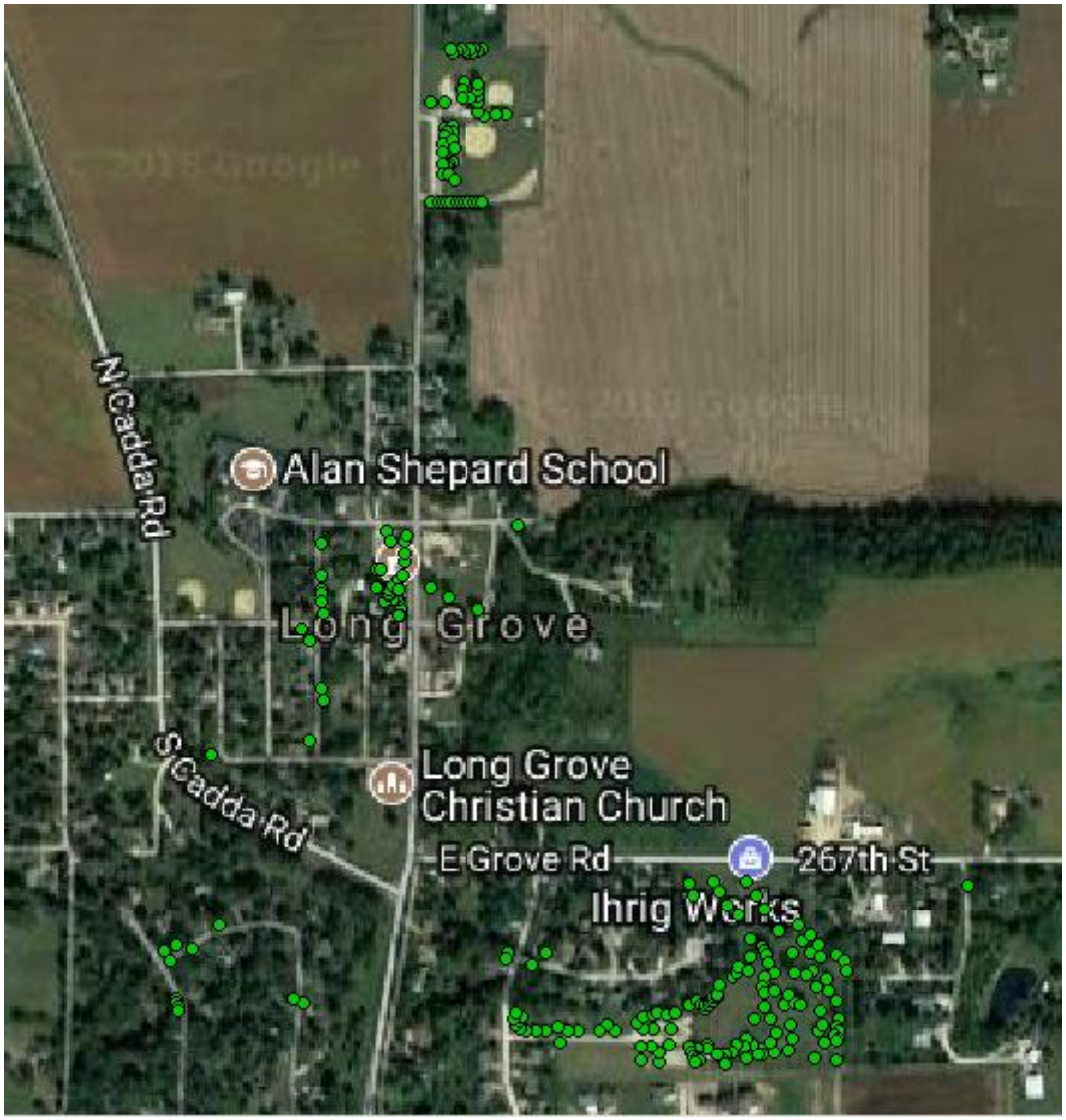
Community Tree Management Plan for Long Grove, IA



2017 Urban Forest Management Plan
Prepared by ArborPro, Inc.
In Partnership with the Iowa DNR

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Executive Summary

Overview

This plan was developed to assist the City of Long Grove 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 8.66% of Long Grove's community, unless preventative treatment is used, will become infested and die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 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 242 trees inventoried.

- Essex's trees provide $8,052 of benefits annually, an average of $34 a tree
- There are over 41 species of trees
- The top three genera are: Maple 26.03%, Oak 20.42%, and Ash 8.67%
- 71.48% of trees need some type of management or mitigation.
- 15 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 14 trees needing removal, 5 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*
- 8 of the 33 ash trees should be carefully examined, as they present with some of the 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, Bradford Pear, female Ginko, Chinese Elm, Scot's Pine, Austrian Pine, Willow or Black Walnut.
- Check ash trees with a visual survey yearly

With the current budget it could take 24 years to remove ash – Suggestion: request a budget increase to $10,000 annually and apply for grants to plant replacement trees

Introduction

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

Trees are an important component of Long Grove'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 Essex 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 Long Grove's urban forestry goals.

Inventory

In 2017, a tree inventory was conducted that included 100% of the city owned street trees and park trees. The tree data was collected using a hand held Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 242 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. Long Grove's trees reduce energy related costs by approximately $8,052 annually (Appendix A, Table 1). These savings are both in Electricity (38.23 MWh) and in Natural Gas (5,256.20 Therms).

Annual Stormwater Benefits

Long Grove's trees intercept about 368,025 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $9,973 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 Essex it is estimated that trees remove 58.92 lbs of air pollution (ozone (O_3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $1,345 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Long Grove, trees sequester about 77,476.78lbs of carbon a year with an associated value of $581 (Appendix A, Table 4). In addition, the trees store 1,160,105.98lbs of carbon, with a yearly benefit of $8,700.79 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Long Grove receives $36.48 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, Long Grove's trees provide $29,030 of benefits annually. Benefits of individual trees vary based on size, species, health and

location, but on average each of the 242 trees in Long Grove provide approximately $122 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Essex has over 41 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genera is as follows:

Long Grove
Population Summary of Public Trees for 1
3/12/2018

Species	Total	%
Red maple	46	19.00%
Green ash	14	5.78%
Northern red oak	14	5.78%
Northern hackberry	9	3.71%
Silver maple	8	3.30%
Bur oak	7	2.89%
White ash	7	2.89%
Broadleaf Deciduous Large	5	2.00%
Pin oak	3	1.23%
Black walnut	2	0.82%
Sugar maple	2	0.82%
Black maple	1	0.41%
Catalpa	1	0.41%
Eastern cottonwood	1	0.41%
Honeylocust	6	2.47%
Norway maple	6	2.47%
Littleleaf linden	5	2.00%
Broadleaf Deciduous Medium	4	1.65%
Swamp white oak	4	1.65%
Birch	3	1.23%
Willow	2	0.82%
Boxelder	2	0.82%
Ginkgo	2	0.82%
Amur corktree	1	0.41%
River birch	1	0.41%
Callery pear	1	0.41%
Apple	23	9.50%
White mulberry	4	1.65%
Black cherry	3	1.23%
Japanese tree lilac	1	0.41%

Japanese maple	1	0.41%
Eastern redbud	1	0.41%
Norway spruce	11	4.54%
Eastern white pine	7	2.89%
Spruce	3	1.23%
Conifer Evergreen Large	1	0.41%
Blue spruce	23	9.50%
Austrian pine	2	0.82%

Age Class

Approximately two thirds (78%) of Long Grove's trees are between 0 and 18 inches in diameter at 4.5 ft. (Appendix A, Figure 2). It is preferred that the highest number of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Long Grove's size curve is on the downward side, indicating a young forest 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 Long Grove indicate that 25.74% of the trees are in fair health, with 69.62% of the trees in good health, and only 4.22% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 27% of Essex's trees are in fair health for wood condition, with 64.56% in good wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health, dead or dying is about 8.44% of the population. This 8.44% 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).

Priority Tasks for Public Trees by Zone (None)				
Total	69	(N/A)	29.11	29.11
Priority Tasks for Public Trees by Zone (Stake/Train)				
Total	16	(N/A)	6.75	6.75
Priority Tasks for Public Trees by Zone (Crown cleaning)				
Total	85	(N/A)	35.86	35.86
Priority Tasks for Public Trees by Zone (Crown reduction/thinning)				
Total	44	(N/A)	18.57	18.57
Priority Tasks for Public Trees by Zone (Crown Raising)				
Total	9	(N/A)	3.80	3.80
Priority Tasks for Public Trees by Zone (Crown reduction/thinning)				
Total	44	(N/A)	18.57	18.57
Priority Tasks for Public Trees by Zone (Remove)				
Total	14	(N/A)	5.91	5.91

Canopy Cover

The total canopy with both private and public trees is .62%, 652.80 acres. The canopy cover included in the Long Grove inventory includes approximately 4.08 acres (Appendix A, Figure 4). The City's Canopy goal is %, in 30 years. To achieve this goal, it is estimated that 7-12 trees need to be planted annually.

Land Use and Location

The majority of Long Grove'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.

Single family residential	18	(N/A)	7.59	7.59
Multi-family residential	0	(N/A)	0.00	0.00
Small commercial	0	(N/A)	0.00	0.00
Industrial/Large commercial	0	(N/A)	0.00	0.00
Park/vacant/other	219	(N/A)	92.41	92.41

Front yard	19	7.51
Planting strip	0	0.00
Cutout	0	0.00
Median	0	0.00
Other maintained locations	222	91.73
Other un-maintained locations	0	0.00
Backyard	0	0.00

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

Long Grove has 2 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). It is

recommended to start with the large diameter critical concern trees first. There are 7 trees over 25 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 the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There is a total of 347 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 14 removals, none are ash trees. There is a total of 22 ash trees, and 9 of those have signs and symptoms that have been associated with EAB. In addition, there are 14 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 Essex.

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 (52.43%) (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 <u>No Additional Funding</u>

Year 1

Removal: 3 largest critical concern trees
Planting and Replacement: 3 trees to be planted in open locations
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 2

Removal: 2 critical concern trees and 2 additional ash trees with poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 3 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: 4trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 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 - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 4 trees in open locations from previous removals
Routine trimming: Contract to trim 1/3 of the city trees
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 5

Removal: 4 trees - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 3 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 - removal of any new critical concern trees and ash in poor health
*Or saving for ash tree treatment and/or future ash removal

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

*Reduction of ash over 6 years: 14 ash trees removed (approximately 63.63% of ash). It will take approximately 10 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 $5000 a year. If the budget were increased to $3500 a year all ash could be removed in 13 years.

