

# Lake Park, IA



2018 Urban Forest Management Plan  
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# Executive Summary

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## Overview

This plan was developed to assist the City of Lake Park 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 41% of Lake Park'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 2017, 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 623 trees inventoried.

- Lake Park's trees provide \$125,521 of benefits annually, an average of \$201 a tree
- There are over 31 species of trees
- The top three genera are: Ash 41%, Maple 25%, and Oak 14%
- 13% of trees are in need of some type of management
- 42 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 42 trees needing removal, 19 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\\*](#)
- 26 of the 256 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 or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 84 years to remove ash – Suggestion: request a budget increase to \$10,000 annually and apply for grants to plant replacement trees

# Introduction

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This plan was developed to assist Lake Park 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 or treatment and replacement planting. With proper planning and management of the current canopy in Lake Park, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

# Inventory

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In 2017, 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 623 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. The following are results from the i-Tree STREETS analysis.

## Annual Benefits

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### Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Lake Park's trees reduce energy related costs by approximately \$32,799 annually (Appendix A, Table 1). These savings are both in Electricity (156.4 MWh) and in Natural Gas (21,352.0 Therms).

### Annual Stormwater Benefits

Lake Park's trees intercept about 1,801,808 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides \$48,829 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 Lake Park, it is estimated that trees remove 1,370 lbs of air pollution (ozone (O<sub>3</sub>), particulate matter less than 10 microns (PM<sub>10</sub>), carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>)) per year with a net value of \$5,758 (Appendix A, Table 3).

### Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Lake Park, trees sequester about 389,702 lbs of carbon a year with an associated value of \$4,635 (Appendix A, Table 5). In addition, the trees store 6,766,576 lbs of carbon, with a yearly benefit of \$50,749 (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. Lake Park receives \$33,499 in annual social benefits from trees (Appendix A, Table 6).

### Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STREETS analysis, Lake Park's trees provide \$125,521 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 623 trees in Lake Park provide approximately \$201 annually (Appendix A, Table 7).

## Forest Structure

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### Species Distribution

Lake Park has over 31 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Ash	256	41%
Maple	153	25%

Oak	85	14%
Spruce	27	4%
Hackberry	24	4%
Walnut	15	2%
Cottonwood	15	2%
Linden	12	2%
Honeylocust	11	2%
Cedar	8	1%
Buckeye	3	<1%
Other	3	<1%
Apple (crabapple)	3	<1%
Arborvitae	3	<1%
Birch	1	<1%
Pine	1	<1%
Cherry	1	<1%
Willow	1	<1%
Elm	1	<1%

**Age Class**

Most of Lake Park’s trees (39%) are between 24 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. Lake Park’s size curve is on the Larger side, indicating an 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 Lake Park indicate that 93% of the trees are in good health, with only 1% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Also, 22% of Lake Park’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 16% of the population. This 16% 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	32	5%
Crown Raising	0	0%
Tree Staking	0	0%
Tree Removal	42	7%
Crown Reduction	1	<1%

## Canopy Cover

The total canopy with both private and public trees is 12%, 124 acres. The canopy cover included in the Lake Park inventory includes approximately 18 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 75 trees need to be planted annually on public and private lands.

## Land Use and Location

The majority of Lake Park'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.

<u>Land Use</u>	
Single family residential	47%
Park/vacant/other	52%
Industrial/Large commercial	0%
Small commercial	0%
Multifamily residential	0%

<u>Location</u>	
Planting strip	31%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	69%

## 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

Lake Park has 8 critical concern trees 6 that need immediate removal and 2 that need trimming. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is recommended to start with the large diameter critical concern trees first. There are 18 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 49 trees with these needs.

### Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 42 removals, 21 are ash trees. There are a total of 256 ash trees, and 26 of those have signs and symptoms that have been associated with EAB. In



addition, there are 51 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 Lake Park.

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 (25%) (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 or black walnut. All trees planted must meet the restrictions in city ordinance.

### **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.

### **Six Year Maintenance Plan with No Additional Funding**

#### **Year 1**

- Removal: 4 largest and critical concern trees
- Planting and Replacement: 5 trees to be planted in open locations
- Young Tree Pruning & Maintenance:
- Visual Survey for signs and symptoms of EAB

#### **Year 2**

- Removal: 3 trees with poor health
- \*Or saving for ash tree treatment and/or future ash removal

Planting and Replacement: 5 trees in open locations from year one removals  
Young Tree Pruning & Maintenance:  
Routine trimming: Contract to trim 1/3 of the city trees  
Visual Survey for signs and symptoms of EAB

#### Year 3

Removal: 4 trees - removal of any new critical concern trees in poor health  
\*Or saving for ash tree treatment and/or future ash removal  
Planting and Replacement: 5 trees to be planted in open locations and locations from previous removals  
Young Tree Pruning & Maintenance:  
Visual Survey for signs and symptoms of EAB

#### Year 4

Removal: 3 trees with poor health  
\*Or saving for ash tree treatment and/or future ash removal  
Planting and Replacement: 5 trees in open locations from year one removals  
Young Tree Pruning & Maintenance:  
Routine trimming: Contract to trim 1/3 of the city trees  
Visual Survey for signs and symptoms of EAB

#### Year 5

Removal: 4 trees - removal of any new critical concern trees in poor health  
\*Or saving for ash tree treatment and/or future ash removal  
Planting and Replacement: 5 trees to be planted in open locations and locations from previous removals  
Young Tree Pruning & Maintenance:  
Visual Survey for signs and symptoms of EAB

#### Year 6

Removal: 3 trees with poor health  
\*Or saving for ash tree treatment and/or future ash removal  
Planting and Replacement: 5 trees in open locations from year one removals  
Young Tree Pruning & Maintenance:  
Routine trimming: Contract to trim 1/3 of the city trees  
Visual Survey for signs and symptoms of EAB

\*Reduction of ash over 6 years: Approximately 15 ash trees removed (approximately 6% of ash). It will take approximately 84 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 \$42,000 a year. If the budget were increased to \$10,000 a year all ash could be removed in 18 years.

## 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. The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

## **Postponed Work**

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on 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 if preventative treatments are not being used.

