Gas (58,510.1 Therms).

Annual Stormwater Benefits

Odebolt's trees intercept about 5,028,762 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $136,279 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 Odebolt, it is estimated that trees remove 5,706 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 $16,205 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Odebolt, trees sequester about 891,823 lbs. of carbon a year with an associated value of $6,689 (Appendix A, Table 5). In addition, the trees store 19,244,266 lbs. of carbon, with a yearly benefit of $144,332 (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. Odebolt receives $88,231 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, Odebolt's trees provide $336,805 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,413 trees in Odebolt provide approximately $238 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Odebolt has over 30 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Maple	500	35.4%
Hackberry	345	24.4%
Ash	293	20.7%
Oak	53	3.8%
Linden/Basswood	46	3.3%
Apple	36	2.5%
Spruce	31	2.2%
Walnut	22	1.5%
Honeylocust	11	0.8%
Poplar (Cottonwood/Aspen)	6	0.4%
Elm	6	0.4%
Birch	5	0.4%
Kentucky Coffeetree	3	0.2%
Mulberry	3	0.2%
Sycamore	2	0.1%
Mountain Ash	2	0.1%
Northern Catalpa	1	<0.1%
Pine	1	<0.1%
Unspecified	1	<0.1%
Other Large Evergreen	30	2.1%
Other Broadleaf Deciduous	15	1.1%

Age Class

Most of Odebolt's trees (57%) are between 18 and 36 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. Odebolt's size curve is on the medium-to-larger side, indicating that tree planting should be significantly increased in the community as budgetary opportunities allow.

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 Odebolt indicate that 90% of the trees are in good health, with only 2% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 59% of Odebolt'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 8% of the population. This 8% 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	473	33%
Staking/Training	39	3%
Tree Removal	34	2%
Crown Reduction	17	1%
Crown Raising	8	<1%

Canopy Cover

The canopy cover of Odebolt is approximately 52 acres (Appendix A, Figure 5). According to the 2010 census, Odebolt occupies 672 acres. Thus the canopy cover on city land is about 8%.

Land Use and Location

The majority of Odebolt'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	70.6%
Park/vacant/other	26.5%
Industrial/Large commercial	0.6%
Small commercial	0.6%
Multifamily residential	1.7%

Location	
Planting strip	50.7%
Front yard	46.3%
Median	2.6%
Cutout (surrounded by pavement)	0.4%

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

Odebolt has 7 critical concern (hazard) trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. Of these 7 trees, 6 are over 24 inches in diameter at 4.5 ft. and should therefore be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the removal trees are addressed, there should be follow up on the critical concern trees marked as needing maintenance. There are a total of 30 additional trees with these needs.

Poor tree species

After the removal and maintenance 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 7 critical concern trees that need to be removed as soon as possible, 2 are ash trees; 3 additional ash trees are in need of removal within the next few years. There are 27 ash trees in addition to these 5 that have poor wood condition; these trees should be prioritized for removal next. After taking all of these trees into account, 15 remaining ash trees show signs and symptoms of EAB and should therefore be monitored closely. *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 Odebolt.

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 (35%) (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, evergreen, willow and black walnut; additionally, section 6-12-3 of the city ordinance prohibits fruit trees. *All trees planted must meet the restrictions laid out in chapter 12 ("Tree Management") of section title 6 ("Physical Environment").* (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

Total $59,955 over 6 years ($9,993/year average)

YEAR 1	**ESTIMATED COSTS**
Remove: 7 critical concern trees, including 2 ash trees, and 3 ash trees in need of non-critical removal	$7,000
Plant: 15 trees in open locations	$2,250
Inspect: ash trees for signs of Emerald Ash Borer	

YEAR 2

Remove: 9 non-ash trees designated as needing non-critical removal	$6,300
Plant: 11 trees in open locations and locations from previous removals	$1,650
Prune: 1/3 of city owned trees	$2,685
Inspect: ash trees for signs of Emerald Ash Borer	

YEAR 3

Remove: 11 non-ash trees designated as needing removal	$7,700
Plant: 16 trees in open locations and locations from previous removals	$2,400
Inspect: ash trees for signs of Emerald Ash Borer	

YEAR 4

Remove: remaining 4 non-ash trees designated as needing removal and 4 ash trees in poor health	$5,600
**Or saving for ash tree treatment and/or future ash removal*	
Plant: 11 trees in open locations and locations from previous removals	$1,650
Prune: 1/3 of city owned trees	$2,685
Inspect: ash trees for signs of Emerald Ash Borer	

YEAR 5

Remove: 11 trees (any new critical concern trees or ash in poor health)	$7,700
**Or saving for ash tree treatment and/or future ash removal*	
Plant: 16 trees in open locations and locations from previous removals	$2,400
Inspect: ash trees for signs and symptoms of EAB	

YEAR 6

Remove: 8 trees (any new critical concern trees or ash in poor health)	$5,600
**Or saving for ash tree treatment and/or future ash removal*	
Plant: 11 trees in open locations and locations from previous removals	$1,650
Prune: 1/3 of city owned trees	$2,685
Inspect: ash trees for signs of Emerald Ash Borer	

Estimated costs based on average costs of $700/tree for removal, $150/tree for planting and maintenance, and $15/tree for pruning.

*Reduction of ash over 6 years: Approximately 32 ash trees should be removed (approximately 14% of ash), including trees with poor wood structure and those displaying multiple symptoms of EAB. If the current budget of $10,000 were devoted solely to the removal of ash trees and excluded such activities as removal, replanting and maintenance of other species, it would take nearly 21 years to remove all of the ash trees in Odebolt. EAB could potentially kill all ash within 4 to 15 years of its arrival. Treatment of ash would alter the cost and timeline and treatment price varies greatly by tree size and state location.

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 an 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) 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 6-12-3 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow, black walnut or fruit trees.

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 upon arrival of EAB.

<u>Proposed Budget Increase</u>

EAB could potentially kill all ash trees in Odebolt within 4 years of its arrival. The total cost of maintaining, removing, and replanting Odebolt's current population of city trees, which would include removing and replanting all of the city's ash trees, is estimated at around $290,000. If the current budget were doubled from $10,000 per year to $20,000, this work could be accomplished in approximately 15 years. Additionally, it is recommended that Odebolt 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 to treat a number of selected trees, either to maintain those trees in the landscape or to delay their removal – to reduce the costs and number of trees that need to be 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, the average diameter for the ash tree population of Odebolt is 27 inches; at $15 per inch, it would cost an average of approximately $405 per tree every two years, for as many years as the tree is preserved. While treatment is cheaper than removal in the short-run, it is more expensive in the long run, as it would only take 6 years of treatment per tree to exceed the cost of removal and replacement ($1,215 for treatment over a six-year period, compared with $850 for one-time removal and replacement, on average). Furthermore, treatment does not cure the tree of the devastation associated with emerald ash borer, but rather delays its onset for as long as treatment is carried out. Whether or not the treatment option is selected, there will be an

increased cost of dealing with ash trees if EAB is found in Odebolt; therefore, it is suggested that the budget be increased to plan for this regardless of how the problem is addressed.

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Odebolt

Annual Energy Benefits of Public Trees

1/29/2016

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	135.0	10,250	19,103.9	18,722	28,972	(N/A)	24.4	32.4	83.98
Green ash	81.4	6,176	11,078.7	10,857	17,033	(N/A)	18.4	19.1	65.51
Silver maple	84.5	6,411	11,155.0	10,932	17,343	(N/A)	17.4	19.4	70.79
Norway maple	44.9	3,411	6,519.7	6,389	9,800	(N/A)	12.8	11.0	54.14
Sugar maple	10.2	772	1,369.2	1,342	2,114	(N/A)	2.6	2.4	57.12
Apple	4.9	368	742.9	728	1,096	(N/A)	2.5	1.2	30.46
American basswood	8.4	637	1,193.2	1,169	1,806	(N/A)	2.2	2.0	58.26
Conifer Evergreen Large	3.1	234	431.3	423	657	(N/A)	2.1	0.7	21.89
Ash	7.3	551	1,049.9	1,029	1,580	(N/A)	2.1	1.8	54.48
Spruce	1.9	144	270.0	265	409	(N/A)	1.8	0.5	16.35
Maple	3.5	268	481.7	472	740	(N/A)	1.7	0.8	30.84
Black walnut	7.3	556	1,015.9	996	1,552	(N/A)	1.6	1.7	70.55
Northern red oak	2.0	155	285.1	279	435	(N/A)	1.2	0.5	25.57
Pin oak	5.1	387	682.1	668	1,056	(N/A)	1.1	1.2	70.39
Littleleaf linden	1.5	113	217.7	213	327	(N/A)	1.1	0.4	21.79
Honeylocust	3.9	297	511.3	501	798	(N/A)	0.8	0.9	72.55
Bur oak	1.6	119	214.6	210	329	(N/A)	0.6	0.4	36.53
Broadleaf Deciduous Small	0.9	70	148.2	145	215	(N/A)	0.6	0.2	23.92
Oak	0.8	58	109.6	107	166	(N/A)	0.6	0.2	20.72
Broadleaf Deciduous Large	1.6	122	209.3	205	327	(N/A)	0.4	0.4	54.51
Red maple	1.6	123	209.9	206	329	(N/A)	0.4	0.4	54.82
Blue spruce	0.4	30	58.9	58	88	(N/A)	0.4	0.1	17.60
Elm	1.7	129	228.7	224	353	(N/A)	0.4	0.4	70.62
Boxelder	1.2	94	159.6	156	251	(N/A)	0.4	0.3	50.14
Cottonwood	1.4	109	190.6	187	296	(N/A)	0.3	0.3	73.95
Swamp white oak	0.6	42	80.0	78	120	(N/A)	0.3	0.1	30.05
White ash	0.9	69	124.2	122	191	(N/A)	0.3	0.2	47.77
Kentucky coffeetree	0.4	32	54.4	53	86	(N/A)	0.2	0.1	28.50
Mulberry	0.2	13	29.5	29	42	(N/A)	0.2	0.0	13.93
Quaking aspen	0.4	32	57.4	56	88	(N/A)	0.1	0.1	43.92
Birch	0.3	25	48.2	47	72	(N/A)	0.1	0.1	35.97
Black maple	0.4	30	56.4	55	85	(N/A)	0.1	0.1	42.63
American sycamore	0.9	70	122.1	120	190	(N/A)	0.1	0.2	94.83
Paper birch	0.4	27	51.8	51	78	(N/A)	0.1	0.1	38.98
Mountain ash	0.3	21	44.5	44	64	(N/A)	0.1	0.1	32.17
Red pine	0.1	11	19.7	19	30	(N/A)	0.1	0.0	30.47
Siberian elm	0.5	38	62.2	61	98	(N/A)	0.1	0.1	98.48
White oak	0.0	2	3.7	4	6	(N/A)	0.1	0.0	5.82
River birch	0.3	24	47.4	46	71	(N/A)	0.1	0.1	70.84
Northern catalpa	0.3	25	46.9	46	71	(N/A)	0.1	0.1	70.91
Norway spruce	0.2	14	24.6	24	38	(N/A)	0.1	0.0	38.17
Total	422.4	32,061	58,510.1	57,340	89,401	(N/A)	100.0	100.0	63.31