Emerald Ash Borer Plan

Ash Tree Removal

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

Treatment of Ash Trees

Chemical treatment can be effective tool for communities to spread removal costs out over several years while allowing trees to continue to provide benefits. 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. 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 (Appendix C). 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 tree is not being treated. An example of City Code could state “If it is determined with reasonable certainty that any such condition exists (trees or shrubs in the City reported or suspected to be infected with or damaged by any disease or insect or disease pests) on private property and that the danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Budget

Current Budget
Total $10,596 over 6 years ($1,766/year)

FY 2018 Budget
Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Watering & Maintenance: $150

FY 2019 Budget
Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting: $500
Routine trimming: $500
Watering & Maintenance: $200

FY 2020 Budget
Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Watering & Maintenance: $150

FY 2021 Budget
Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting: $500
Routine trimming: $500
Watering & Maintenance: $200

FY 2022 Budget
Removal: $800
*Or saving for ash tree treatment and/or future ash removal
Planting: $800
Watering & Maintenance: $200

FY 2023 Budget
Removal: $500
*Or saving for ash tree treatment and/or future ash removal
Planting: $500
Routine trimming: $500
Watering & Maintenance: $200

*Reduction of ash over 6 years: approximately 14 ash trees removed (approximately 63.63% of ash). **It will take approximately 10 years to remove all ash with the current budget.**

Purposed Budget Increase
EAB could potentially kill all ash trees in Essex within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $8000 a year. If the budget were

increased to $10,000 a year all ash could be removed within 13 years. Additionally, it is recommended that Essex 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 Long Grove * would still need to find $8,000 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $2,250 a year for treatment and leave $1,800 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 Essex. 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

Long Grove

3/27/2018

Annual Energy Benefits of Public Trees by Species

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/tree
Red maple	7.45	565.28	988.10	968.33	1,533.62	(N/A)	19.41	19.05	33.34
Apple	1.35	102.74	234.57	229.88	332.63	(N/A)	9.70	4.13	14.46
Blue spruce	1.61	122.39	244.15	239.26	361.65	(N/A)	9.70	4.49	15.72
Green ash	3.79	287.38	504.05	493.97	781.34	(N/A)	5.91	9.70	55.81
Northern red oak	0.85	64.72	120.63	118.22	182.94	(N/A)	5.91	2.27	13.07
Norway spruce	1.15	87.01	145.50	142.59	229.60	(N/A)	4.64	2.85	20.87
Northern hackberry	3.18	241.15	441.92	433.08	674.23	(N/A)	3.80	8.37	74.91
Silver maple	3.05	231.17	405.05	396.95	628.12	(N/A)	3.38	7.80	78.52
Bur oak	2.46	186.40	343.09	336.23	522.63	(N/A)	2.95	6.49	74.66
Eastern white pine	0.48	36.78	76.70	75.16	111.94	(N/A)	2.95	1.39	15.99
White ash	1.17	89.07	138.46	135.69	224.77	(N/A)	2.95	2.79	32.11
Norway maple	0.52	39.55	81.18	79.55	119.10	(N/A)	2.53	1.48	19.85
Honeylocust	1.67	126.71	219.02	214.64	341.35	(N/A)	2.53	4.24	56.89
Littleleaf linden	1.00	76.21	119.70	117.31	193.52	(N/A)	2.11	2.40	38.70
Broadleaf Deciduous Large	1.24	94.32	170.62	167.21	261.53	(N/A)	2.11	3.25	52.31
Swamp white oak	0.55	41.75	80.05	78.45	120.19	(N/A)	1.69	1.49	30.05
White mulberry	0.80	60.59	126.49	123.96	184.56	(N/A)	1.69	2.29	46.14
Broadleaf Deciduous Medi	0.29	21.75	46.08	45.16	66.92	(N/A)	1.69	0.83	16.73
Spruce	0.24	18.34	33.63	32.95	51.29	(N/A)	1.27	0.64	17.10
Black cherry	0.58	44.26	87.91	86.15	130.41	(N/A)	1.27	1.62	43.47
Pin oak	0.62	46.76	79.56	77.97	124.73	(N/A)	1.27	1.55	41.58
Birch	0.25	18.83	39.89	39.10	57.93	(N/A)	1.27	0.72	19.31
Willow	0.64	48.74	94.83	92.94	141.68	(N/A)	0.84	1.76	70.84
Boxelder	0.46	34.81	60.15	58.95	93.76	(N/A)	0.84	1.16	46.88
Black walnut	0.19	14.37	27.46	26.91	41.27	(N/A)	0.84	0.51	20.64
Sugar maple	0.65	49.28	81.45	79.82	129.10	(N/A)	0.84	1.60	64.55
Ginkgo	0.00	0.34	0.82	0.81	1.14	(N/A)	0.84	0.01	0.57
Austrian pine	0.20	15.33	29.71	29.12	44.45	(N/A)	0.84	0.55	22.22
River birch	0.24	17.87	29.49	28.90	46.78	(N/A)	0.42	0.58	46.78
Callery pear	0.24	17.87	29.49	28.90	46.78	(N/A)	0.42	0.58	46.78
Amur corktree	0.24	17.87	29.49	28.90	46.78	(N/A)	0.42	0.58	46.78
Catalpa	0.23	17.78	26.99	26.45	44.23	(N/A)	0.42	0.55	44.23
Japanese tree lilac	0.02	1.68	3.80	3.72	5.40	(N/A)	0.42	0.07	5.40
Conifer Evergreen Large	0.00	0.27	0.66	0.65	0.93	(N/A)	0.42	0.01	0.93
Black maple	0.28	21.58	39.90	39.10	60.68	(N/A)	0.42	0.75	60.68
Eastern cottonwood	0.44	33.23	58.98	57.80	91.02	(N/A)	0.42	1.13	91.02
Japanese maple	0.07	5.62	12.83	12.58	18.19	(N/A)	0.42	0.23	18.19
Eastern redbud	0.02	1.68	3.80	3.72	5.40	(N/A)	0.42	0.07	5.40
Total	38.23	2,901.51	5,256.20	5,151.08	8,052.59	(N/A)	100.00	100.00	33.98

Table 2: Annual Storm Water Benefits

Long Grove

3/27/2018

Annual Stormwater Benefits of Public Trees by Species

Species	Total Rainfall Interception (Gal)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/tree
Red maple	54,574.06	1,478.96	(N/A)	19.41	14.83	32.15
Apple	4,785.85	129.70	(N/A)	9.70	1.30	5.64
Blue spruce	19,242.56	521.47	(N/A)	9.70	5.23	22.67
Green ash	39,309.80	1,065.30	(N/A)	5.91	10.68	76.09
Northern red oak	4,582.62	124.19	(N/A)	5.91	1.25	8.87
Norway spruce	14,582.98	395.20	(N/A)	4.64	3.96	35.93
Northern hackberry	35,898.58	972.85	(N/A)	3.80	9.75	108.09
Silver maple	48,593.34	1,316.88	(N/A)	3.38	13.20	164.61
Bur oak	32,834.82	889.82	(N/A)	2.95	8.92	127.12
Eastern white pine	6,542.33	177.30	(N/A)	2.95	1.78	25.33
White ash	7,442.23	201.68	(N/A)	2.95	2.02	28.81
Norway maple	3,716.06	100.71	(N/A)	2.53	1.01	16.78
Honeylocust	14,236.18	385.80	(N/A)	2.53	3.87	64.30
Littleleaf linden	6,297.99	170.68	(N/A)	2.11	1.71	34.14
Broadleaf Deciduous Large	12,745.30	345.40	(N/A)	2.11	3.46	69.08
Swamp white oak	3,166.97	85.82	(N/A)	1.69	0.86	21.46
White mulberry	4,696.13	127.27	(N/A)	1.69	1.28	31.82
Broadleaf Deciduous Medi	1,497.33	40.58	(N/A)	1.69	0.41	10.14
Spruce	2,729.66	73.97	(N/A)	1.27	0.74	24.66
Black cherry	3,014.60	81.70	(N/A)	1.27	0.82	27.23
Pin oak	5,130.22	139.03	(N/A)	1.27	1.39	46.34
Birch	1,334.62	36.17	(N/A)	1.27	0.36	12.06
Willow	7,528.69	204.03	(N/A)	0.84	2.05	102.01
Boxelder	4,545.63	123.19	(N/A)	0.84	1.24	61.59
Black walnut	1,215.72	32.95	(N/A)	0.84	0.33	16.47
Sugar maple	8,450.05	229.00	(N/A)	0.84	2.30	114.50
Ginkgo	14.21	0.39	(N/A)	0.84	0.00	0.19
Austrian pine	3,067.78	83.14	(N/A)	0.84	0.83	41.57
River birch	1,409.09	38.19	(N/A)	0.42	0.38	38.19
Callery pear	1,409.09	38.19	(N/A)	0.42	0.38	38.19
Amur corktree	1,409.09	38.19	(N/A)	0.42	0.38	38.19
Catalpa	1,465.55	39.72	(N/A)	0.42	0.40	39.72
Japanese tree lilac	68.66	1.86	(N/A)	0.42	0.02	1.86
Conifer Evergreen Large	48.74	1.32	(N/A)	0.42	0.01	1.32
Black maple	2,866.98	77.70	(N/A)	0.42	0.78	77.70
Eastern cottonwood	7,238.92	196.17	(N/A)	0.42	1.97	196.17
Japanese maple	264.49	7.17	(N/A)	0.42	0.07	7.17
Eastern redbud	68.66	1.86	(N/A)	0.42	0.02	1.86
Citywide total	368,025.58	9,973.49	(N/A)	100.00	100.00	42.08

Table 3: Annual Air Quality Benefits

Long Grove

3/27/2018

Average Annual Benefits of Public Trees by Species ($/tree)