# **Budget**

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## **Current Budget**

Total \$24,000 over 6 years (\$4,000/year)

## **FY 2018 Budget**

Removal: \$3,200

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$500

Watering & Maintenance: \$300

## **FY 2019 Budget**

Removal: \$2,400

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$900

Watering & Maintenance: \$300

## **FY 2020 Budget**

Removal: \$3,200

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$500

Watering & Maintenance: \$300

## **FY 2021 Budget**

Removal: \$2,400

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$900

Watering & Maintenance: \$300

## **FY 2022 Budget**

Removal: \$3,200

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$500

Watering & Maintenance: \$300

## **FY 2023 Budget**

Removal: \$2,400

\*Or saving for ash tree treatment and/or future ash removal

Planting: \$400

Routine trimming: \$900

Watering & Maintenance: \$300

**\*Reduction of ash over 6 years: approximately 15 ash trees removed (approximately 6% of ash). It will take approximately 84 years to remove all ash with the current budget.**

### Purposed Budget Increase

EAB could potentially kill all ash trees in Lake Park within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to \$14,000 a year. If the budget were increased to \$10,000 a year all ash could be removed within 18 years. Additionally, it is recommended that Lake Park 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 Lake Park would still need to find \$198,400 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately \$2,250 a year for treatment and leave \$192,800 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 Lake Park. It is suggested to consider increasing the budget to plan for this.

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# Appendix A: i-Tree Data

**Table 1: Annual Energy Benefits**

**Lake Park**

**Annual Energy Benefits of Public Trees**

3/29/2018

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	66.9	5,080	9,144.3	8,961	14,042	(N/A)	40.8	42.8	55.28
Bur oak	22.5	1,705	3,036.2	2,975	4,681	(N/A)	13.0	14.3	57.79
Silver maple	24.7	1,875	3,261.0	3,196	5,071	(N/A)	11.7	15.5	69.47
Norway maple	8.7	663	1,258.6	1,233	1,897	(N/A)	7.1	5.8	43.11
Northern hackberry	8.3	629	1,176.8	1,153	1,783	(N/A)	3.9	5.4	74.28
Maple	0.3	26	52.9	52	78	(N/A)	3.2	0.2	3.91
Black walnut	4.5	345	629.1	617	961	(N/A)	2.4	2.9	64.08
Blue spruce	1.2	92	163.7	160	252	(N/A)	2.3	0.8	18.02
Eastern cottonwood	5.4	411	750.0	735	1,146	(N/A)	2.3	3.5	81.87
Honeylocust	3.8	288	494.3	484	773	(N/A)	1.8	2.4	70.25
American basswood	2.7	203	363.1	356	559	(N/A)	1.8	1.7	50.78
Sugar maple	1.7	131	230.9	226	358	(N/A)	1.6	1.1	35.78
Eastern red cedar	0.9	68	131.5	129	197	(N/A)	1.3	0.6	24.57
Spruce	0.2	11	18.6	18	30	(N/A)	1.1	0.1	4.24
Norway spruce	0.6	42	72.4	71	113	(N/A)	1.0	0.3	18.86
Red maple	0.3	20	40.5	40	60	(N/A)	1.0	0.2	10.02
Ohio buckeye	0.7	54	88.5	87	140	(N/A)	0.5	0.4	46.78
Northern red oak	0.5	36	68.2	67	103	(N/A)	0.5	0.3	34.39
Northern white cedar	0.1	5	11.9	12	17	(N/A)	0.5	0.1	5.61
Apple	0.2	17	32.3	32	49	(N/A)	0.5	0.1	16.31
Conifer Evergreen Large	0.2	18	34.1	33	52	(N/A)	0.3	0.2	25.88
White ash	0.2	14	26.7	26	40	(N/A)	0.3	0.1	20.10
Cottonwood	0.3	25	46.9	46	71	(N/A)	0.2	0.2	70.91
Willow	0.3	20	39.6	39	59	(N/A)	0.2	0.2	58.69
Paper birch	0.1	7	13.7	13	21	(N/A)	0.2	0.1	20.64
Black cherry	0.2	15	31.6	31	46	(N/A)	0.2	0.1	46.14
Littleleaf linden	0.2	17	33.8	33	50	(N/A)	0.2	0.2	50.34
Scotch pine	0.1	4	9.5	9	14	(N/A)	0.2	0.0	13.58
American elm	0.4	29	52.8	52	80	(N/A)	0.2	0.2	80.37
Pin oak	0.3	21	38.4	38	58	(N/A)	0.2	0.2	58.37
UNKNOWN	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
<b>Total</b>	<b>156.4</b>	<b>11,874</b>	<b>21,352.0</b>	<b>20,925</b>	<b>32,799</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>52.73</b>

**Table 2: Annual Stormwater Benefits**

**Lake Park**

**Annual Stormwater Benefits of Public Trees**

3/29/2018

Species	Total rainfall interception (Gal)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	737,548	19,988	(N/A)	40.8	40.9	78.69
Bur oak	241,840	6,554	(N/A)	13.0	13.4	80.91
Silver maple	372,253	10,088	(N/A)	11.7	20.7	138.19
Norway maple	73,689	1,997	(N/A)	7.1	4.1	45.39
Northern hackberry	79,063	2,143	(N/A)	3.9	4.4	89.28
Maple	1,475	40	(N/A)	3.2	0.1	2.00
Black walnut	53,183	1,441	(N/A)	2.4	3.0	96.08
Blue spruce	14,592	395	(N/A)	2.3	0.8	28.25
Eastern cottonwood	77,068	2,089	(N/A)	2.3	4.3	149.18
Honeylocust	47,475	1,287	(N/A)	1.8	2.6	116.96
American basswood	25,531	692	(N/A)	1.8	1.4	62.90
Sugar maple	20,059	544	(N/A)	1.6	1.1	54.36
Eastern red cedar	13,076	354	(N/A)	1.3	0.7	44.30
Spruce	1,831	50	(N/A)	1.1	0.1	7.09
Norway spruce	6,402	174	(N/A)	1.0	0.4	28.92
Red maple	1,423	39	(N/A)	1.0	0.1	6.43
Ohio buckeye	4,227	115	(N/A)	0.5	0.2	38.19
Northern red oak	5,088	138	(N/A)	0.5	0.3	45.96
Northern white cedar	638	17	(N/A)	0.5	0.0	5.77
Apple	804	22	(N/A)	0.5	0.0	7.26
Conifer Evergreen Large	5,200	141	(N/A)	0.3	0.3	70.46
White ash	1,227	33	(N/A)	0.3	0.1	16.63
Cottonwood	3,943	107	(N/A)	0.2	0.2	106.85
Willow	2,479	67	(N/A)	0.2	0.1	67.19
Paper birch	608	16	(N/A)	0.2	0.0	16.47
Black cherry	1,174	32	(N/A)	0.2	0.1	31.82
Littleleaf linden	2,366	64	(N/A)	0.2	0.1	64.13
Scotch pine	596	16	(N/A)	0.2	0.0	16.14
American elm	4,551	123	(N/A)	0.2	0.3	123.33
Pin oak	2,397	65	(N/A)	0.2	0.1	64.95
UNKNOWN	0	0	(N/A)	0.0	0.0	0.00
Citywide total	1,801,808	48,829	(N/A)	100.0	100.0	78.50