Table 2: Annual Stormwater Benefits

Odebolt

Annual Stormwater Benefits of Public Trees

1/29/2016

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	1,450,640	39,312	(N/A)	24.4	28.8	113.95
Green ash	1,006,525	27,277	(N/A)	18.4	20.0	104.91
Silver maple	1,293,331	35,049	(N/A)	17.4	25.7	143.06
Norway maple	420,790	11,403	(N/A)	12.8	8.4	63.00
Sugar maple	116,121	3,147	(N/A)	2.6	2.3	85.05
Apple	24,673	669	(N/A)	2.5	0.5	18.57
American basswood	99,402	2,694	(N/A)	2.2	2.0	86.90
Conifer Evergreen Large	66,895	1,813	(N/A)	2.1	1.3	60.43
Ash	71,686	1,943	(N/A)	2.1	1.4	66.99
Spruce	31,321	849	(N/A)	1.8	0.6	33.95
Maple	26,699	724	(N/A)	1.7	0.5	30.15
Black walnut	92,850	2,516	(N/A)	1.6	1.8	114.37
Northern red oak	17,932	486	(N/A)	1.2	0.4	28.59
Pin oak	56,353	1,527	(N/A)	1.1	1.1	101.81
Littleleaf linden	14,803	401	(N/A)	1.1	0.3	26.74
Honeylocust	47,973	1,300	(N/A)	0.8	1.0	118.19
Bur oak	16,897	458	(N/A)	0.6	0.3	50.88
Broadleaf Deciduous Small	5,113	139	(N/A)	0.6	0.1	15.40
Oak	6,736	183	(N/A)	0.6	0.1	22.82
Broadleaf Deciduous Large	18,269	495	(N/A)	0.4	0.4	82.52
Red maple	13,413	363	(N/A)	0.4	0.3	60.58
Blue spruce	5,893	160	(N/A)	0.4	0.1	31.94
Elm	20,729	562	(N/A)	0.4	0.4	112.35
Boxelder	14,533	394	(N/A)	0.4	0.3	78.77
Cottonwood	18,138	492	(N/A)	0.3	0.4	122.88
Swamp white oak	3,167	86	(N/A)	0.3	0.1	21.46
White ash	9,752	264	(N/A)	0.3	0.2	66.07
Kentucky coffeetree	2,681	73	(N/A)	0.2	0.1	24.22
Mulberry	598	16	(N/A)	0.2	0.0	5.40
Quaking aspen	5,662	153	(N/A)	0.1	0.1	76.72
Birch	3,777	102	(N/A)	0.1	0.1	51.17
Black maple	3,492	95	(N/A)	0.1	0.1	47.32
American sycamore	14,478	392	(N/A)	0.1	0.3	196.17
Paper birch	3,199	87	(N/A)	0.1	0.1	43.34
Mountain ash	1,439	39	(N/A)	0.1	0.0	19.49
Red pine	2,969	80	(N/A)	0.1	0.1	80.46
Siberian elm	7,351	199	(N/A)	0.1	0.1	199.22
White oak	172	5	(N/A)	0.1	0.0	4.65
River birch	3,764	102	(N/A)	0.1	0.1	102.01
Northern catalpa	3,943	107	(N/A)	0.1	0.1	106.85
Norway spruce	4,605	125	(N/A)	0.1	0.1	124.79
Citywide total	5,028,762	136,279	(N/A)	100.0	100.0	96.52

Table 3: Annual Air Quality Benefits

Odebolt

Annual Air Quality Benefits of Public Trees

1/29/2016

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							
Northern hackberry	249.7	43.2	123.9	11.2	1,353	651.3	94.4	89.9	612.4	4,042	0.0	0	1,876.0	5,396 (N/A)	24.4	15.64
Green ash	144.2	23.1	66.5	6.5	761	388.0	56.5	53.9	368.8	2,418	0.0	0	1,107.4	3,179 (N/A)	18.4	12.23
Silver maple	240.0	40.7	116.3	10.6	1,290	398.6	58.3	55.7	382.1	2,493	-126.2	-473	1,176.1	3,309 (N/A)	17.4	13.51
Norway maple	85.6	14.8	42.1	3.8	462	218.2	31.5	30.0	203.9	1,351	-20.1	-75	609.8	1,738 (N/A)	12.8	9.60
Sugar maple	16.3	2.8	8.1	0.7	88	48.3	7.0	6.7	46.0	301	-12.8	-48	123.2	342 (N/A)	2.6	9.23
Apple	8.5	1.4	3.9	0.4	45	23.9	3.4	3.3	22.0	147	0.0	0	66.7	192 (N/A)	2.5	5.33
American basswood	14.2	2.4	6.9	0.6	76	40.5	5.9	5.6	38.1	251	-11.9	-45	102.2	283 (N/A)	2.2	9.13
Conifer Evergreen Large	7.9	1.6	6.4	1.0	52	14.8	2.1	2.0	14.0	92	-38.7	-145	11.0	-2 (N/A)	2.1	-0.05
Ash	15.2	2.6	7.4	0.7	82	35.2	5.1	4.8	32.9	218	-3.5	-13	100.4	287 (N/A)	2.1	9.89
Spruce	3.4	0.7	2.9	0.4	23	9.1	1.3	1.3	8.6	57	-14.9	-56	12.9	24 (N/A)	1.8	0.95
Maple	5.8	1.0	2.8	0.3	31	16.8	2.5	2.3	16.0	105	-2.0	-8	45.4	128 (N/A)	1.7	5.34
Black walnut	12.5	2.0	5.8	0.6	66	35.1	5.1	4.9	33.2	218	0.0	0	99.2	285 (N/A)	1.6	12.94
Northern red oak	3.6	0.6	1.8	0.2	19	9.8	1.4	1.4	9.3	61	-5.1	-19	22.9	61 (N/A)	1.2	3.60
Pin oak	9.9	1.7	5.1	0.4	54	24.2	3.5	3.4	23.1	151	-18.3	-69	53.0	136 (N/A)	1.1	9.10
Littleleaf linden	2.5	0.4	1.2	0.1	13	7.3	1.0	1.0	6.8	45	-1.2	-4	19.1	54 (N/A)	1.1	3.59
Honeylocust	9.6	1.6	4.3	0.4	50	18.4	2.7	2.6	17.7	115	-7.6	-29	49.7	137 (N/A)	0.8	12.46
Bur oak	2.0	0.3	1.0	0.1	11	7.5	1.1	1.0	7.1	46	0.0	0	20.1	57 (N/A)	0.6	6.37
Broadleaf Deciduous Small	1.8	0.3	0.8	0.1	9	4.6	0.7	0.6	4.2	28	0.0	0	13.0	38 (N/A)	0.6	4.17
Oak	0.6	0.1	0.3	0.0	3	3.7	0.5	0.5	3.5	23	0.0	0	9.3	26 (N/A)	0.6	3.28
Broadleaf Deciduous Large	2.9	0.5	1.3	0.1	15	7.6	1.1	1.1	7.3	47	0.0	0	21.8	63 (N/A)	0.4	10.42
Red maple	3.2	0.5	1.5	0.1	17	7.6	1.1	1.1	7.4	48	-1.1	-4	21.5	61 (N/A)	0.4	10.15
Blue spruce	0.8	0.2	0.7	0.1	5	1.9	0.3	0.3	1.8	12	-2.1	-8	3.9	9 (N/A)	0.4	1.85
Elm	3.2	0.5	1.5	0.1	17	8.1	1.2	1.1	7.7	50	0.0	0	23.5	67 (N/A)	0.4	13.50
Boxelder	2.0	0.3	0.9	0.1	11	5.8	0.9	0.8	5.6	37	-0.6	-2	15.9	45 (N/A)	0.4	9.03
Cottonwood	3.0	0.5	1.3	0.1	16	6.8	1.0	0.9	6.5	43	0.0	0	20.2	58 (N/A)	0.3	14.54
Swamp white oak	0.4	0.1	0.2	0.0	2	2.7	0.4	0.4	2.5	17	-0.1	0	6.5	18 (N/A)	0.3	4.58
White ash	1.3	0.2	0.6	0.1	7	4.3	0.6	0.6	4.1	27	0.0	0	12.0	34 (N/A)	0.3	8.55
Kentucky coffeetree	0.2	0.0	0.1	0.0	1	2.0	0.3	0.3	1.9	12	0.0	0	4.8	13 (N/A)	0.2	4.47
Mulberry	0.1	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	5	0.0	0	2.0	6 (N/A)	0.2	1.93
Quaking aspen	0.8	0.1	0.4	0.0	4	2.0	0.3	0.3	1.9	12	0.0	0	5.8	17 (N/A)	0.1	8.29
Birch	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.8	14 (N/A)	0.1	6.86
Black maple	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	-0.3	-1	5.3	15 (N/A)	0.1	7.59
American sycamore	2.7	0.4	1.2	0.1	14	4.4	0.6	0.6	4.2	27	0.0	0	14.3	42 (N/A)	0.1	20.79
Paper birch	0.3	0.0	0.2	0.0	2	1.7	0.3	0.2	1.6	11	0.0	0	4.4	12 (N/A)	0.1	6.17
Mountain ash	0.5	0.1	0.2	0.0	3	1.4	0.2	0.2	1.2	8	0.0	0	3.8	11 (N/A)	0.1	5.45
Red pine	0.3	0.1	0.3	0.0	2	0.7	0.1	0.1	0.7	4	-1.4	-5	0.9	1 (N/A)	0.1	1.45
Siberian elm	1.7	0.3	0.8	0.1	9	2.3	0.3	0.3	2.2	15	0.0	0	8.0	23 (N/A)	0.1	23.37
White oak	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)	0.1	0.87
River birch	0.9	0.1	0.4	0.0	5	1.6	0.2	0.2	1.5	10	-0.2	-1	4.7	14 (N/A)	0.1	13.58
Northern catalpa	0.5	0.1	0.2	0.0	3	1.6	0.2	0.2	1.5	10	0.0	0	4.4	12 (N/A)	0.1	12.48
Norway spruce	0.6	0.1	0.4	0.1	4	0.9	0.1	0.1	0.8	5	-2.9	-11	0.3	-2 (N/A)	0.1	-1.58
Citywide total	860.4	145.7	420.5	39.4	4,636	2,023.2	294.1	280.3	1,914.2	12,587	-271.2	-1,017	5,706.5	16,205 (N/A)	100.0	11.48