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/ Other	Total	Standard Error
Red maple	33.34	4.19	5.82	32.15	41.43	116.93	(N/A)
Apple	14.46	1.39	2.01	5.64	5.09	28.60	(N/A)
Blue spruce	15.72	1.19	1.68	22.67	21.24	62.51	(N/A)
Green ash	55.81	7.49	9.81	76.09	52.04	201.24	(N/A)
Northern red oak	13.07	1.41	1.83	8.87	10.02	35.20	(N/A)
Norway spruce	20.87	2.00	2.21	35.93	27.52	88.53	(N/A)
Northern hackberry	74.91	7.55	14.29	108.09	58.33	263.19	(N/A)
Silver maple	78.52	17.47	15.14	164.61	132.40	408.14	(N/A)
Bur oak	74.66	10.01	13.90	127.12	62.73	288.42	(N/A)
Eastern white pine	15.99	1.37	1.47	25.33	19.94	64.11	(N/A)
White ash	32.11	4.39	5.23	28.81	46.42	116.95	(N/A)
Norway maple	19.85	2.37	3.08	16.78	20.14	62.22	(N/A)
Honeylocust	56.89	7.07	9.36	64.30	104.35	241.97	(N/A)
Littleleaf linden	38.70	6.24	6.42	34.14	55.09	140.59	(N/A)
Broadleaf Deciduous Large	52.31	7.16	8.96	69.08	51.28	188.79	(N/A)
Swamp white oak	30.05	3.64	4.58	21.46	29.46	89.18	(N/A)
White mulberry	46.14	4.04	8.35	31.82	14.40	104.74	(N/A)
Broadleaf Deciduous Medi	16.73	2.07	2.34	10.14	19.55	50.83	(N/A)
Spruce	17.10	1.53	1.92	24.66	21.05	66.27	(N/A)
Black cherry	43.47	4.09	7.75	27.23	14.76	97.31	(N/A)
Pin oak	41.58	7.38	5.61	46.34	57.29	158.20	(N/A)
Birch	19.31	2.36	2.72	12.06	21.78	58.22	(N/A)
Willow	70.84	3.49	13.58	102.01	0.00	189.93	(N/A)
Boxelder	46.88	8.00	7.84	61.59	52.39	176.71	(N/A)
Black walnut	20.64	2.71	2.99	16.47	28.56	71.37	(N/A)
Sugar maple	64.55	9.40	11.04	114.50	77.93	277.42	(N/A)
Ginkgo	0.57	0.04	0.07	0.19	0.37	1.25	(N/A)
Austrian pine	22.22	1.90	2.32	41.57	20.53	88.54	(N/A)
River birch	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Callery pear	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Amur corktree	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Catalpa	44.23	6.14	7.42	39.72	45.86	143.36	(N/A)
Japanese tree lilac	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)
Conifer Evergreen Large	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)
Black maple	60.68	3.27	11.54	77.70	0.00	153.19	(N/A)
Eastern cottonwood	91.02	10.90	19.04	196.17	58.34	375.47	(N/A)
Japanese maple	18.19	1.74	2.55	7.17	6.40	36.05	(N/A)
Eastern redbud	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)
Citywide Total	33.98	4.29	5.66	42.08	36.48	122.49	(N/A)

Table 4: Annual Carbon Stored

Long Grove

3/27/2018

Annual Air Quality Benefits of Public Trees by Species

Species	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Total Deposition ($)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Tree Numbers	Avg. $/tree
Red maple	11.70	1.99	5.63	0.52	62.81	35.23	5.15	4.92	33.74	220.24	- 4.10	- 15.37	94.79	267.68	(N/A)	19.41	5.82
Apple	0.79	0.13	0.47	0.04	4.47	6.90	0.97	0.92	6.13	41.88	- 0.01	- 0.02	16.34	46.33	(N/A)	9.70	2.01
Blue spruce	1.90	0.38	1.81	0.23	13.23	7.88	1.13	1.08	7.30	48.63	- 6.21	- 23.27	15.51	38.59	(N/A)	9.70	1.68
Green ash	4.71	0.75	2.29	0.21	25.20	17.95	2.62	2.50	17.16	112.15	0.00	0.00	48.21	137.35	(N/A)	5.91	9.81
Northern red oak	0.59	0.10	0.36	0.03	3.41	4.10	0.59	0.57	3.86	25.45	- 0.85	- 3.19	9.35	25.66	(N/A)	5.91	1.83
Norway spruce	1.56	0.31	1.37	0.19	10.55	5.36	0.79	0.75	5.19	33.66	- 5.32	- 19.94	10.21	24.27	(N/A)	4.64	2.21
Northern hackberry	6.24	1.08	3.08	0.28	33.79	15.26	2.22	2.11	14.41	94.85	0.00	0.00	44.67	128.63	(N/A)	3.80	14.29
Silver maple	9.13	1.55	4.40	0.40	48.99	14.40	2.10	2.01	13.78	89.97	- 4.76	- 17.85	43.01	121.11	(N/A)	3.38	15.14
Bur oak	4.56	0.73	2.09	0.20	24.05	11.79	1.71	1.63	11.13	73.28	0.00	0.00	33.85	97.33	(N/A)	2.95	13.90
Eastern white pine	0.65	0.13	0.60	0.08	4.48	2.40	0.34	0.33	2.20	14.74	- 2.38	- 8.91	4.35	10.31	(N/A)	2.95	1.47
White ash	0.41	0.07	0.29	0.02	2.43	5.40	0.80	0.77	5.32	34.14	0.00	0.00	13.07	36.58	(N/A)	2.95	5.23
Norway maple	0.57	0.10	0.31	0.03	3.18	2.58	0.37	0.35	2.37	15.86	- 0.15	- 0.57	6.52	18.47	(N/A)	2.53	3.08
Honeylocust	2.62	0.43	1.23	0.12	13.91	7.87	1.15	1.10	7.56	49.27	- 1.87	- 7.00	20.21	56.18	(N/A)	2.53	9.36
Littleleaf linden	0.80	0.14	0.43	0.04	4.43	4.65	0.69	0.66	4.56	29.34	- 0.44	- 1.65	11.52	32.12	(N/A)	2.11	6.42
Broadleaf Deciduous Large	1.46	0.23	0.72	0.07	7.83	5.94	0.86	0.82	5.63	36.98	0.00	0.00	15.74	44.81	(N/A)	2.11	8.96
Swamp white oak	0.39	0.07	0.23	0.02	2.20	2.67	0.39	0.37	2.50	16.55	- 0.12	- 0.43	6.51	18.32	(N/A)	1.69	4.58
White mulberry	1.74	0.29	0.78	0.08	9.13	3.96	0.57	0.54	3.62	24.29	- 0.01	- 0.04	11.55	33.39	(N/A)	1.69	8.35
Broadleaf Deciduous Medi	0.13	0.02	0.09	0.01	0.76	1.43	0.20	0.19	1.30	8.77	- 0.05	- 0.17	3.33	9.36	(N/A)	1.69	2.34
Spruce	0.27	0.05	0.25	0.03	1.87	1.16	0.17	0.16	1.09	7.19	- 0.88	- 3.29	2.31	5.77	(N/A)	1.27	1.92
Black cherry	1.08	0.18	0.49	0.05	5.67	2.85	0.41	0.39	2.64	17.60	- 0.01	- 0.02	8.08	23.25	(N/A)	1.27	7.75
Pin oak	0.76	0.13	0.41	0.03	4.23	2.90	0.42	0.41	2.79	18.15	- 1.48	- 5.56	6.38	16.82	(N/A)	1.27	5.61
Birch	0.12	0.02	0.08	0.01	0.71	1.24	0.18	0.17	1.13	7.59	- 0.04	- 0.16	2.90	8.15	(N/A)	1.27	2.72
Willow	1.73	0.30	0.82	0.08	9.27	3.13	0.45	0.43	2.91	19.36	- 0.39	- 1.46	9.46	27.16	(N/A)	0.84	13.58
Boxelder	0.58	0.09	0.27	0.03	3.07	2.16	0.32	0.30	2.08	13.54	- 0.25	- 0.93	5.58	15.68	(N/A)	0.84	7.84
Black walnut	0.05	0.01	0.04	0.00	0.31	0.92	0.13	0.13	0.86	5.67	0.00	0.00	2.13	5.99	(N/A)	0.84	2.99
Sugar maple	1.24	0.21	0.60	0.05	6.65	3.03	0.45	0.43	2.94	19.05	- 0.96	- 3.61	7.98	22.09	(N/A)	0.84	11.04
Ginkgo	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.14	0.00	0.00	0.05	0.14	(N/A)	0.84	0.07
Austrian pine	0.42	0.08	0.35	0.05	2.78	0.98	0.14	0.13	0.91	6.06	- 1.12	- 4.21	1.95	4.63	(N/A)	0.84	2.32
River birch	0.22	0.04	0.12	0.01	1.21	1.10	0.16	0.16	1.07	6.93	- 0.06	- 0.22	2.81	7.92	(N/A)	0.42	7.92
Callery pear	0.22	0.04	0.12	0.01	1.21	1.10	0.16	0.16	1.07	6.93	- 0.06	- 0.22	2.81	7.92	(N/A)	0.42	7.92
Amur corktree	0.22	0.04	0.12	0.01	1.21	1.10	0.16	0.16	1.07	6.93	- 0.06	- 0.22	2.81	7.92	(N/A)	0.42	7.92
Catalpa	0.11	0.02	0.07	0.00	0.62	1.07	0.16	0.15	1.06	6.80	0.00	0.00	2.65	7.42	(N/A)	0.42	7.42
Japanese tree lilac	0.00	0.00	0.00	0.00	0.03	0.11	0.02	0.02	0.10	0.68	0.00	0.00	0.25	0.71	(N/A)	0.42	0.71
Conifer Evergreen Large	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.02	0.11	- 0.02	- 0.07	0.02	0.05	(N/A)	0.42	0.05
Black maple	0.75	0.13	0.34	0.03	3.97	1.36	0.20	0.19	1.29	8.48	- 0.24	- 0.91	4.05	11.54	(N/A)	0.42	11.54
Eastern cottonwood	1.16	0.19	0.51	0.05	6.05	2.08	0.30	0.29	1.98	12.99	0.00	0.00	6.57	19.04	(N/A)	0.42	19.04
Japanese maple	0.05	0.01	0.03	0.00	0.26	0.38	0.05	0.05	0.34	2.29	0.00	0.00	0.90	2.55	(N/A)	0.42	2.55
Eastern redbud	0.00	0.00	0.00	0.00	0.03	0.11	0.02	0.02	0.10	0.68	0.00	0.00	0.25	0.71	(N/A)	0.42	0.71
Citywide Total	58.92	10.02	30.83	3.01	324.00	182.60	26.58	25.34	173.21	1,137.20	- 31.80	- 119.27	478.70	1,341.93	(N/A)	100.00	5.66