**Table 3: Annual Air Quality Benefits**

Lake Park

**Annual Air Quality Benefits of Public Trees**

3/29/2018

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 <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	90.2	14.4	43.3	4.0	481	319.4	46.5	44.4	303.3	1,990	0.0	0	865.6	2,471 (N/A)	40.8	9.73
Bur oak	29.3	4.7	14.1	1.3	156	106.9	15.6	14.9	101.8	667	0.0	0	288.6	823 (N/A)	13.0	10.16
Silver maple	64.4	10.9	31.5	2.9	347	116.5	17.1	16.3	111.7	729	-32.4	-122	338.8	954 (N/A)	11.7	13.07
Norway maple	14.0	2.4	7.0	0.6	76	42.4	6.1	5.8	39.7	262	-3.4	-13	114.7	326 (N/A)	7.1	7.41
Northern hackberry	12.2	2.1	6.2	0.5	67	40.0	5.8	5.5	37.6	248	0.0	0	110.0	315 (N/A)	3.9	13.12
Maple	0.1	0.0	0.1	0.0	1	1.7	0.2	0.2	1.6	10	-0.1	0	3.9	11 (N/A)	3.2	0.55
Black walnut	6.8	1.1	3.2	0.3	36	21.7	3.2	3.0	20.6	135	0.0	0	59.8	171 (N/A)	2.4	11.41
Blue spruce	1.6	0.3	1.5	0.2	11	5.7	0.8	0.8	5.5	36	-5.0	-19	11.5	28 (N/A)	2.3	2.02
Eastern cottonwood	11.2	1.8	5.0	0.5	59	25.9	3.8	3.6	24.5	161	0.0	0	76.4	220 (N/A)	2.3	15.72
Honeylocust	9.5	1.6	4.3	0.4	50	17.9	2.6	2.5	17.2	112	-7.6	-29	48.2	133 (N/A)	1.8	12.09
American basswood	3.3	0.6	1.7	0.1	18	12.8	1.9	1.8	12.1	79	-2.9	-11	31.3	87 (N/A)	1.8	7.87
Sugar maple	2.7	0.5	1.4	0.1	15	8.2	1.2	1.1	7.8	51	-2.2	-8	20.9	58 (N/A)	1.6	5.80
Eastern red cedar	2.7	0.5	2.2	0.3	18	4.3	0.6	0.6	4.0	27	-7.2	-27	8.1	17 (N/A)	1.3	2.19
Spruce	0.2	0.0	0.2	0.0	1	0.7	0.1	0.1	0.7	4	-0.7	-2	1.3	3 (N/A)	1.1	0.45
Norway spruce	0.7	0.1	0.6	0.1	5	2.6	0.4	0.4	2.5	16	-2.1	-8	5.2	13 (N/A)	1.0	2.15
Red maple	0.2	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	-0.1	0	3.1	9 (N/A)	1.0	1.46
Ohio buckeye	0.7	0.1	0.3	0.0	4	3.3	0.5	0.5	3.2	21	-0.2	-1	8.4	24 (N/A)	0.5	7.92
Northern red oak	1.1	0.2	0.5	0.0	6	2.3	0.3	0.3	2.2	14	-1.6	-6	5.4	14 (N/A)	0.5	4.79
Northern white cedar	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	2 (N/A)	0.5	0.56
Apple	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.0	7	0.0	0	2.8	8 (N/A)	0.5	2.66
Conifer Evergreen Large	0.6	0.1	0.5	0.1	4	1.2	0.2	0.2	1.1	7	-3.0	-11	0.9	0 (N/A)	0.3	-0.05
White ash	0.0	0.0	0.0	0.0	0	0.9	0.1	0.1	0.8	6	0.0	0	2.1	6 (N/A)	0.3	2.91
Cottonwood	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)	0.2	12.48
Willow	0.5	0.1	0.2	0.0	3	1.3	0.2	0.2	1.2	8	-0.1	0	3.6	10 (N/A)	0.2	10.16
Paper birch	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3 (N/A)	0.2	2.99
Black cherry	0.4	0.1	0.2	0.0	2	1.0	0.1	0.1	0.9	6	0.0	0	2.9	8 (N/A)	0.2	8.35
Littleleaf linden	0.4	0.1	0.2	0.0	2	1.1	0.2	0.2	1.0	7	-0.2	-1	2.9	8 (N/A)	0.2	8.23
Scotch pine	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1 (N/A)	0.2	1.48
American elm	0.5	0.1	0.3	0.0	3	1.8	0.3	0.3	1.7	11	0.0	0	4.9	14 (N/A)	0.2	14.10
Pin oak	0.3	0.1	0.2	0.0	2	1.3	0.2	0.2	1.2	8	-0.7	-3	2.9	8 (N/A)	0.2	7.54
UNKNOWN	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0 (N/A)	0.0	0.00
Citywide total	254.4	42.0	125.2	11.8	1,370	746.1	108.7	103.6	708.9	4,649	-69.7	-261	2,031.0	5,758 (N/A)	100.0	9.26