Table 4: Annual Carbon Stored

Odebolt

Stored CO2 Benefits of Public Trees

1/29/2016

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	3,903,363	29,275	(N/A)	24.4	20.3	84.86
Green ash	4,805,338	36,040	(N/A)	18.4	25.0	138.62
Silver maple	5,786,741	43,401	(N/A)	17.4	30.1	177.15
Norway maple	1,406,437	10,548	(N/A)	12.8	7.3	58.28
Sugar maple	478,454	3,588	(N/A)	2.6	2.5	96.98
Apple	132,751	996	(N/A)	2.5	0.7	27.66
American basswood	532,878	3,997	(N/A)	2.2	2.8	128.92
Conifer Evergreen La	98,491	739	(N/A)	2.1	0.5	24.62
Ash	251,225	1,884	(N/A)	2.1	1.3	64.97
Spruce	35,394	265	(N/A)	1.8	0.2	10.62
Maple	64,633	485	(N/A)	1.7	0.3	20.20
Black walnut	410,388	3,078	(N/A)	1.6	2.1	139.91
Northern red oak	73,691	553	(N/A)	1.2	0.4	32.51
Pin oak	256,552	1,924	(N/A)	1.1	1.3	128.28
Littleleaf linden	53,355	400	(N/A)	1.1	0.3	26.68
Honeylocust	123,689	928	(N/A)	0.8	0.6	84.33
Bur oak	67,144	504	(N/A)	0.6	0.3	55.95
Broadleaf Deciduous	28,262	212	(N/A)	0.6	0.1	23.55
Oak	20,294	152	(N/A)	0.6	0.1	19.03
Broadleaf Deciduous	97,739	733	(N/A)	0.4	0.5	122.17
Red maple	34,708	260	(N/A)	0.4	0.2	43.39
Blue spruce	5,692	43	(N/A)	0.4	0.0	8.54
Elm	109,827	824	(N/A)	0.4	0.6	164.74
Boxelder	80,698	605	(N/A)	0.4	0.4	121.05
Cottonwood	101,370	760	(N/A)	0.3	0.5	190.07
Swamp white oak	6,926	52	(N/A)	0.3	0.0	12.99
White ash	26,300	197	(N/A)	0.3	0.1	49.31
Kentucky coffeetree	5,741	43	(N/A)	0.2	0.0	14.35
Mulberry	1,994	15	(N/A)	0.2	0.0	4.98
Quaking aspen	26,129	196	(N/A)	0.1	0.1	97.98
Birch	14,297	107	(N/A)	0.1	0.1	53.61
Black maple	9,046	68	(N/A)	0.1	0.0	33.92
American sycamore	95,241	714	(N/A)	0.1	0.5	357.15
Paper birch	9,492	71	(N/A)	0.1	0.0	35.60
Mountain ash	7,651	57	(N/A)	0.1	0.0	28.69
Red pine	3,343	25	(N/A)	0.1	0.0	25.07
Siberian elm	41,265	309	(N/A)	0.1	0.2	309.48
White oak	185	1	(N/A)	0.1	0.0	1.39
River birch	14,280	107	(N/A)	0.1	0.1	107.10
Northern catalpa	15,773	118	(N/A)	0.1	0.1	118.30
Norway spruce	7,490	56	(N/A)	0.1	0.0	56.18
Citywide total	19,244,266	144,332	(N/A)	100.0	100.0	102.22

Table 5: Annual Carbon Sequestered

Odebolt

Annual CO Benefits of Public Trees

1/29/2016

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
Northern hackberry	182,524	1,369	-18,736	-1,320	-10	0	0	162,467	1,219	(N/A)	24.4	18.2	3.53
Green ash	180,228	1,352	-23,066	-878	-7	0	0	156,284	1,172	(N/A)	18.4	17.5	4.51
Silver maple	392,546	2,944	-27,780	-981	-7	0	0	363,785	2,728	(N/A)	17.4	40.8	11.14
Norway maple	66,350	498	-6,756	-467	-4	0	0	59,126	443	(N/A)	12.8	6.6	2.45
Sugar maple	23,699	178	-2,298	-112	-1	0	0	21,289	160	(N/A)	2.6	2.4	4.32
Apple	3,925	29	-637	-76	-1	0	0	3,212	24	(N/A)	2.5	0.4	0.67
American basswood	29,889	224	-2,558	-99	-1	0	0	27,232	204	(N/A)	2.2	3.1	6.59
Conifer Evergreen Large	3,175	24	-473	-63	0	0	0	2,639	20	(N/A)	2.1	0.3	0.66
Ash	6,051	45	-1,207	-84	-1	0	0	4,760	36	(N/A)	2.1	0.5	1.23
Spruce	1,330	10	-170	-40	0	0	0	1,120	8	(N/A)	1.8	0.1	0.34
Maple	5,356	40	-310	-34	0	0	0	5,011	38	(N/A)	1.7	0.6	1.57
Black walnut	17,627	132	-1,970	-79	-1	0	0	15,578	117	(N/A)	1.6	1.7	5.31
Northern red oak	1,996	15	-354	-26	0	0	0	1,615	12	(N/A)	1.2	0.2	0.71
Pin oak	23,947	180	-1,231	-53	0	0	0	22,662	170	(N/A)	1.1	2.5	11.33
Littleleaf linden	5,087	38	-259	-20	0	0	0	4,808	36	(N/A)	1.1	0.5	2.40
Honeylocust	9,302	70	-594	-30	0	0	0	8,678	65	(N/A)	0.8	1.0	5.92
Bur oak	3,656	27	-322	-17	0	0	0	3,316	25	(N/A)	0.6	0.4	2.76
Broadleaf Deciduous Smal	1,164	9	-136	-15	0	0	0	1,013	8	(N/A)	0.6	0.1	0.84
Oak	1,843	14	-97	-10	0	0	0	1,736	13	(N/A)	0.6	0.2	1.63
Broadleaf Deciduous Larg	2,991	22	-469	-17	0	0	0	2,505	19	(N/A)	0.4	0.3	3.13
Red maple	3,296	25	-167	-14	0	0	0	3,116	23	(N/A)	0.4	0.3	3.89
Blue spruce	357	3	-27	-8	0	0	0	322	2	(N/A)	0.4	0.0	0.48
Elm	3,400	26	-527	-18	0	0	0	2,855	21	(N/A)	0.4	0.3	4.28
Boxelder	5,061	38	-387	-16	0	0	0	4,657	35	(N/A)	0.4	0.5	6.99
Cottonwood	2,741	21	-487	-16	0	0	0	2,238	17	(N/A)	0.3	0.3	4.20
Swamp white oak	1,058	8	-33	-5	0	0	0	1,019	8	(N/A)	0.3	0.1	1.91
White ash	2,524	19	-126	-9	0	0	0	2,390	18	(N/A)	0.3	0.3	4.48
Kentucky coffeetree	863	6	-28	-4	0	0	0	831	6	(N/A)	0.2	0.1	2.08
Mulberry	266	2	-10	-3	0	0	0	253	2	(N/A)	0.2	0.0	0.63
Quaking aspen	1,034	8	-125	-5	0	0	0	903	7	(N/A)	0.1	0.1	3.39
Birch	5	0	-69	-4	0	0	0	-68	-1	(N/A)	0.1	0.0	-0.25
Black maple	165	1	-43	-4	0	0	0	118	1	(N/A)	0.1	0.0	0.44
American sycamore	1,391	10	-457	-11	0	0	0	923	7	(N/A)	0.1	0.1	3.46
Paper birch	868	7	-46	-4	0	0	0	819	6	(N/A)	0.1	0.1	3.07
Mountain ash	592	4	-37	-4	0	0	0	552	4	(N/A)	0.1	0.1	2.07
Red pine	187	1	-16	-3	0	0	0	169	1	(N/A)	0.1	0.0	1.26
Siberian elm	983	7	-198	-6	0	0	0	779	6	(N/A)	0.1	0.1	5.84
White oak	74	1	-1	-1	0	0	0	73	1	(N/A)	0.1	0.0	0.55
River birch	370	3	-69	-4	0	0	0	298	2	(N/A)	0.1	0.0	2.23
Northern catalpa	857	6	-76	-4	0	0	0	778	6	(N/A)	0.1	0.1	5.83
Norway spruce	0	0	-36	-5	0	0	0	-41	0	(N/A)	0.1	0.0	-0.31
Citywide total	988,777	7,416	-92,387	-4,567	-34	0	0	891,823	6,689	(N/A)	100.0	100.0	4.74