Table 5: Annual Carbon Sequestered

Long Grove

3/27/2018

Annual CO2 Benefits of Public Trees by Species

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release(lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/tree
Red maple	13,879.89	104.10	- 631.43	- 69.42	- 5.26	12,492.57	93.69	25,671.62	192.54	(N/A)	19.41	18.93	4.19
Apple	2,104.98	15.79	- 77.72	- 22.62	- 0.75	2,270.60	17.03	4,275.24	32.06	(N/A)	9.70	3.15	1.39
Blue spruce	1,017.82	7.63	- 42.23	- 28.67	- 0.53	2,704.78	20.29	3,651.72	27.39	(N/A)	9.70	2.69	1.19
Green ash	8,415.04	63.11	- 748.67	- 38.22	- 5.90	6,350.94	47.63	13,979.10	104.84	(N/A)	5.91	10.31	7.49
Northern red oak	1,258.24	9.44	- 45.83	- 10.92	- 0.43	1,430.35	10.73	2,631.84	19.74	(N/A)	5.91	1.94	1.41
Norway spruce	1,091.16	8.18	- 54.68	- 19.11	- 0.55	1,922.98	14.42	2,940.35	22.05	(N/A)	4.64	2.17	2.00
Northern hackberry	4,248.42	31.86	- 480.33	- 31.40	- 3.84	5,329.30	39.97	9,066.00	67.99	(N/A)	3.80	6.69	7.55
Silver maple	14,622.38	109.67	- 1,059.36	- 35.88	- 8.21	5,108.86	38.32	18,636.00	139.77	(N/A)	3.38	13.74	17.47
Bur oak	5,967.14	44.75	- 718.93	- 26.91	- 5.59	4,119.44	30.90	9,340.75	70.06	(N/A)	2.95	6.89	10.01
Eastern white pine	503.13	3.77	- 23.44	- 9.75	- 0.25	812.85	6.10	1,282.79	9.62	(N/A)	2.95	0.95	1.37
White ash	2,209.31	16.57	- 72.74	- 10.53	- 0.62	1,968.53	14.76	4,094.57	30.71	(N/A)	2.95	3.02	4.39
Norway maple	1,076.32	8.07	- 50.41	- 6.24	- 0.42	873.96	6.55	1,893.63	14.20	(N/A)	2.53	1.40	2.37
Honeylocust	3,022.70	22.67	- 157.02	- 13.26	- 1.28	2,800.26	21.00	5,652.67	42.40	(N/A)	2.53	4.17	7.07
Littleleaf linden	2,571.26	19.28	- 86.28	- 9.75	- 0.72	1,684.21	12.63	4,159.44	31.20	(N/A)	2.11	3.07	6.24
Broadleaf Deciduous Large	2,933.10	22.00	- 228.31	- 12.87	- 1.81	2,084.41	15.63	4,776.34	35.82	(N/A)	2.11	3.52	7.16
Swamp white oak	1,057.79	7.93	- 33.25	- 5.46	- 0.29	922.58	6.92	1,941.66	14.56	(N/A)	1.69	1.43	3.64
White mulberry	956.91	7.18	- 129.46	- 12.48	- 1.06	1,339.11	10.04	2,154.07	16.16	(N/A)	1.69	1.59	4.04
Broadleaf Deciduous Medi	639.12	4.79	- 14.06	- 3.51	- 0.13	480.76	3.61	1,102.31	8.27	(N/A)	1.69	0.81	2.07
Spruce	220.80	1.66	- 8.08	- 4.29	- 0.09	405.31	3.04	613.74	4.60	(N/A)	1.27	0.45	1.53
Black cherry	746.09	5.60	- 79.31	- 8.19	- 0.66	978.04	7.34	1,636.64	12.27	(N/A)	1.27	1.21	4.09
Pin oak	2,016.46	15.12	- 91.30	- 6.05	- 0.73	1,033.42	7.75	2,952.53	22.14	(N/A)	1.27	2.18	7.38
Birch	543.51	4.08	- 12.31	- 2.93	- 0.11	416.23	3.12	944.50	7.08	(N/A)	1.27	0.70	2.36
Willow	0.00	0.00	- 137.09	- 8.58	- 1.09	1,077.18	8.08	931.51	6.99	(N/A)	0.84	0.69	3.49
Boxelder	1,456.45	10.92	- 85.94	- 5.46	- 0.69	769.33	5.77	2,134.38	16.01	(N/A)	0.84	1.57	8.00
Black walnut	417.59	3.13	- 9.93	- 2.34	- 0.09	317.50	2.38	722.82	5.42	(N/A)	0.84	0.53	2.71
Sugar maple	1,602.53	12.02	- 179.03	- 7.02	- 1.40	1,089.08	8.17	2,505.55	18.79	(N/A)	0.84	1.85	9.40
Ginkgo	4.41	0.03	- 0.07	- 0.39	0.00	7.41	0.06	11.35	0.09	(N/A)	0.84	0.01	0.04
Austrian pine	185.66	1.39	- 14.14	- 3.90	- 0.14	338.78	2.54	506.40	3.80	(N/A)	0.84	0.37	1.90
River birch	385.95	2.89	- 17.40	- 1.95	- 0.15	395.01	2.96	761.61	5.71	(N/A)	0.42	0.56	5.71
Callery pear	385.95	2.89	- 17.40	- 1.95	- 0.15	395.01	2.96	761.61	5.71	(N/A)	0.42	0.56	5.71
Amur corktree	385.95	2.89	- 17.40	- 1.95	- 0.15	395.01	2.96	761.61	5.71	(N/A)	0.42	0.56	5.71
Catalpa	445.34	3.34	- 17.62	- 1.95	- 0.15	392.87	2.95	818.63	6.14	(N/A)	0.42	0.60	6.14
Japanese tree lilac	37.94	0.28	- 0.85	- 0.59	- 0.01	37.19	0.28	73.69	0.55	(N/A)	0.42	0.05	0.55
Conifer Evergreen Large	3.53	0.03	- 0.02	- 0.20	0.00	6.07	0.05	9.39	0.07	(N/A)	0.42	0.01	0.07
Black maple	0.00	0.00	- 38.14	- 2.73	- 0.31	476.96	3.58	436.10	3.27	(N/A)	0.42	0.32	3.27
Eastern cottonwood	912.12	6.84	- 188.44	- 5.07	- 1.45	734.33	5.51	1,452.94	10.90	(N/A)	0.42	1.07	10.90
Japanese maple	113.87	0.85	- 4.36	- 1.17	- 0.04	124.15	0.93	232.50	1.74	(N/A)	0.42	0.17	1.74
Eastern redbud	37.94	0.28	- 0.85	- 0.59	- 0.01	37.19	0.28	73.69	0.55	(N/A)	0.42	0.05	0.55
Citywide Total	77,476.79	581.08	- 5,573.81	- 434.27	- 45.06	64,122.56	480.92	135,591.26	1,016.93	(N/A)	100.00	100.00	4.29

Table 6: Annual Social and Aesthetic Benefits

Long Grove

3/27/2018

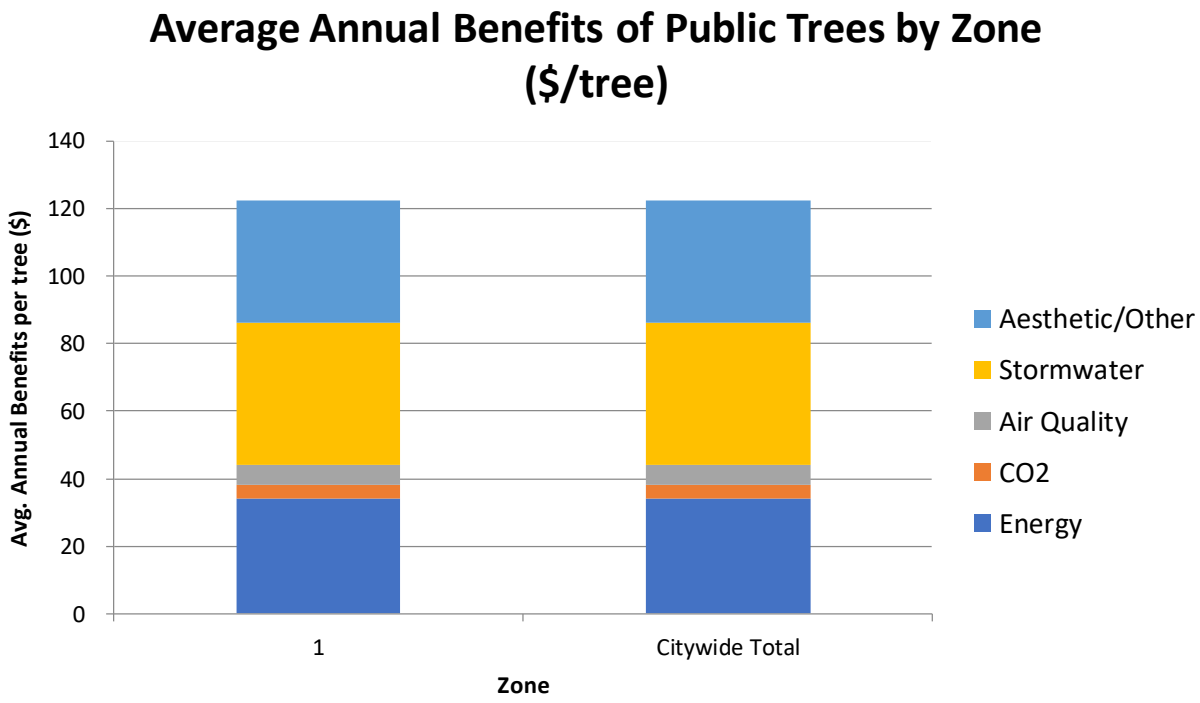
Average Annual Benefits of Public Trees by Species ($/tree)