**Table 4: Annual Carbon Stored**

**Lake Park**

**Stored CO2 Benefits of Public Trees**

3/29/2018

Species	Total Stored CO2 (lbs)	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	2,939,508	22,046	(N/A)	40.8	43.4	86.80
Bur oak	951,926	7,139	(N/A)	13.0	14.1	88.14
Silver maple	1,410,420	10,578	(N/A)	11.7	20.8	144.91
Norway maple	233,129	1,748	(N/A)	7.1	3.4	39.74
Northern hackberry	181,846	1,364	(N/A)	3.9	2.7	56.83
Maple	2,429	18	(N/A)	3.2	0.0	0.91
Black walnut	219,243	1,644	(N/A)	2.4	3.2	109.62
Blue spruce	8,701	65	(N/A)	2.3	0.1	4.66
Eastern cottonwood	366,349	2,748	(N/A)	2.3	5.4	196.26
Honeylocust	123,356	925	(N/A)	1.8	1.8	84.11
American basswood	121,943	915	(N/A)	1.8	1.8	83.14
Sugar maple	82,875	622	(N/A)	1.6	1.2	62.16
Eastern red cedar	8,817	66	(N/A)	1.3	0.1	8.27
Spruce	1,185	9	(N/A)	1.1	0.0	1.27
Norway spruce	4,281	32	(N/A)	1.0	0.1	5.35
Red maple	2,470	19	(N/A)	1.0	0.0	3.09
Ohio buckeye	10,872	82	(N/A)	0.5	0.2	27.18
Northern red oak	23,469	176	(N/A)	0.5	0.3	58.67
Northern white cedar	115	1	(N/A)	0.5	0.0	0.29
Apple	3,393	25	(N/A)	0.5	0.1	8.48
Conifer Evergreen La	7,747	58	(N/A)	0.3	0.1	29.05
White ash	2,069	16	(N/A)	0.3	0.0	7.76
Cottonwood	15,773	118	(N/A)	0.2	0.2	118.30
Willow	7,945	60	(N/A)	0.2	0.1	59.59
Paper birch	1,035	8	(N/A)	0.2	0.0	7.76
Black cherry	6,743	51	(N/A)	0.2	0.1	50.57
Littleleaf linden	8,218	62	(N/A)	0.2	0.1	61.63
Scotch pine	257	2	(N/A)	0.2	0.0	1.93
American elm	12,245	92	(N/A)	0.2	0.2	91.84
Pin oak	8,218	62	(N/A)	0.2	0.1	61.63
UNKNOWN	0	0	(N/A)	0.0	0.0	0.00
<b>Citywide total</b>	<b>6,766,576</b>	<b>50,749</b>	<b>(N/A)</b>	<b>100.0</b>	<b>100.0</b>	<b>81.59</b>

**Table 5: Annual Carbon Sequestered**

Lake Park

**Annual CO Benefits of Public Trees**

3/29/2018

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
Green ash	159,687	1,198	-14,110	-700	-111	112,270	842	257,147	1,929 (N/A)	40.8	41.6	7.59
Bur oak	53,179	399	-4,569	-230	-36	37,685	283	86,064	645 (N/A)	13.0	13.9	7.97
Silver maple	104,610	785	-6,771	-276	-53	41,443	311	139,006	1,043 (N/A)	11.7	22.5	14.28
Norway maple	13,377	100	-1,119	-90	-9	14,658	110	26,825	201 (N/A)	7.1	4.3	4.57
Northern hackberry	10,402	78	-873	-77	-7	13,910	104	23,362	175 (N/A)	3.9	3.8	7.30
Maple	398	3	-12	-7	0	583	4	962	7 (N/A)	3.2	0.2	0.36
Black walnut	11,107	83	-1,052	-48	-8	7,617	57	17,623	132 (N/A)	2.4	2.9	8.81
Blue spruce	816	6	-42	-20	0	2,031	15	2,785	21 (N/A)	2.3	0.5	1.49
Eastern cottonwood	13,284	100	-1,758	-60	-14	9,087	68	20,552	154 (N/A)	2.3	3.3	11.01
Honeylocust	3,173	24	-592	-28	-5	6,371	48	8,923	67 (N/A)	1.8	1.4	6.08
American basswood	7,448	56	-585	-29	-5	4,478	34	11,312	85 (N/A)	1.8	1.8	7.71
Sugar maple	4,027	30	-400	-20	-3	2,906	22	6,513	49 (N/A)	1.6	1.1	4.88
Eastern red cedar	0	0	-42	-16	0	1,495	11	1,437	11 (N/A)	1.3	0.2	1.35
Spruce	137	1	-6	-3	0	253	2	381	3 (N/A)	1.1	0.1	0.41
Norway spruce	505	4	-21	-9	0	933	7	1,407	11 (N/A)	1.0	0.2	1.76
Red maple	378	3	-12	-4	0	452	3	814	6 (N/A)	1.0	0.1	1.02
Ohio buckeye	1,158	9	-52	-6	0	1,185	9	2,285	17 (N/A)	0.5	0.4	5.71
Northern red oak	757	6	-113	-6	-1	803	6	1,441	11 (N/A)	0.5	0.2	3.60
Northern white cedar	54	0	-1	-2	0	113	1	165	1 (N/A)	0.5	0.0	0.41
Apple	344	3	-16	-3	0	383	3	707	5 (N/A)	0.5	0.1	1.77
Conifer Evergreen Large	309	2	-37	-5	0	405	3	672	5 (N/A)	0.3	0.1	2.52
White ash	364	3	-10	-2	0	311	2	663	5 (N/A)	0.3	0.1	2.49
Cottonwood	857	6	-76	-4	-1	552	4	1,330	10 (N/A)	0.2	0.2	9.97
Willow	470	4	-38	-3	0	440	3	869	7 (N/A)	0.2	0.1	6.52
Paper birch	209	2	-5	-1	0	159	1	361	3 (N/A)	0.2	0.1	2.71
Black cherry	478	4	-32	-3	0	335	3	778	6 (N/A)	0.2	0.1	5.84
Littleleaf linden	789	6	-39	-3	0	380	3	1,127	8 (N/A)	0.2	0.2	8.45
Scotch pine	53	0	-1	-1	0	94	1	145	1 (N/A)	0.2	0.0	1.08
American elm	454	3	-59	-4	0	632	5	1,023	8 (N/A)	0.2	0.2	7.68
Pin oak	880	7	-39	-3	0	458	3	1,296	10 (N/A)	0.2	0.2	9.72
UNKNOWN	0	0	0	0	0	0	0	0	0 (N/A)	0.0	0.0	0.00
Citywide total	389,702	2,923	-32,484	-1,662	-256	262,420	1,968	617,977	4,635 (N/A)	100.0	100.0	7.45