Table 6: Annual Social and Aesthetic Benefits

Odebolt

Annual Aesthetic/Other Benefits of Public Trees

1/29/2016

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern hackberry	22,586	(N/A)	24.4	25.6	65.47
Green ash	14,067	(N/A)	18.4	15.9	54.11
Silver maple	28,927	(N/A)	17.4	32.8	118.07
Norway maple	6,253	(N/A)	12.8	7.1	34.55
Sugar maple	2,424	(N/A)	2.6	2.7	65.52
Apple	228	(N/A)	2.5	0.3	6.34
American basswood	2,064	(N/A)	2.2	2.3	66.58
Conifer Evergreen Large	491	(N/A)	2.1	0.6	16.38
Ash	603	(N/A)	2.1	0.7	20.78
Spruce	390	(N/A)	1.8	0.4	15.60
Maple	765	(N/A)	1.7	0.9	31.87
Black walnut	1,340	(N/A)	1.6	1.5	60.93
Northern red oak	183	(N/A)	1.2	0.2	10.76
Pin oak	1,819	(N/A)	1.1	2.1	121.24
Littleleaf linden	546	(N/A)	1.1	0.6	36.37
Honeylocust	2,334	(N/A)	0.8	2.6	212.16
Bur oak	333	(N/A)	0.6	0.4	36.99
Broadleaf Deciduous Small	68	(N/A)	0.6	0.1	7.58
Oak	215	(N/A)	0.6	0.2	26.82
Broadleaf Deciduous Large	250	(N/A)	0.4	0.3	41.64
Red maple	416	(N/A)	0.4	0.5	69.30
Blue spruce	86	(N/A)	0.4	0.1	17.13
Elm	264	(N/A)	0.4	0.3	52.86
Boxelder	308	(N/A)	0.4	0.3	61.55
Cottonwood	207	(N/A)	0.3	0.2	51.65
Swamp white oak	118	(N/A)	0.3	0.1	29.46
White ash	295	(N/A)	0.3	0.3	73.64
Kentucky coffeetree	103	(N/A)	0.2	0.1	34.32
Mulberry	15	(N/A)	0.2	0.0	4.95
Quaking aspen	81	(N/A)	0.1	0.1	40.67
Birch	3	(N/A)	0.1	0.0	1.37
Black maple	30	(N/A)	0.1	0.0	14.92
American sycamore	87	(N/A)	0.1	0.1	43.45
Paper birch	86	(N/A)	0.1	0.1	43.12
Mountain ash	35	(N/A)	0.1	0.0	17.60
Red pine	47	(N/A)	0.1	0.1	47.08
Siberian elm	54	(N/A)	0.1	0.1	54.03
White oak	15	(N/A)	0.1	0.0	14.73
River birch	31	(N/A)	0.1	0.0	31.46
Northern catalpa	66	(N/A)	0.1	0.1	65.59
Norway spruce	0	(N/A)	0.1	0.0	0.00
Citywide total	88,231	(N/A)	100.0	100.0	62.49

Table 7: Summary of Benefits in Dollars

Odebolt

Total Annual Benefits of Public Trees by Species ($)

1/29/2016

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Northern hackberry	28,972	1,219	5,396	39,312	22,586	97,484	(N/A)	28.9
Green ash	17,033	1,172	3,179	27,277	14,067	62,729	(N/A)	18.6
Silver maple	17,343	2,728	3,309	35,049	28,927	87,357	(N/A)	25.9
Norway maple	9,800	443	1,738	11,403	6,253	29,638	(N/A)	8.8
Sugar maple	2,114	160	342	3,147	2,424	8,186	(N/A)	2.4
Apple	1,096	24	192	669	228	2,209	(N/A)	0.7
American basswood	1,806	204	283	2,694	2,064	7,051	(N/A)	2.1
Conifer Evergreen Large	657	20	-2	1,813	491	2,979	(N/A)	0.9
Ash	1,580	36	287	1,943	603	4,447	(N/A)	1.3
Spruce	409	8	24	849	390	1,680	(N/A)	0.5
Maple	740	38	128	724	765	2,395	(N/A)	0.7
Black walnut	1,552	117	285	2,516	1,340	5,810	(N/A)	1.7
Northern red oak	435	12	61	486	183	1,177	(N/A)	0.3
Pin oak	1,056	170	136	1,527	1,819	4,708	(N/A)	1.4
Littleleaf linden	327	36	54	401	546	1,363	(N/A)	0.4
Honeylocust	798	65	137	1,300	2,334	4,634	(N/A)	1.4
Bur oak	329	25	57	458	333	1,202	(N/A)	0.4
Broadleaf Deciduous Sm	215	8	38	139	68	467	(N/A)	0.1
Oak	166	13	26	183	215	602	(N/A)	0.2
Broadleaf Deciduous La	327	19	63	495	250	1,153	(N/A)	0.3
Red maple	329	23	61	363	416	1,192	(N/A)	0.4
Blue spruce	88	2	9	160	86	345	(N/A)	0.1
Elm	353	21	67	562	264	1,268	(N/A)	0.4
Boxelder	251	35	45	394	308	1,032	(N/A)	0.3
Cottonwood	296	17	58	492	207	1,069	(N/A)	0.3
Swamp white oak	120	8	18	86	118	350	(N/A)	0.1
White ash	191	18	34	264	295	802	(N/A)	0.2
Kentucky coffeetree	86	6	13	73	103	281	(N/A)	0.1
Mulberry	42	2	6	16	15	81	(N/A)	0.0
Quaking aspen	88	7	17	153	81	346	(N/A)	0.1
Birch	72	-1	14	102	3	190	(N/A)	0.1
Black maple	85	1	15	95	30	226	(N/A)	0.1
American sycamore	190	7	42	392	87	717	(N/A)	0.2
Paper birch	78	6	12	87	86	269	(N/A)	0.1
Mountain ash	64	4	11	39	35	154	(N/A)	0.0
Red pine	30	1	1	80	47	161	(N/A)	0.0
Siberian elm	98	6	23	199	54	381	(N/A)	0.1
White oak	6	1	1	5	15	27	(N/A)	0.0
River birch	71	2	14	102	31	220	(N/A)	0.1
Northern catalpa	71	6	12	107	66	262	(N/A)	0.1
Norway spruce	38	0	-2	125	0	161	(N/A)	0.0
Citywide Total	89,401	6,689	16,205	136,279	88,231	336,805	(N/A)	100.0