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/ Other	Total	Standard Error
Red maple	33.34	4.19	5.82	32.15	41.43	116.93	(N/A)
Apple	14.46	1.39	2.01	5.64	5.09	28.60	(N/A)
Blue spruce	15.72	1.19	1.68	22.67	21.24	62.51	(N/A)
Green ash	55.81	7.49	9.81	76.09	52.04	201.24	(N/A)
Northern red oak	13.07	1.41	1.83	8.87	10.02	35.20	(N/A)
Norway spruce	20.87	2.00	2.21	35.93	27.52	88.53	(N/A)
Northern hackberry	74.91	7.55	14.29	108.09	58.33	263.19	(N/A)
Silver maple	78.52	17.47	15.14	164.61	132.40	408.14	(N/A)
Bur oak	74.66	10.01	13.90	127.12	62.73	288.42	(N/A)
Eastern white pine	15.99	1.37	1.47	25.33	19.94	64.11	(N/A)
White ash	32.11	4.39	5.23	28.81	46.42	116.95	(N/A)
Norway maple	19.85	2.37	3.08	16.78	20.14	62.22	(N/A)
Honeylocust	56.89	7.07	9.36	64.30	104.35	241.97	(N/A)
Littleleaf linden	38.70	6.24	6.42	34.14	55.09	140.59	(N/A)
Broadleaf Deciduous Large	52.31	7.16	8.96	69.08	51.28	188.79	(N/A)
Swamp white oak	30.05	3.64	4.58	21.46	29.46	89.18	(N/A)
White mulberry	46.14	4.04	8.35	31.82	14.40	104.74	(N/A)
Broadleaf Deciduous Medi	16.73	2.07	2.34	10.14	19.55	50.83	(N/A)
Spruce	17.10	1.53	1.92	24.66	21.05	66.27	(N/A)
Black cherry	43.47	4.09	7.75	27.23	14.76	97.31	(N/A)
Pin oak	41.58	7.38	5.61	46.34	57.29	158.20	(N/A)
Birch	19.31	2.36	2.72	12.06	21.78	58.22	(N/A)
Willow	70.84	3.49	13.58	102.01	0.00	189.93	(N/A)
Boxelder	46.88	8.00	7.84	61.59	52.39	176.71	(N/A)
Black walnut	20.64	2.71	2.99	16.47	28.56	71.37	(N/A)
Sugar maple	64.55	9.40	11.04	114.50	77.93	277.42	(N/A)
Ginkgo	0.57	0.04	0.07	0.19	0.37	1.25	(N/A)
Austrian pine	22.22	1.90	2.32	41.57	20.53	88.54	(N/A)
River birch	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Callery pear	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Amur corktree	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)
Catalpa	44.23	6.14	7.42	39.72	45.86	143.36	(N/A)
Japanese tree lilac	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)
Conifer Evergreen Large	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)
Black maple	60.68	3.27	11.54	77.70	0.00	153.19	(N/A)
Eastern cottonwood	91.02	10.90	19.04	196.17	58.34	375.47	(N/A)
Japanese maple	18.19	1.74	2.55	7.17	6.40	36.05	(N/A)
Eastern redbud	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)
Citywide Total	33.98	4.29	5.66	42.08	36.48	122.49	(N/A)

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of Public Trees by Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/ Other	Total ($)	Standard Error	% of Total $
Red maple	1,533.62	192.54	267.68	1,478.96	1,905.90	5,378.69	(N/A)	18.53
Apple	332.63	32.06	46.33	129.70	117.14	657.86	(N/A)	2.27
Blue spruce	361.65	27.39	38.59	521.47	488.60	1,437.70	(N/A)	4.95
Green ash	781.34	104.84	137.35	1,065.30	728.54	2,817.37	(N/A)	9.70
Northern red oak	182.94	19.74	25.66	124.19	140.28	492.81	(N/A)	1.70
Norway spruce	229.60	22.05	24.27	395.20	302.67	973.79	(N/A)	3.35
Northern hackberry	674.23	67.99	128.63	972.85	524.96	2,368.67	(N/A)	8.16
Silver maple	628.12	139.77	121.11	1,316.88	1,059.23	3,265.11	(N/A)	11.25
Bur oak	522.63	70.06	97.33	889.82	439.10	2,018.94	(N/A)	6.95
Eastern white pine	111.94	9.62	10.31	177.30	139.61	448.78	(N/A)	1.55
White ash	224.77	30.71	36.58	201.68	324.91	818.65	(N/A)	2.82
Norway maple	119.10	14.20	18.47	100.71	120.82	373.29	(N/A)	1.29
Honeylocust	341.35	42.40	56.18	385.80	626.10	1,451.82	(N/A)	5.00
Littleleaf linden	193.52	31.20	32.12	170.68	275.46	702.97	(N/A)	2.42
Broadleaf Deciduous Large	261.53	35.82	44.81	345.40	256.39	943.94	(N/A)	3.25
Swamp white oak	120.19	14.56	18.32	85.82	117.82	356.73	(N/A)	1.23
White mulberry	184.56	16.16	33.39	127.27	57.61	418.97	(N/A)	1.44
Broadleaf Deciduous Medi	66.92	8.27	9.36	40.58	78.22	203.33	(N/A)	0.70
Spruce	51.29	4.60	5.77	73.97	63.16	198.81	(N/A)	0.68
Black cherry	130.41	12.27	23.25	81.70	44.28	291.92	(N/A)	1.01
Pin oak	124.73	22.14	16.82	139.03	171.86	474.59	(N/A)	1.63
Birch	57.93	7.08	8.15	36.17	65.33	174.66	(N/A)	0.60
Willow	141.68	6.99	27.16	204.03	0.00	379.86	(N/A)	1.31
Boxelder	93.76	16.01	15.68	123.19	104.79	353.42	(N/A)	1.22
Black walnut	41.27	5.42	5.99	32.95	57.11	142.74	(N/A)	0.49
Sugar maple	129.10	18.79	22.09	229.00	155.86	554.83	(N/A)	1.91
Ginkgo	1.14	0.09	0.14	0.39	0.74	2.49	(N/A)	0.01
Austrian pine	44.45	3.80	4.63	83.14	41.05	177.07	(N/A)	0.61
River birch	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)	0.47
Callery pear	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)	0.47
Amur corktree	46.78	5.71	7.92	38.19	39.16	137.75	(N/A)	0.47
Catalpa	44.23	6.14	7.42	39.72	45.86	143.36	(N/A)	0.49
Japanese tree lilac	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)	0.04
Conifer Evergreen Large	0.93	0.07	0.05	1.32	5.76	8.13	(N/A)	0.03
Black maple	60.68	3.27	11.54	77.70	0.00	153.19	(N/A)	0.53
Eastern cottonwood	91.02	10.90	19.04	196.17	58.34	375.47	(N/A)	1.29
Japanese maple	18.19	1.74	2.55	7.17	6.40	36.05	(N/A)	0.12
Eastern redbud	5.40	0.55	0.71	1.86	2.06	10.58	(N/A)	0.04
Citywide Total	8,052.59	1,016.93	1,341.93	9,973.49	8,645.49	29,030.44	(N/A)	100.00


Average Annual Benefits of Public Trees by Zone ($/tree)
Avg. Annual Benefits per tree ($)
140
120
100
80
60
40
20
0
1
Citywide Total
Zone
Aesthetic/Other
Stormwater
Air Quality
CO2
Energy

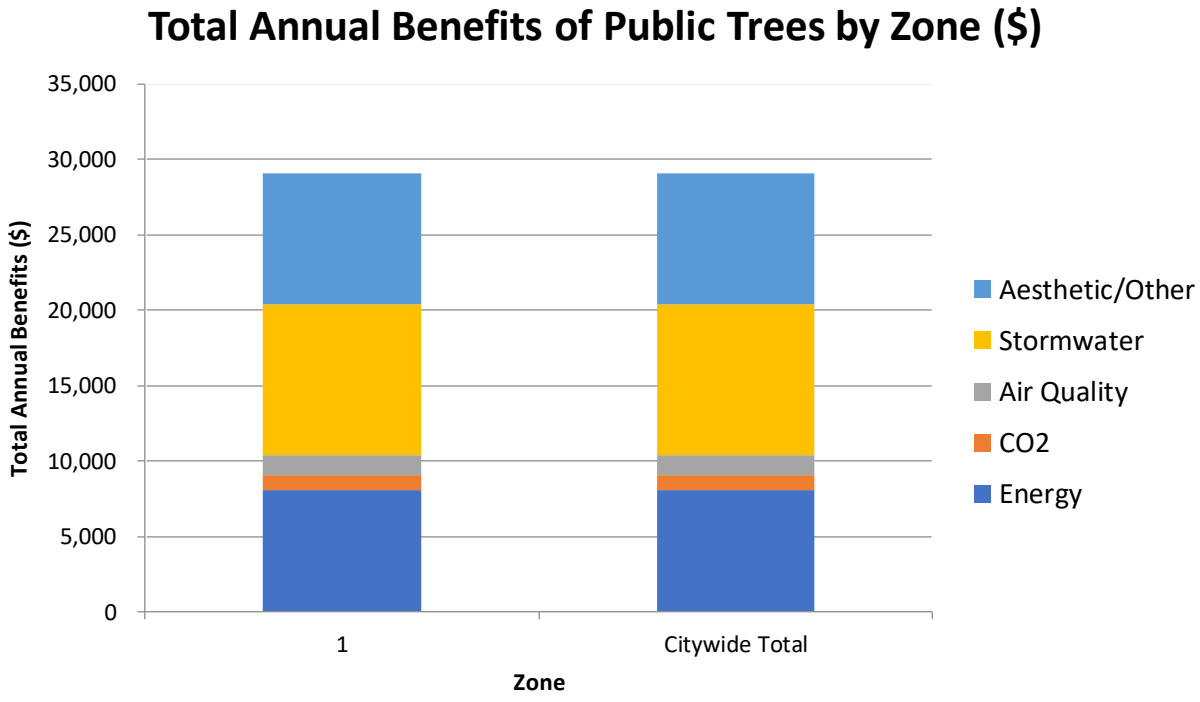

Total Annual Benefits of Public Trees by Zone ($)
Total Annual Benefits ($)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1
Citywide Total
Zone
Aesthetic/Other
Stormwater
Air Quality
CO2
Energy

Figure 1: Species Distribution

Long Grove
Species Distribution of Public Trees fo
3/27/2018

Species	Percent
Red maple	19.41
Apple	9.70
Blue spruce	9.70
Green ash	5.91
Northern red oak	5.91
Norway spruce	4.64
Northern hackberry	3.80
Silver maple	3.38
Bur oak	2.95
Eastern white pine	2.95
Other Species	31.65

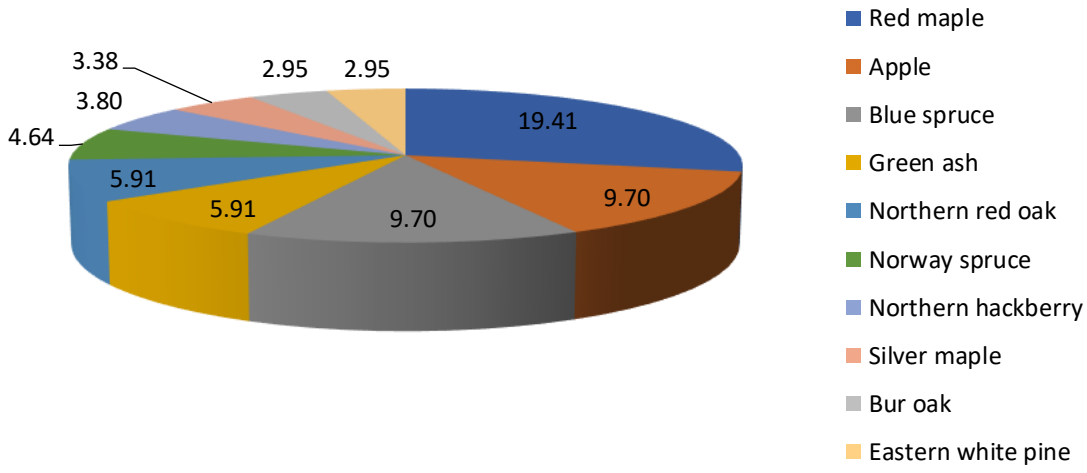


Figure 2: Relative Age Distribution

Long Grove
Relative Age Distribution of Top 10 Public Tree Species (%)
3/27/2018

DBH class (in)