**Table 6: Annual Social and Aesthetic Benefits**

**Lake Park**

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

3/29/2018

Species	Total (\$)	Standard Error	% of Total Trees	% of Total \$	Avg. \$/tree
Green ash	13,315	(N/A)	40.8	39.7	52.42
Bur oak	4,424	(N/A)	13.0	13.2	54.62
Silver maple	8,073	(N/A)	11.7	24.1	110.59
Norway maple	1,339	(N/A)	7.1	4.0	30.44
Northern hackberry	1,393	(N/A)	3.9	4.2	58.04
Maple	67	(N/A)	3.2	0.2	3.34
Black walnut	881	(N/A)	2.4	2.6	58.72
Blue spruce	304	(N/A)	2.3	0.9	21.71
Eastern cottonwood	923	(N/A)	2.3	2.8	65.94
Honeylocust	809	(N/A)	1.8	2.4	73.57
American basswood	548	(N/A)	1.8	1.6	49.82
Sugar maple	417	(N/A)	1.6	1.2	41.66
Eastern red cedar	0	(N/A)	1.3	0.0	0.00
Spruce	67	(N/A)	1.1	0.2	9.55
Norway spruce	143	(N/A)	1.0	0.4	23.87
Red maple	67	(N/A)	1.0	0.2	11.18
Ohio buckeye	117	(N/A)	0.5	0.4	39.16
Northern red oak	53	(N/A)	0.5	0.2	17.62
Northern white cedar	21	(N/A)	0.5	0.1	6.83
Apple	20	(N/A)	0.5	0.1	6.53
Conifer Evergreen Large	42	(N/A)	0.3	0.1	20.84
White ash	67	(N/A)	0.3	0.2	33.42
Cottonwood	66	(N/A)	0.2	0.2	65.59
Willow	43	(N/A)	0.2	0.1	43.05
Paper birch	29	(N/A)	0.2	0.1	28.56
Black cherry	29	(N/A)	0.2	0.1	28.80
Littleleaf linden	81	(N/A)	0.2	0.2	81.48
Scotch pine	15	(N/A)	0.2	0.0	15.42
American elm	64	(N/A)	0.2	0.2	64.36
Pin oak	83	(N/A)	0.2	0.2	83.10
UNKNOWN	0	(N/A)	0.0	0.0	0.00
Citywide total	33,499	(N/A)	100.0	100.0	53.86

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

**Lake Park**

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

3/29/2018

Species	Energy	CO <sub>2</sub>	Air Quality	Stormwater	Aesthetic/Other	Total (\$)	Standard Error	% of Total \$
Green ash	14,042	1,929	2,471	19,988	13,315	51,743	(N/A)	41.2
Bur oak	4,681	645	823	6,554	4,424	17,127	(N/A)	13.6
Silver maple	5,071	1,043	954	10,088	8,073	25,229	(N/A)	20.1
Norway maple	1,897	201	326	1,997	1,339	5,760	(N/A)	4.6
Northern hackberry	1,783	175	315	2,143	1,393	5,808	(N/A)	4.6
Maple	78	7	11	40	67	203	(N/A)	0.2
Black walnut	961	132	171	1,441	881	3,587	(N/A)	2.9
Blue spruce	252	21	28	395	304	1,001	(N/A)	0.8
Eastern cottonwood	1,146	154	220	2,089	923	4,532	(N/A)	3.6
Honeylocust	773	67	133	1,287	809	3,069	(N/A)	2.4
American basswood	559	85	87	692	548	1,970	(N/A)	1.6
Sugar maple	358	49	58	544	417	1,425	(N/A)	1.1
Eastern red cedar	197	11	17	354	0	579	(N/A)	0.5
Spruce	30	3	3	50	67	152	(N/A)	0.1
Norway spruce	113	11	13	174	143	453	(N/A)	0.4
Red maple	60	6	9	39	67	181	(N/A)	0.1
Ohio buckeye	140	17	24	115	117	413	(N/A)	0.3
Northern red oak	103	11	14	138	53	319	(N/A)	0.3
Northern white cedar	17	1	2	17	21	58	(N/A)	0.0
Apple	49	5	8	22	20	104	(N/A)	0.1
Conifer Evergreen Large	52	5	0	141	42	239	(N/A)	0.2
White ash	40	5	6	33	67	151	(N/A)	0.1
Cottonwood	71	10	12	107	66	266	(N/A)	0.2
Willow	59	7	10	67	43	186	(N/A)	0.1
Paper birch	21	3	3	16	29	71	(N/A)	0.1
Black cherry	46	6	8	32	29	121	(N/A)	0.1
Littleleaf linden	50	8	8	64	81	213	(N/A)	0.2
Scotch pine	14	1	1	16	15	48	(N/A)	0.0
American elm	80	8	14	123	64	290	(N/A)	0.2
Pin oak	58	10	8	65	83	224	(N/A)	0.2
UNKNOWN	0	0	0	0	0	0	(N/A)	0.0
<b>Citywide Total</b>	<b>32,799</b>	<b>4,635</b>	<b>5,758</b>	<b>48,829</b>	<b>33,499</b>	<b>125,521</b>	<b>(N/A)</b>	<b>100.0</b>