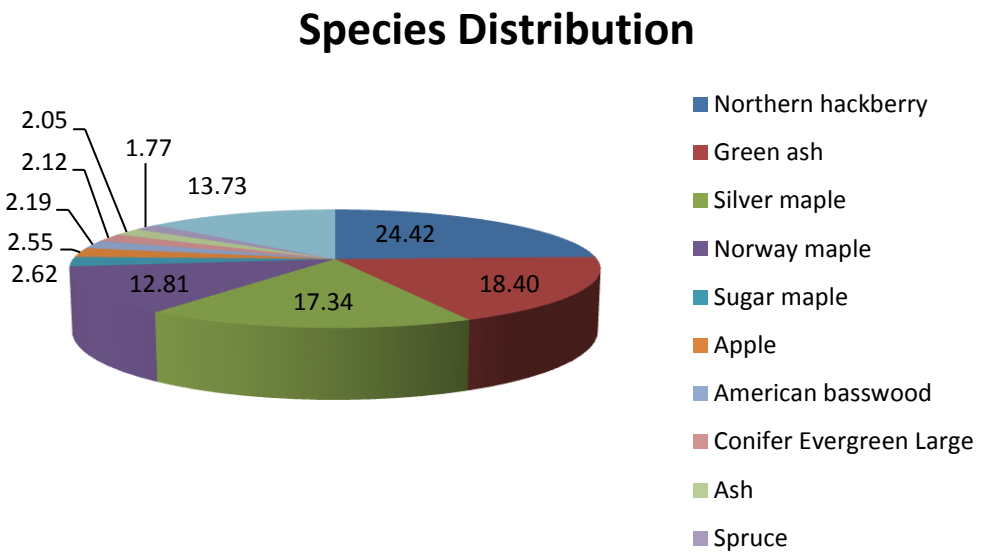
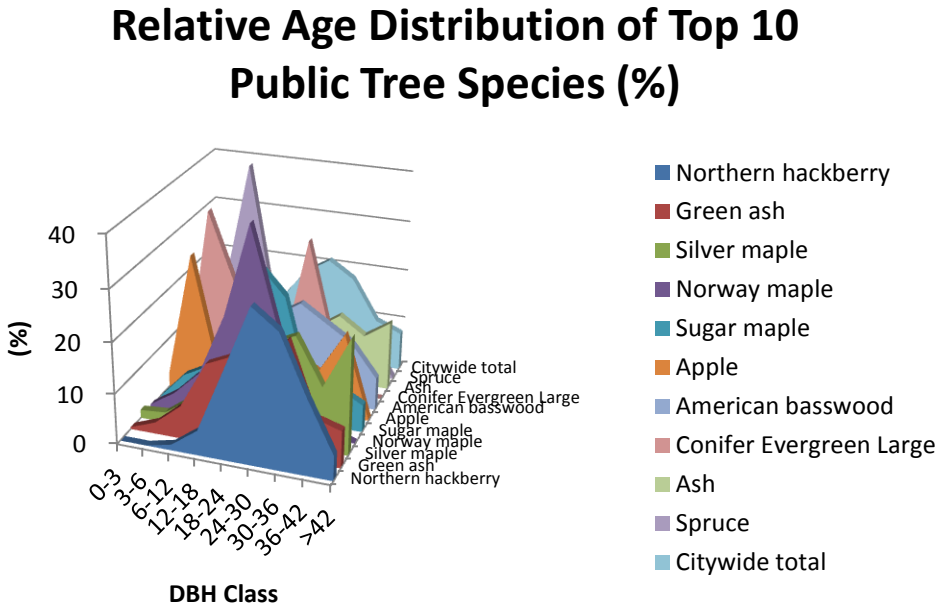


Figure 1: Species Distribution (%)



Species Name	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Northern hackberry	0.00	0.00	1.16	4.93	17.39	30.14	26.38	15.07	4.93
Green ash	0.38	2.31	6.54	15.77	18.08	18.08	22.69	8.85	7.31
Silver maple	1.63	2.04	5.71	6.12	8.16	19.18	21.63	12.65	22.86
Norway maple	0.55	3.87	8.84	20.99	39.23	20.99	3.87	1.66	0.00
Sugar maple	0.00	5.41	8.11	13.51	29.73	24.32	5.41	8.11	5.41
Apple	2.78	27.78	5.56	19.44	8.33	11.11	8.33	16.67	0.00
American basswood	9.68	3.23	0.00	16.13	16.13	19.35	16.13	12.90	6.45
Conifer Evergreen Large	0.00	33.33	20.00	0.00	6.67	30.00	10.00	0.00	0.00
Ash	0.00	3.45	17.24	20.69	10.34	10.34	13.79	10.34	13.79
Spruce	12.00	16.00	40.00	12.00	8.00	0.00	4.00	8.00	0.00
Zone 1 total	2.34	4.39	8.00	11.39	17.83	21.02	17.76	9.62	7.64

Figure 2: Relative Age Class (%)