Species	0 - 3	3 - 6	6 - 12	12 - 18	18 - 24	24 - 30	30 - 36	36 - 42	> 42
Red maple	4.35	21.74	28.26	26.09	13.04	6.52	0.00	0.00	0.00
Apple	8.70	17.39	73.91	0.00	0.00	0.00	0.00	0.00	0.00
Blue spruce	0.00	4.35	82.61	13.04	0.00	0.00	0.00	0.00	0.00
Green ash	0.00	0.00	7.14	35.71	35.71	7.14	0.00	14.29	0.00
Northern red oak	28.57	28.57	35.71	7.14	0.00	0.00	0.00	0.00	0.00
Norway spruce	0.00	0.00	36.36	54.55	9.09	0.00	0.00	0.00	0.00
Northern hackberry	11.11	0.00	0.00	11.11	22.22	11.11	0.00	44.44	0.00
Silver maple	0.00	0.00	0.00	0.00	12.50	25.00	12.50	25.00	25.00
Bur oak	0.00	0.00	0.00	0.00	28.57	14.29	42.86	14.29	0.00
Eastern white pine	0.00	0.00	85.71	0.00	14.29	0.00	0.00	0.00	0.00
Citywide Total	5.06	12.24	35.86	20.68	11.39	4.64	3.80	5.49	0.84

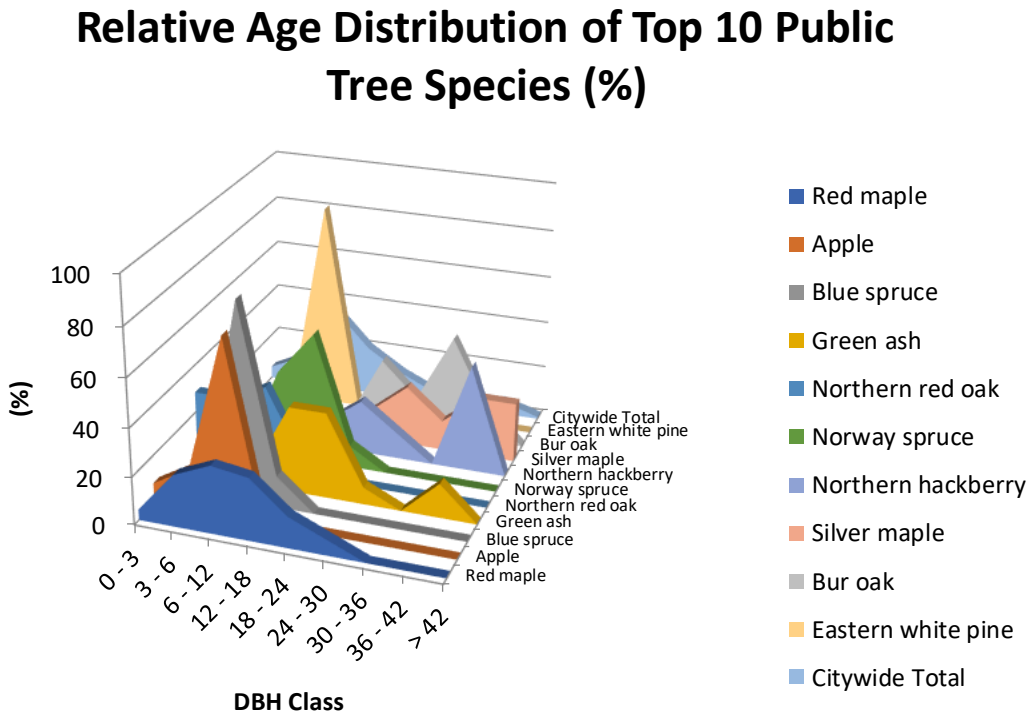
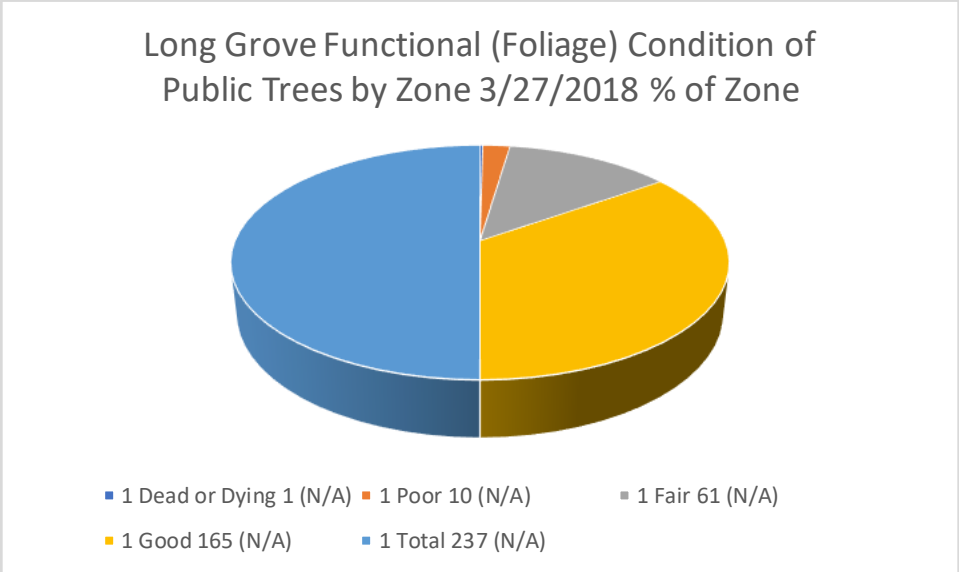


Figure 2: Relative Age Class

Figure 3: Functional Condition of all Trees

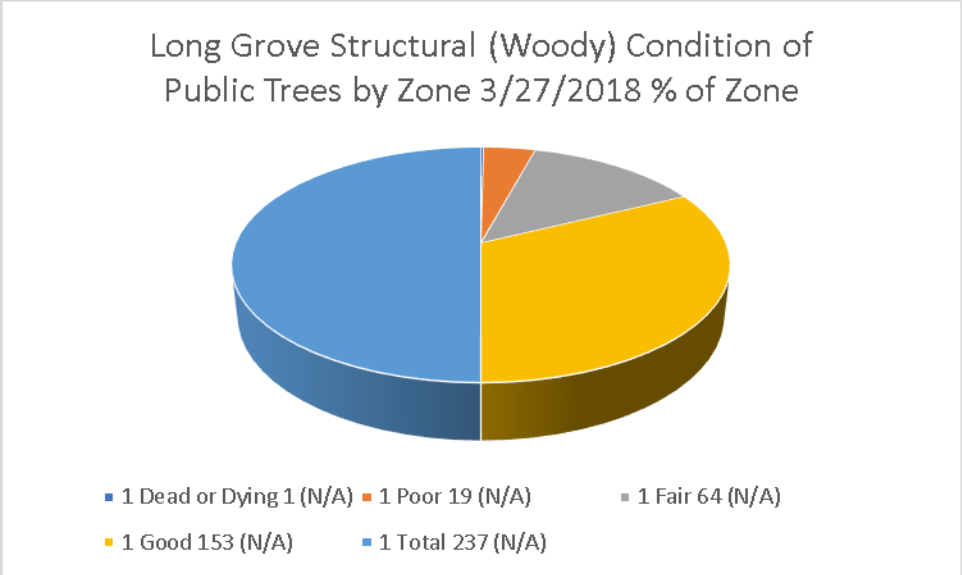


Long Grove
Functional (Foliage) Condition of Public Trees by Zone
3/27/2018

Zone	Condition	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Dead or Dying	1	(N/A)	0.42	0.42
	Poor	10	(N/A)	4.22	4.22
	Fair	61	(N/A)	25.74	25.74
	Good	165	(N/A)	69.62	69.62
	Total	237	(N/A)	100.00	100.00