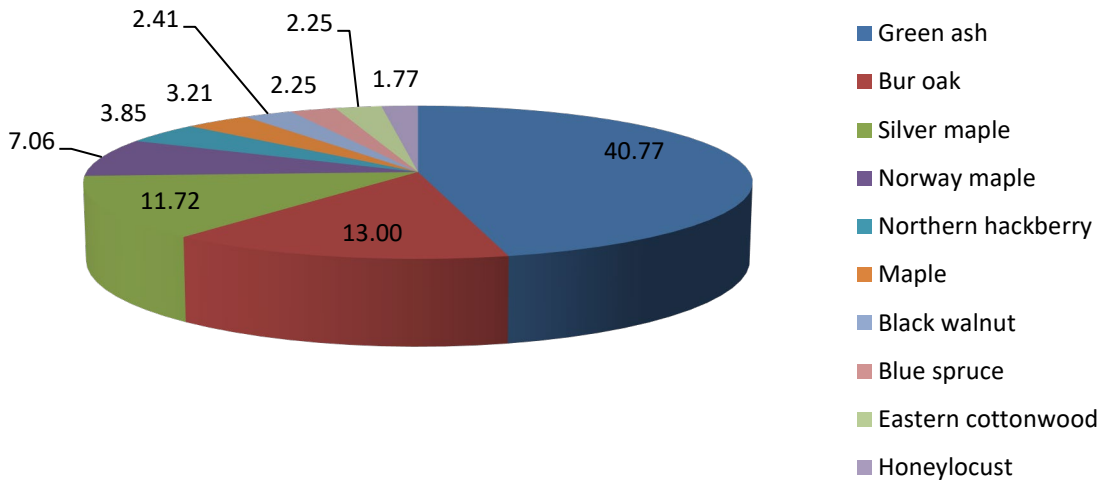


Figure 1: Species Distribution

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

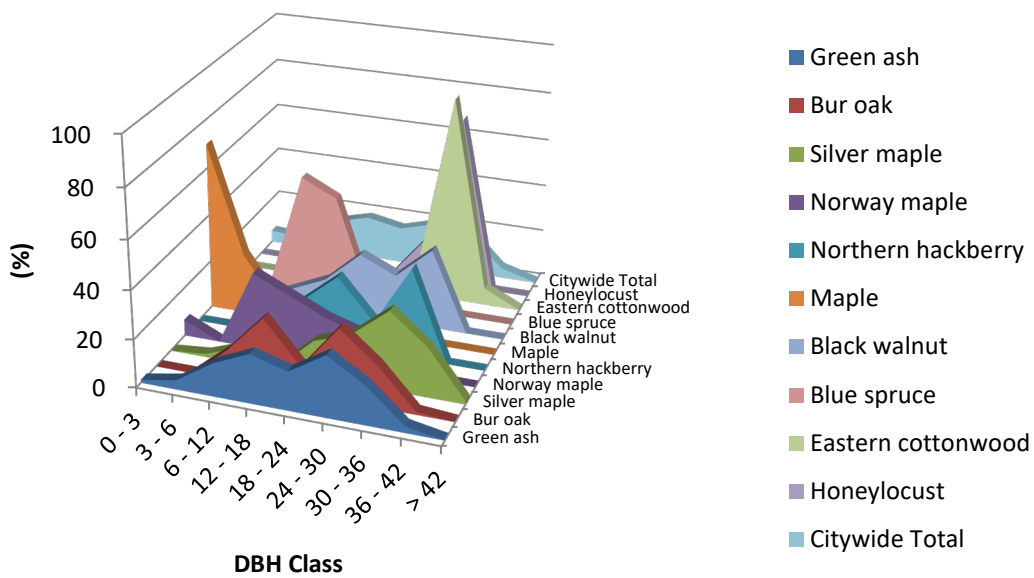
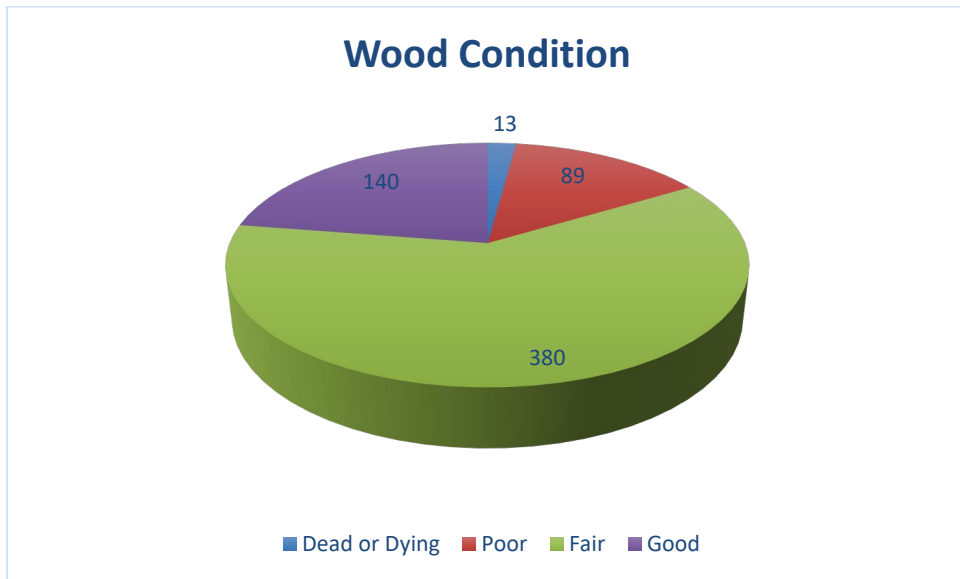