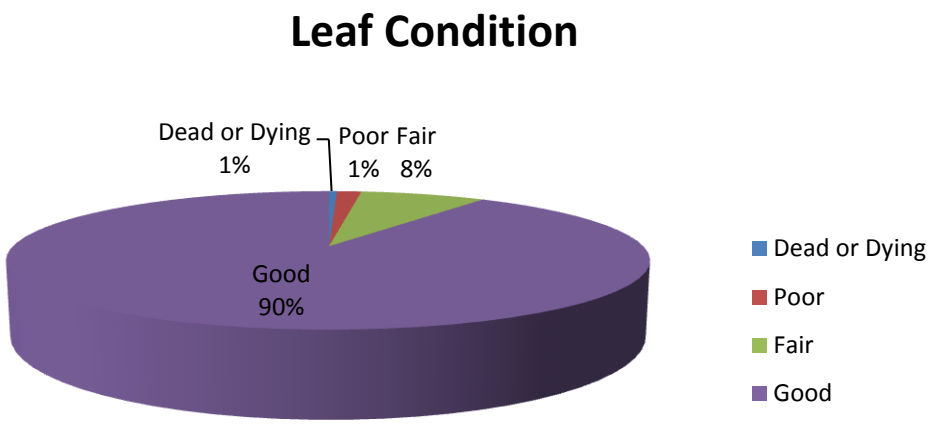


Figure 3: Foliage Condition

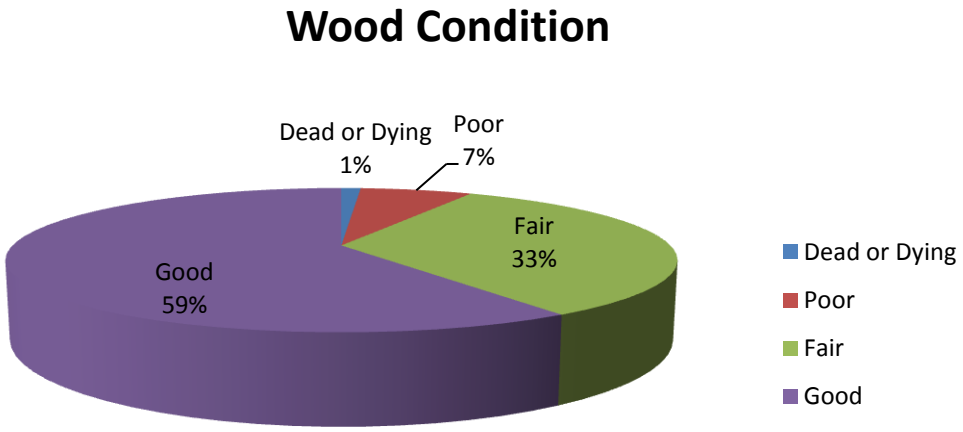


Figure 4: Wood Condition

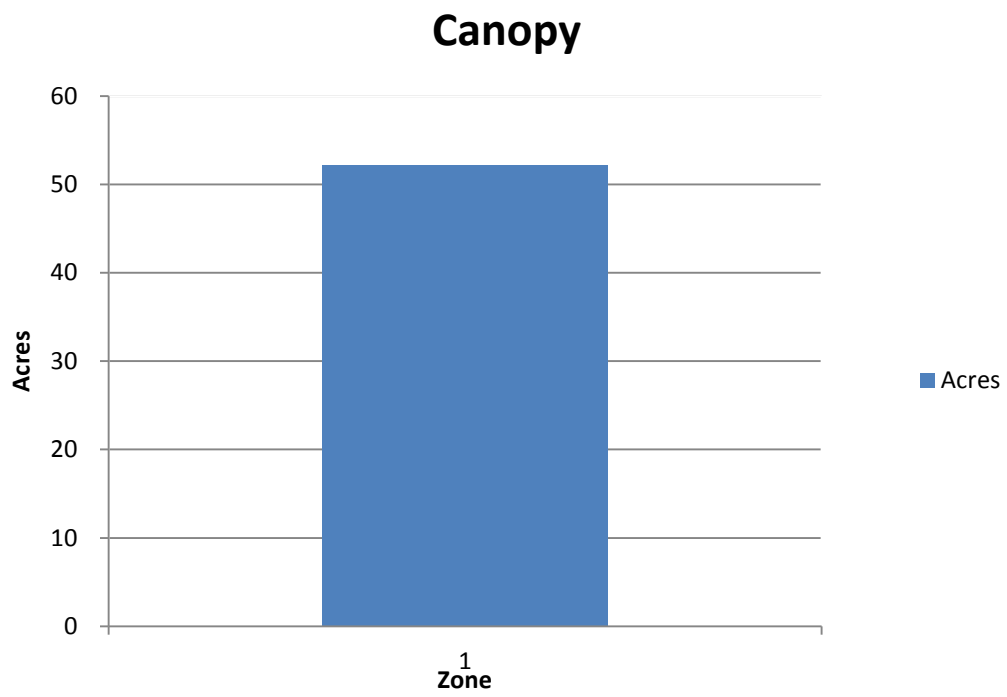


Figure 5: Canopy Cover in Acres

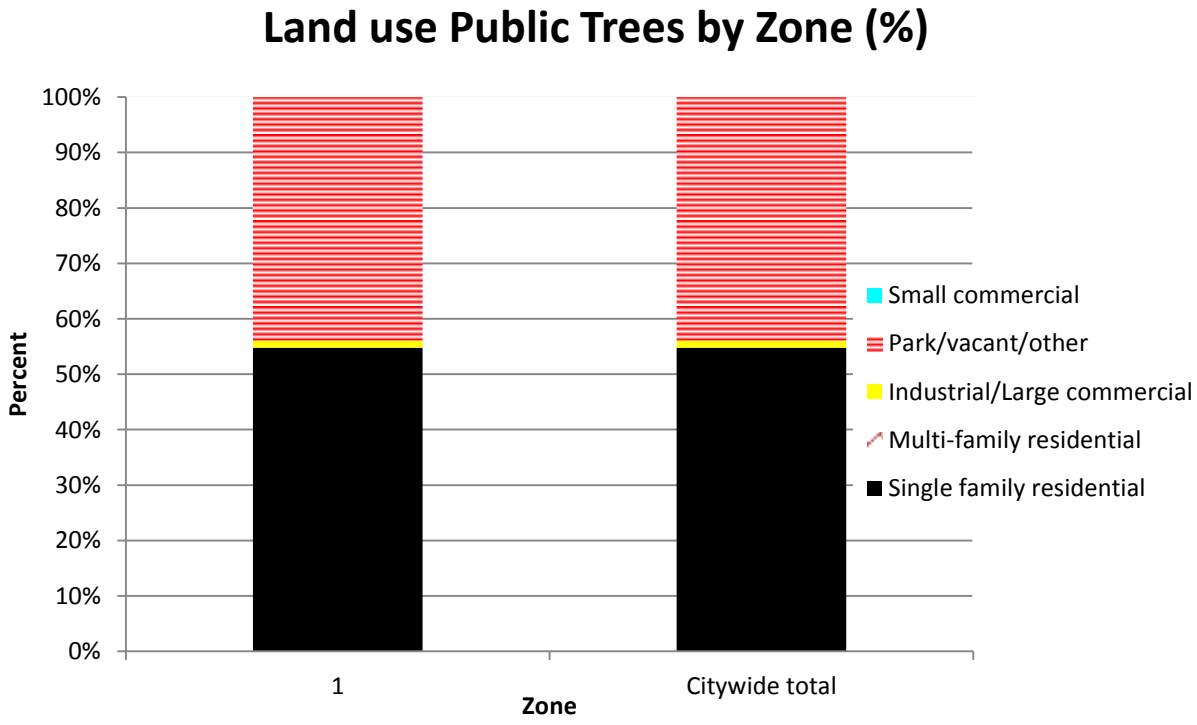


Figure 6: Land Use of city/park trees

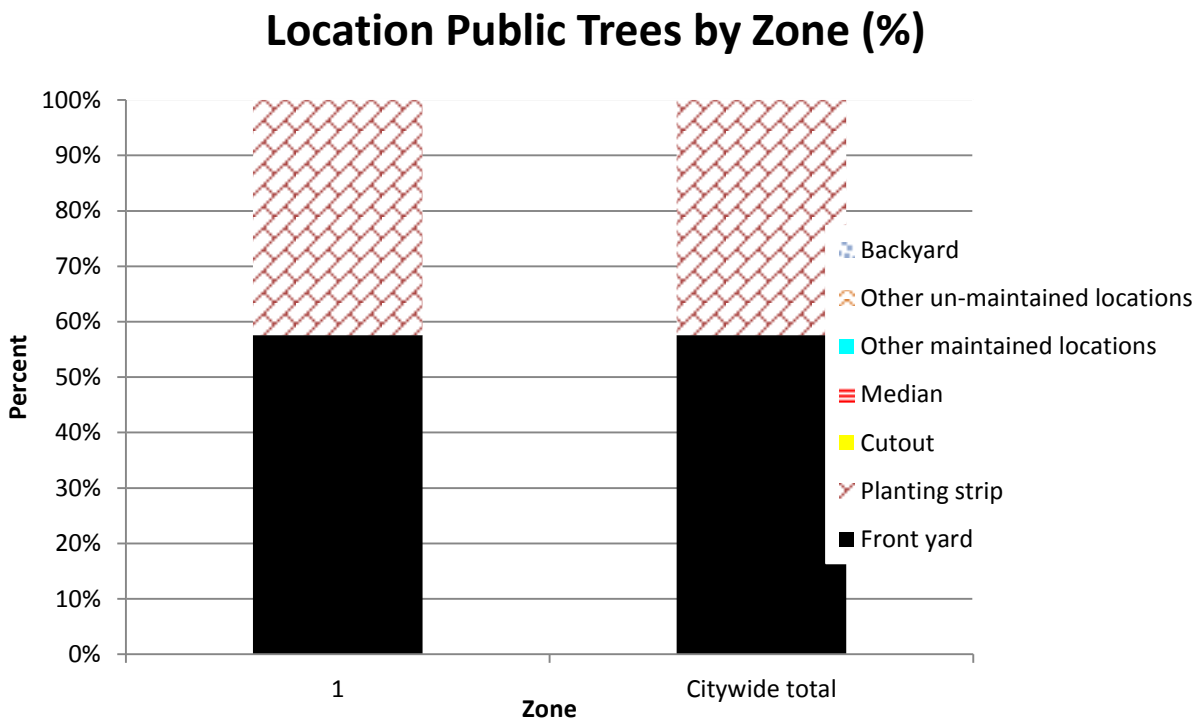


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

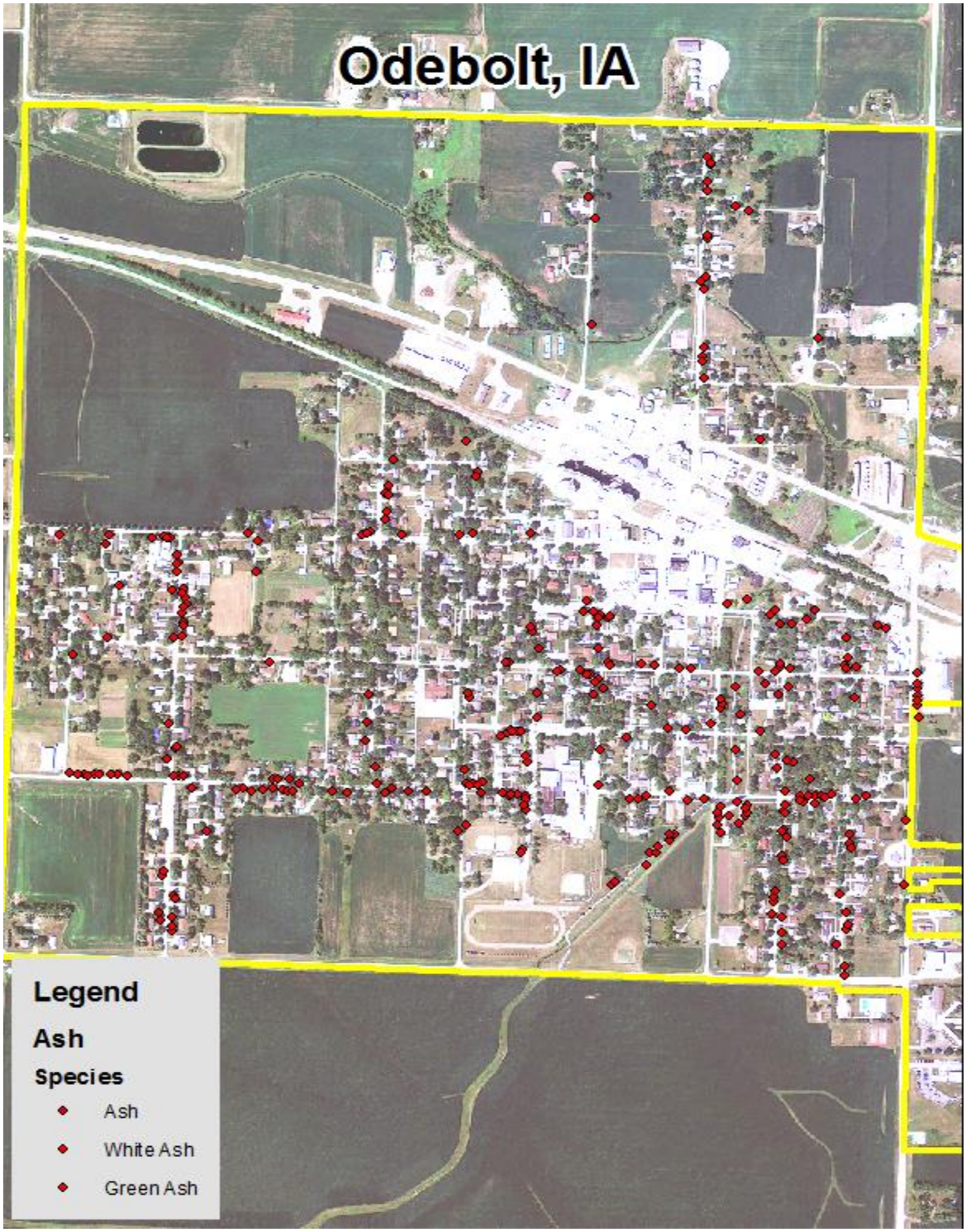


Figure 1: Location of Ash Trees

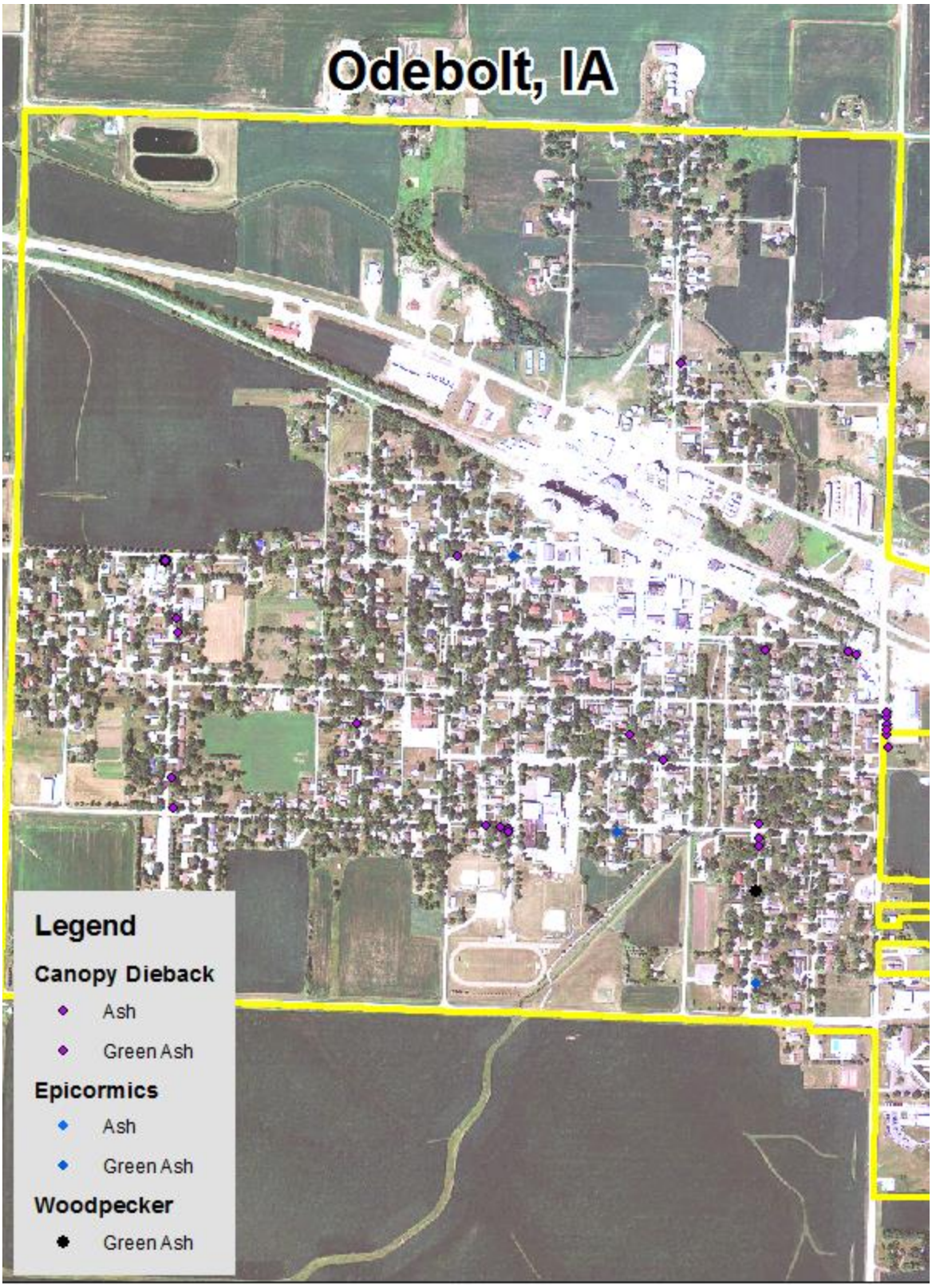


Figure 2: Location of EAB symptoms

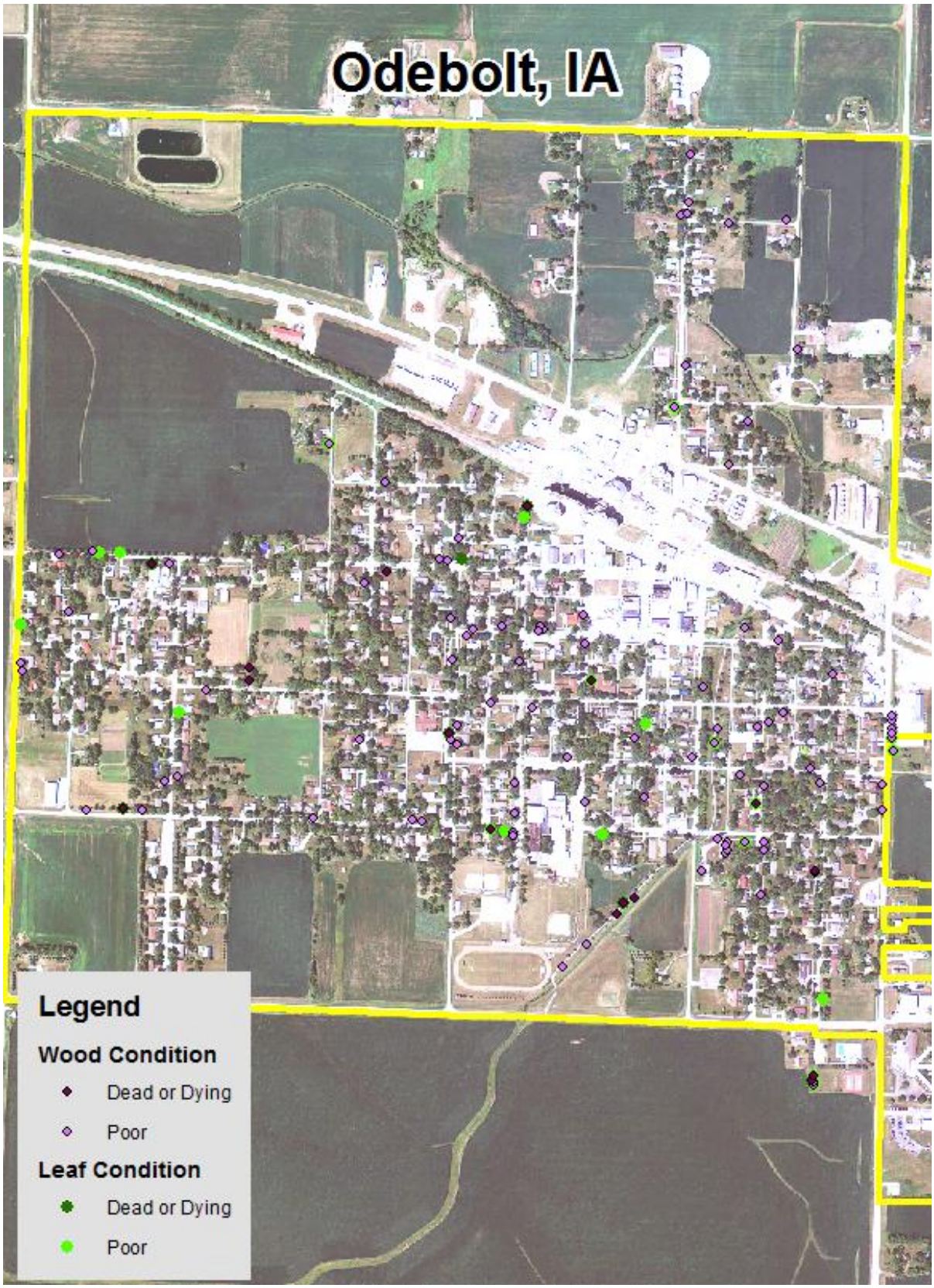


Figure 3: Location of Poor Condition Trees

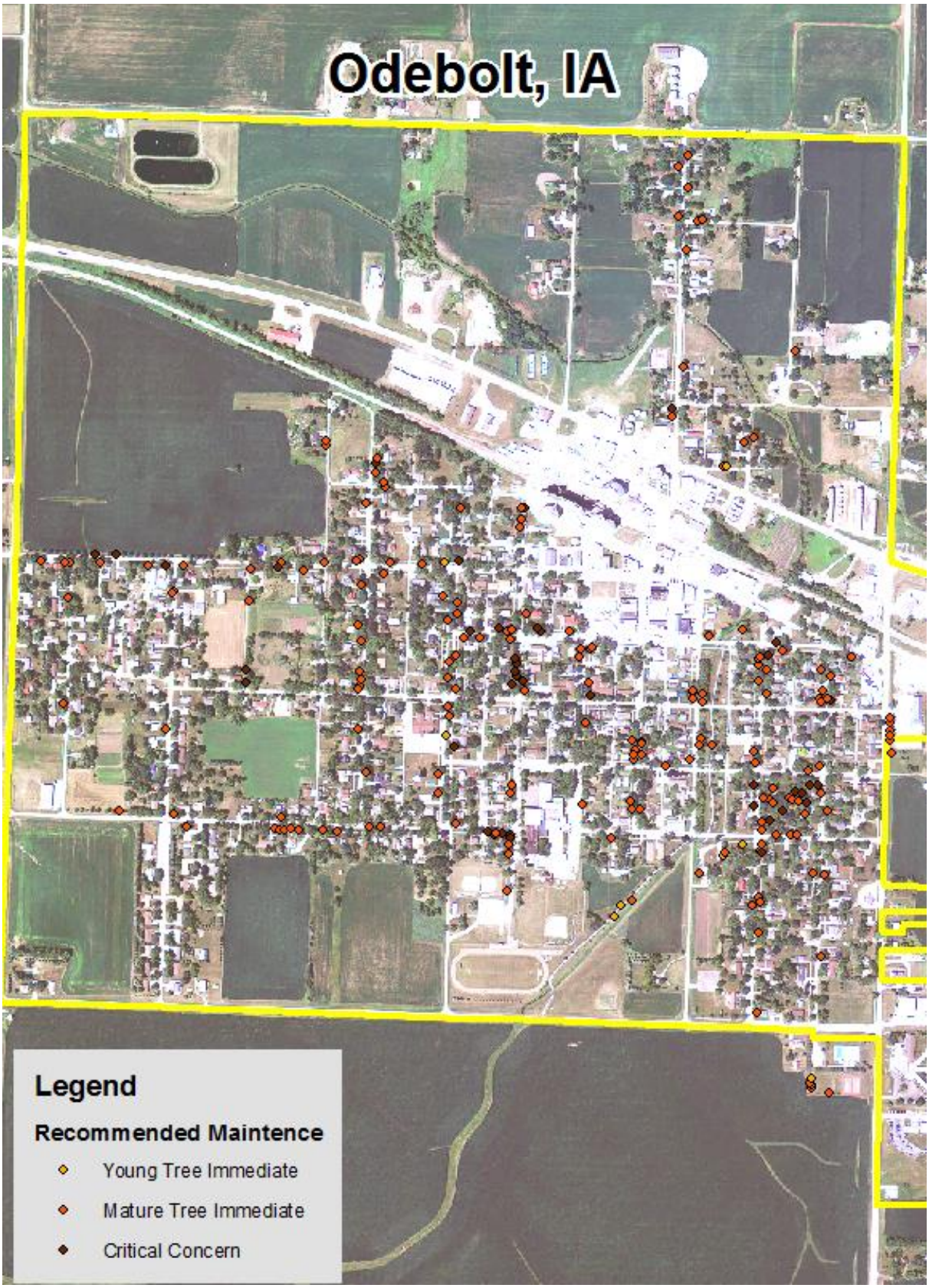


Figure 4: Location of Trees with Recommended Maintenance

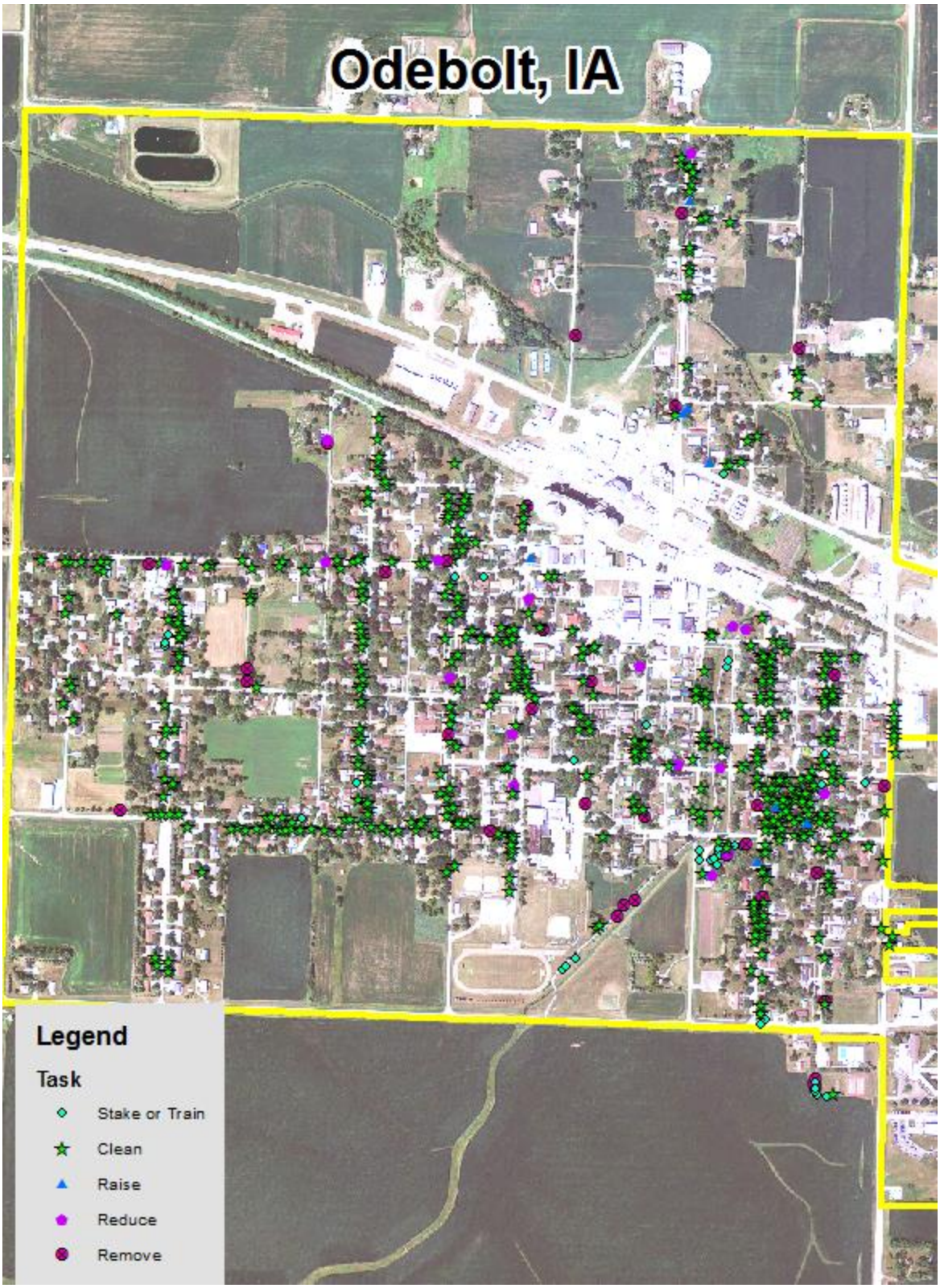


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Odebolt Tree Ordinances

TITLE VI PHYSICAL ENVIRONMENT

CHAPTER 12 TREE MANAGEMENT

6-12-1 PURPOSE. The purpose of the chapters in this Code of Ordinances pertaining to Trees is to beautify and preserve the appearance of the City by regulating and providing for the planting, care and removal of trees.

6-12-2 DEFINITIONS. For use in these chapters, the following terms are defined:

1. "Parking" means 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" means such person as may be designated by the council.