Figure 3: Foliage Condition

Figure 4: Structural Condition of all Trees

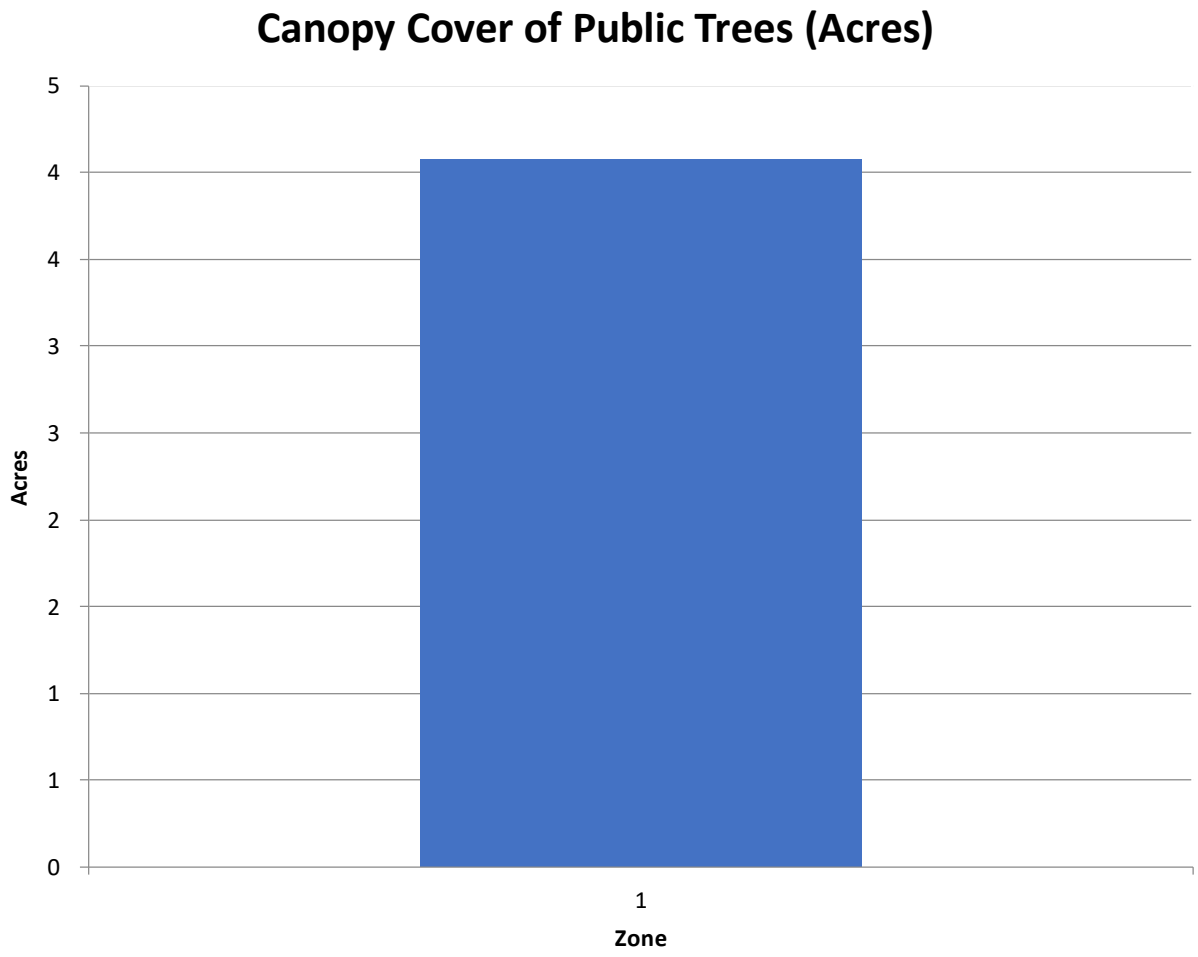


Long Grove
Structural (Woody) Condition of Public Trees by Zone
3/27/2018

Zone	Condition	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Dead or Dying	1	(N/A)	0.42	0.42
	Poor	19	(N/A)	8.02	8.02
	Fair	64	(N/A)	27.00	27.00
	Good	153	(N/A)	64.56	64.56
	Total	237	(N/A)	100.00	100.00

Figure 4: Wood Condition

Figure 5: Canopy of all Trees

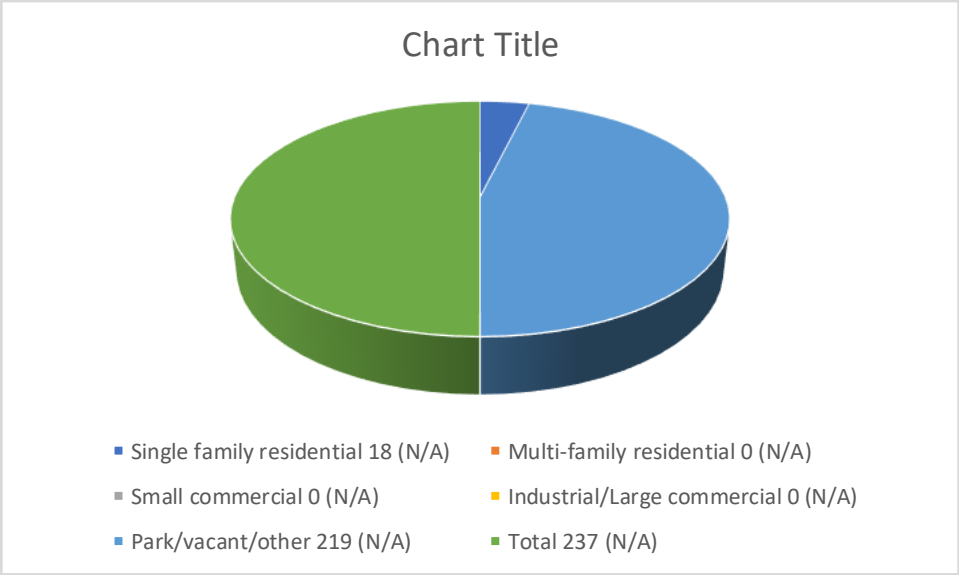


Long Grove
Canopy Cover of Public Trees (Acres)
3/27/2018

Zone	Acres	% of Total Canopy
1	4.08	100.00
Citywide Total	4.08	100.00

Figure 5: Canopy Cover in Acres

Figure 6: Land Use of city/park trees



Long Grove
Land Use of Public Trees by Zone
3/27/2018

Zone	Land Use	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Single family residential	18	(N/A)	7.59	7.59
	Multi-family residential	0	(N/A)	0.00	0.00
	Small commercial	0	(N/A)	0.00	0.00
	Industrial/Large commercial	0	(N/A)	0.00	0.00
	Park/vacant/other	219	(N/A)	92.41	92.41
	Total	237	(N/A)	100.00	100.00

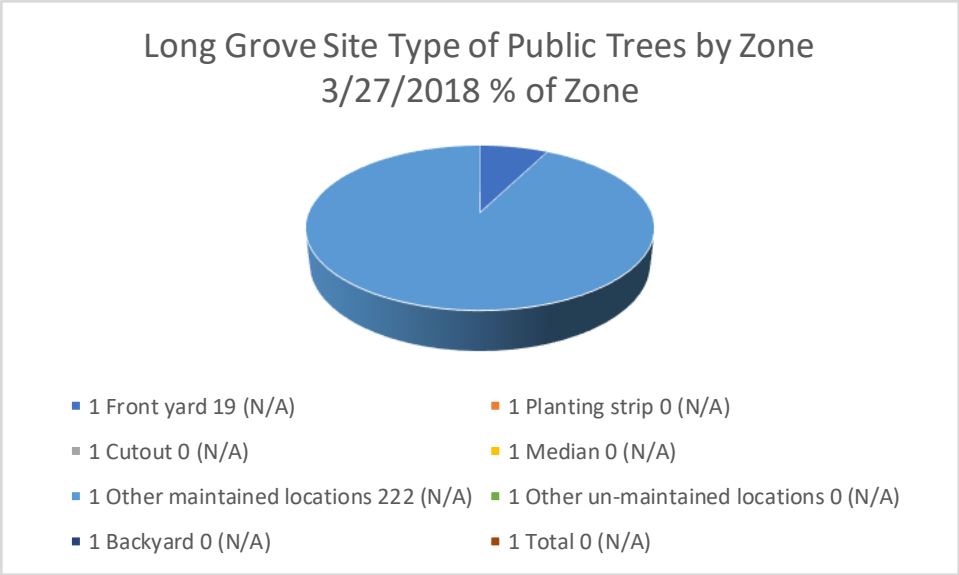


Figure 7: Location of city/park trees

Long Grove
Site Type of Public Trees by Zone
3/27/2018

Zone	Site Type	Tree Count	Standard Error	% of Zone	% of Public Trees
1	Front yard	19	(N/A)	7.51	7.51
	Planting strip	0	(N/A)	0.00	0.00
	Cutout	0	(N/A)	0.00	0.00
	Median	0	(N/A)	0.00	0.00
	Other maintained locations	222	(N/A)	91.73	91.73
	Other un-maintained locations	0	(N/A)	0.00	0.00
	Backyard	0	(N/A)	0.00	0.00
	Total	0	(N/A)	0.00	0.00