Figure 2: Relative Age Class



**Figure 3: Foliage Condition**



**Figure 4: Wood Condition**

# Canopy Cover of Public Trees (Acres)

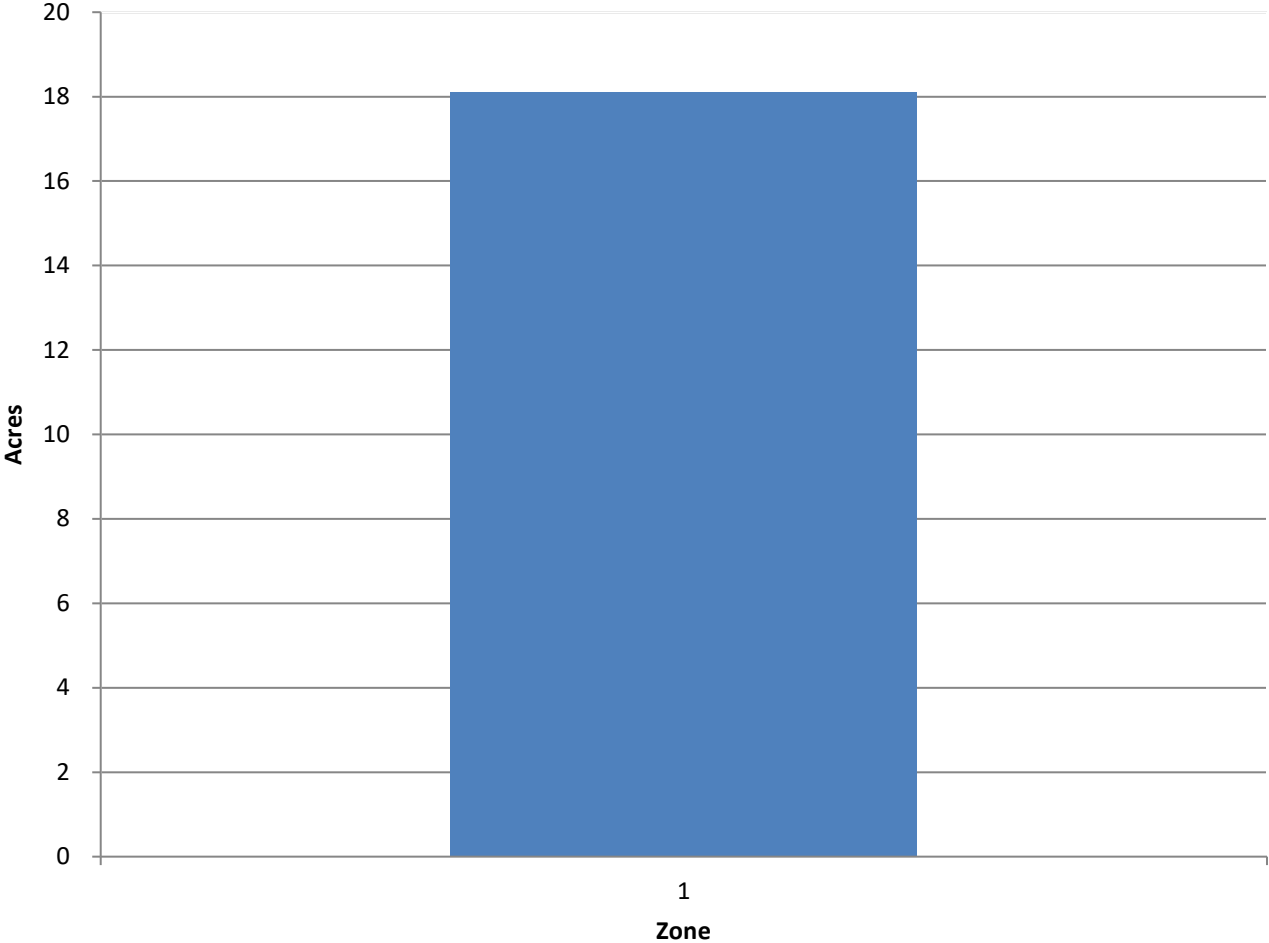
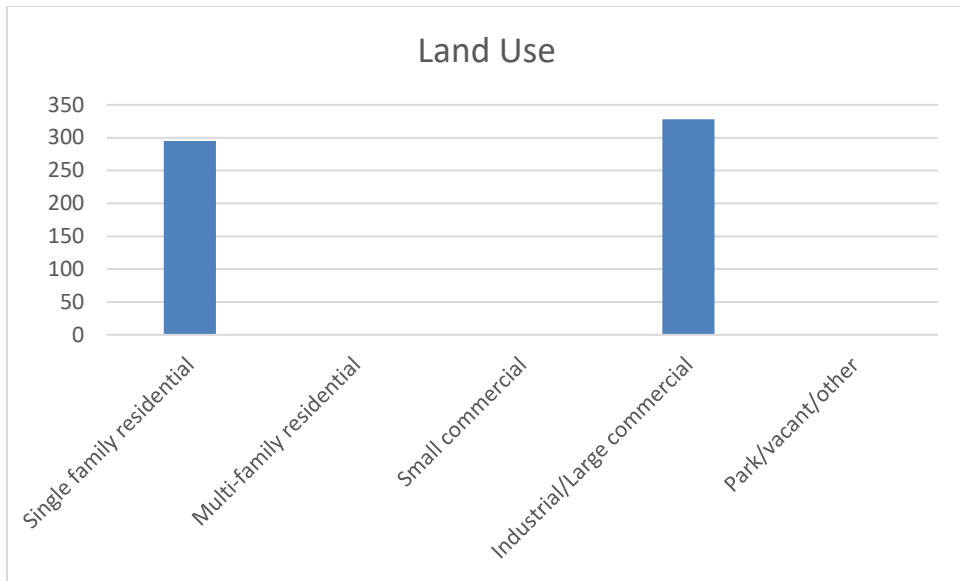
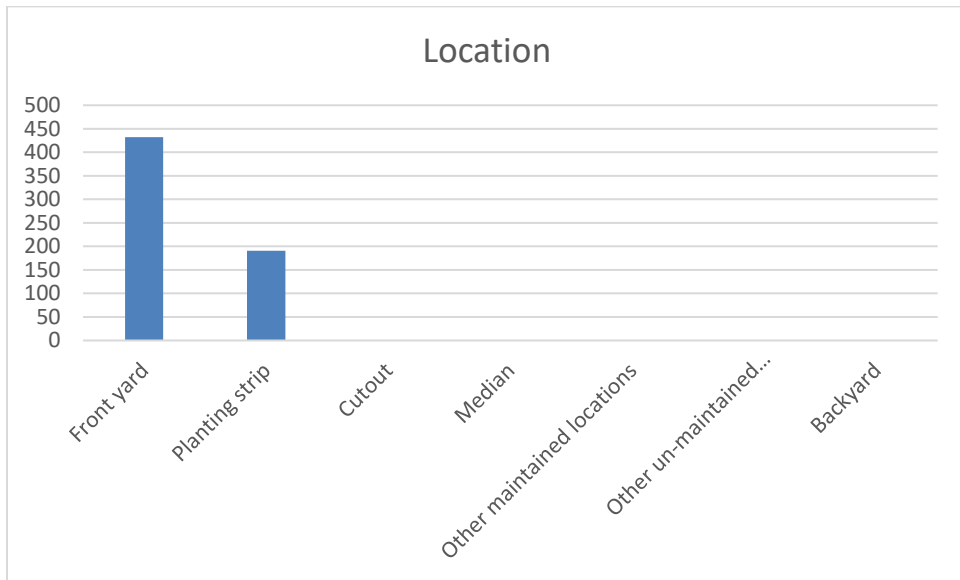