6-12-3 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 or in line with existing trees. 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 any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from 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 plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, boxelder, chinese elm; or evergreens.

6-12-4 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 sixteen (16) feet above the surface of the street and eight (8) feet above the sidewalks.

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

6-12-5 PENALTY AND 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 that such action be taken within five (5) days. If such action is not taken within that time, the same shall constitute a municipal infraction and the City may proceed as provided in Chapter 8 to collect civil penalties or secure injunctive relief, or 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, Sec. 364.12 [2d & e])

6-12-6 TRIMMING TREES TO BE APPROVED BY THE CITY. It shall be unlawful for any person to trim or cut any tree in a street or public place unless the work is approved by the City.

6-12-7 REMOVAL OF TREES. The superintendent shall remove, on order of the Council, any tree on the streets of the City which interferes with the making of improvements or with travel thereon. The superintendent shall additionally remove any trees on the street, not on private property, which are dead or have become diseased, or which constitute a danger to the public, or which may otherwise be declared a nuisance.

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

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Federal law prohibits employment discrimination on the basis of race, color, age, religion, national origin, sex or disability. State law prohibits employment discrimination on the basis of race, color, creed, age, sex, sexual orientation, gender identity, national origin, religion, pregnancy, or disability. State law also prohibits public accommodation (such as access to services or physical facilities) discrimination on the basis of race, color, creed, religion, sex, sexual orientation, gender identity, religion, national origin, or disability. If you believe you have been discriminated against in any program, activity or facility as described above, or if you desire further information, please contact the Iowa Civil Rights Commission, 1-800-457-4416, or write to the Iowa Department of Natural Resources, Wallace State Office Bldg., 502 E. 9th St., Des Moines, IA 50319.

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