Figure 5: Canopy Cover in Acres





**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



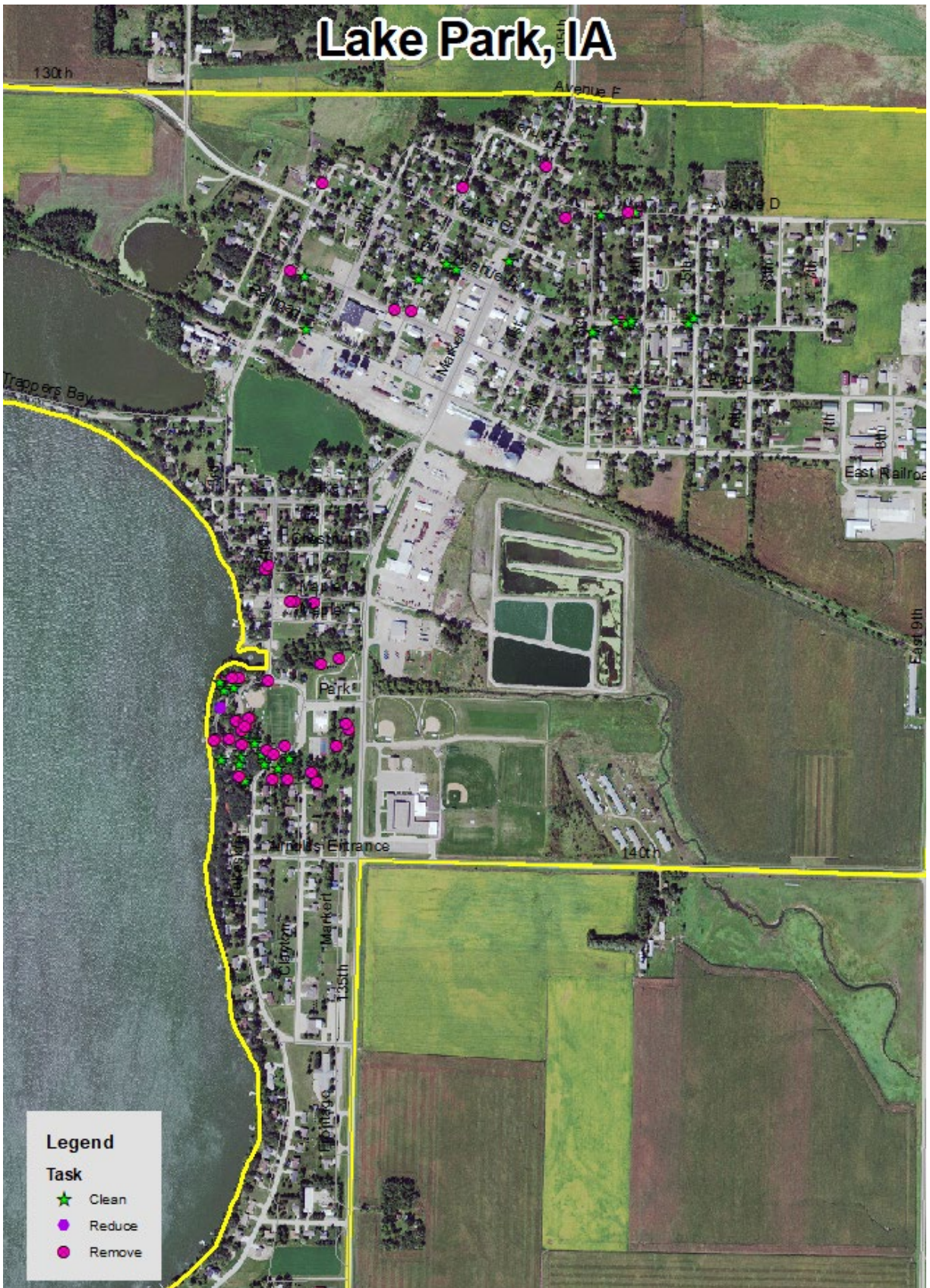


Figure 5: Maintenance Tasks \*City ownership of the trees recommended for removal should be verified prior to any removal\*

# Appendix C: Lake Park Tree Ordinances

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## CHAPTER 142

## TREES — GENERAL PROVISIONS

**142.06 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.

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



TITLE V - BUILDING AND PROPERTY REGULATIONS  
MISCELLANEOUS

CHAPTER 143  
TREES - DUTCH ELM DISEASE CONTROL

143.01 Trees Subject to Removal  
143.02 Duty to Remove  
143.03 Inspection

143.04 Removal from City Property  
143.05 Removal from Private Property

143.01 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, 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.

143.02 DUTY TO REMOVE. No person or entity shall permit any tree or material as defined in Section 143.01 to remain on the premises owned, controlled or occupied by such person or entity within the City.  
(Code of Iowa, Sec. 364.12[3b])

143.03 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 143.01 exists thereon, and also shall inspect or cause to be inspected any elm trees reported or suspected to be infected with the Dutch Elm Disease or any elm bark bearing material reported or suspected to be infected with the elm bark beetles.

143.04 REMOVAL FROM CITY PROPERTY. If the superintendent, upon inspection or examination, determines that any condition as herein defined exists in or upon any public street, alley, park

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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 9<sup>th</sup> 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.