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

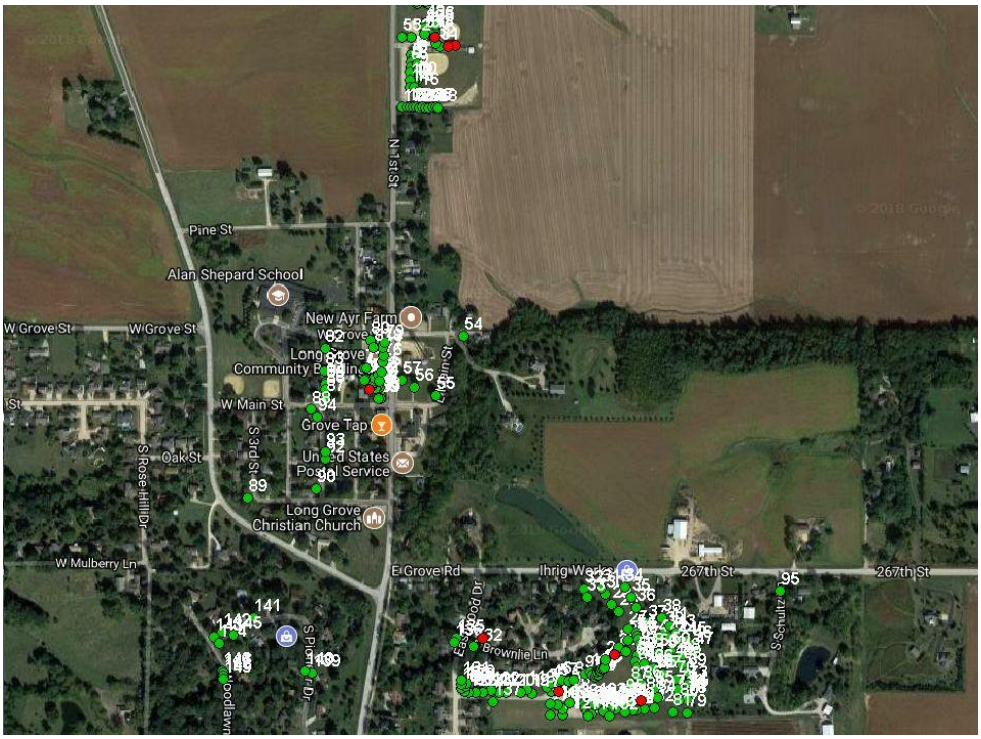


Figure 3: Location of Poor Condition Trees

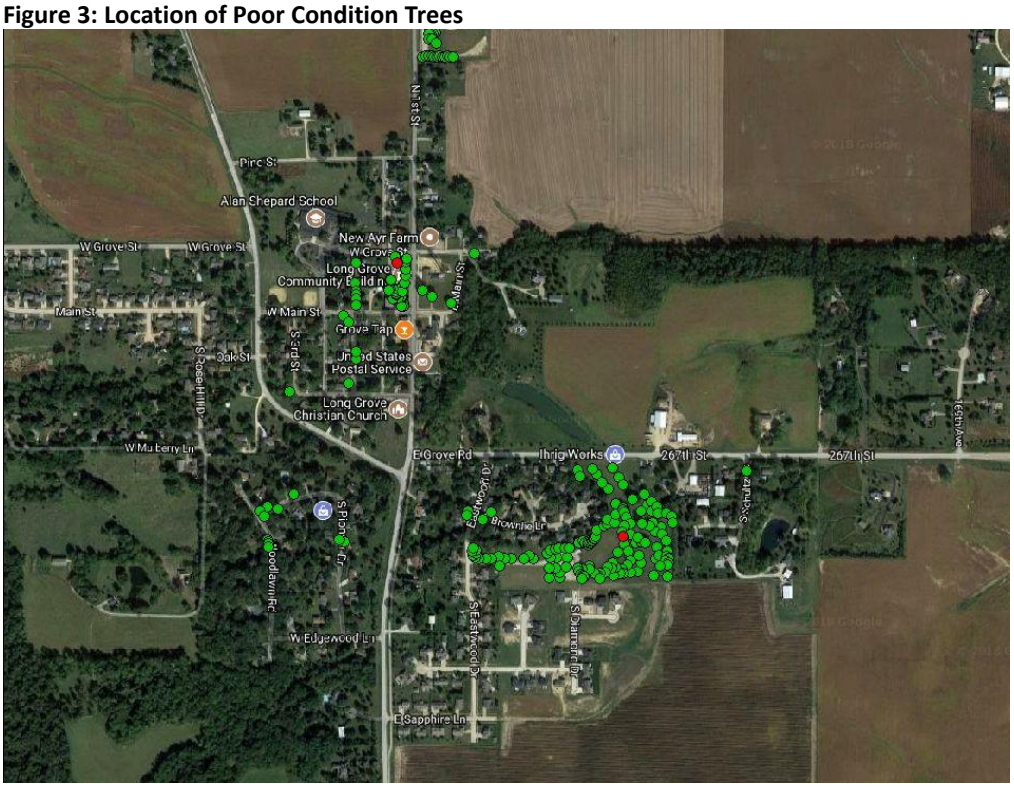
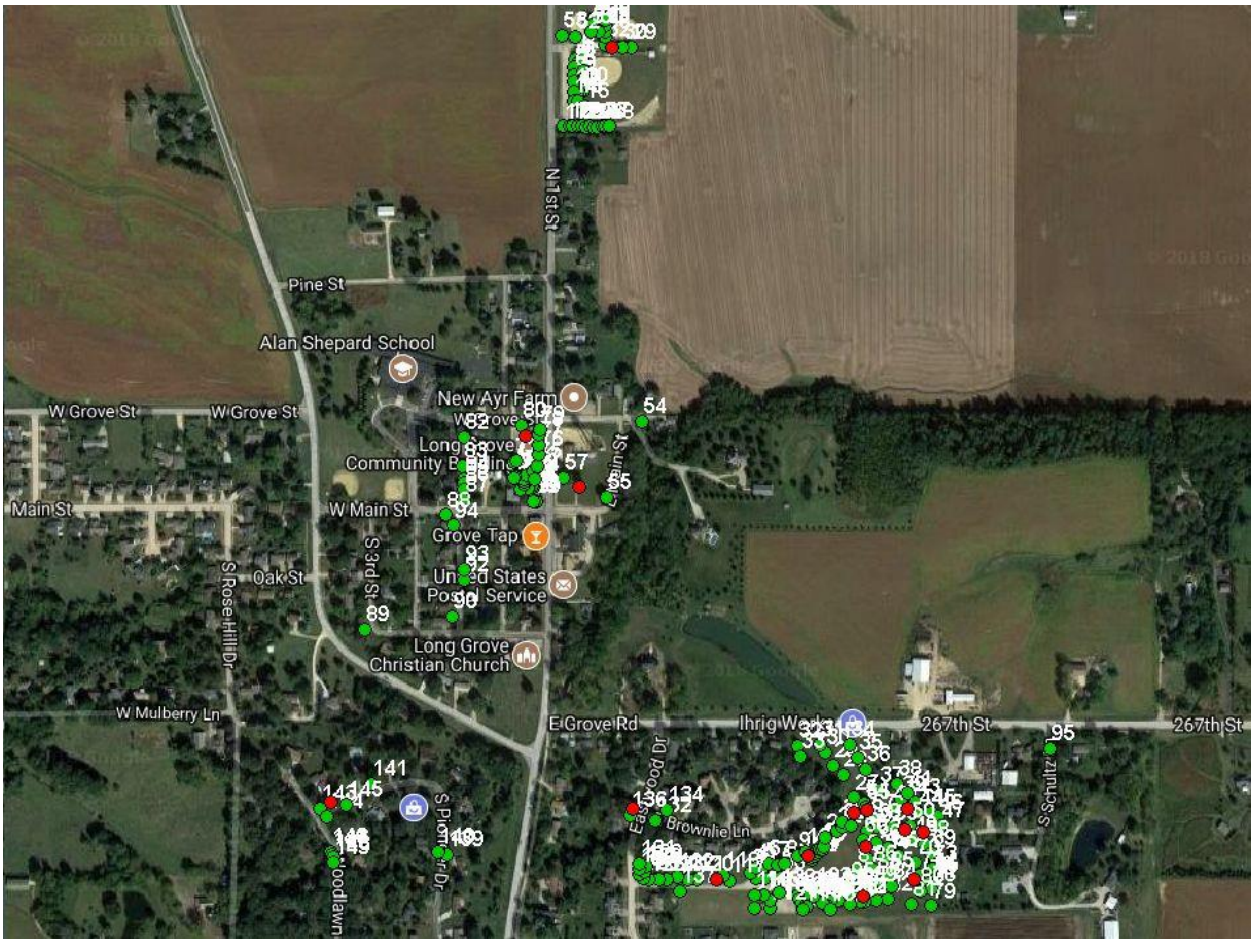


Figure 4: Location of Trees with Recommended Maintenance


Pine St
Alan Shepard School
New Ayr Farm
W Grove St
W Grove St
Main St
W Main St
Oak St
S 3rd St
S Rose Hill Dr
Grove Tap
Long Grove Christian Church
W Mulberry Ln
E Grove Rd
Brownlie Ln
267th St
267th St
S Schultz
N 1st St

Remove

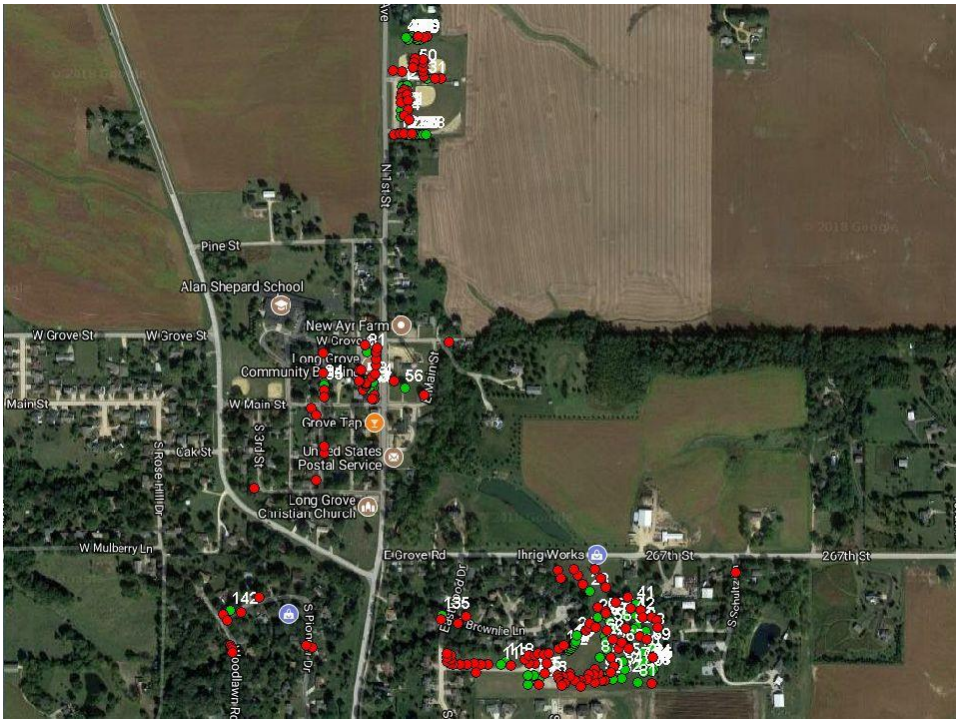


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Long Grove Tree Ordinances

URBAN FORESTRY ORDINANCE

CHAPTER 52
WEEDS AND GRASS

52.01 PUBLIC NUISANCE. Whenever an officer of the City government determines that grasses and/or weeds within 300 feet of established buildings are more than six inches high, those grasses and weeds constitute a public nuisance. Any weeds and/or grasses more than 12 inches in height, whether near a building or not, are likewise a public nuisance.

52.02 OPPORTUNITY TO ABATE. A written notice or a verbal notice shall be given to the landowner when it is determined that weeds and grasses constitute a nuisance. Said landowner shall have seven days in which to cut the weeds and grasses or to request a hearing before the City officer giving notice.

52.03 REQUEST FOR HEARING. The landowner may request a hearing before the officer giving notice, by a verbal or written request addressed to the said officer. The officer may, in his or her discretion, deny an appeal of the hearing to the Council.

52.04 ABATEMENT; FEES. If, after due notice, any weeds and/or grasses have not been cut, the City or its contractor shall cut the weeds and/or grasses and bill the landowner for fees in an amount set by resolution of the Council.

62.06 OBSTRUCTING VIEW AT INTERSECTIONS. It is unlawful to allow any tree, hedge, billboard, or other object to obstruct the view of an intersection by preventing persons from having a clear view of traffic approaching the intersection from cross streets. Any such obstruction is deemed a nuisance and in addition to the standard penalty may be abated in the manner provided by Chapter 50 of this Code of Ordinances.

105.05 OPEN BURNING RESTRICTED. No person shall allow, cause or permit open burning of combustible materials where the products of combustion are emitted into the open air without passing through a chimney or stack without first obtaining a permit and conducting such burning in accordance with the *International Fire Code*.

105.06 SEPARATION OF YARD WASTE REQUIRED. All yard waste shall be separated by the owner or occupant from all other solid waste accumulated on the premises and shall be composted or burned on the premises or placed in acceptable containers and set out for collection. Burning of yard waste is permitted only between 8:00 a.m. and 4:00 p.m. on Wednesdays and Saturdays. All fires must be completely extinguished by 4:00 p.m. on said days. As used in this section, "yard waste" means any debris such as grass clippings, leaves, garden waste, brush and trees. Yard waste does not include tree stumps

135.10 PROPERTY OWNER'S RESPONSIBILITY FOR MAINTENANCE. The abutting property owner shall maintain all property outside the lot and property lines and inside the curb lines upon public streets and shall keep such area in a safe condition, free from nuisances, obstructions, and hazards. In the absence of a curb, such property shall extend from the property line to that portion of the public street used or improved for vehicular

purposes. The abutting property owner shall not be required to remove diseased trees or dead wood on the publicly owned property or right-of-way. Maintenance includes, but is not limited to, timely mowing, trimming trees and shrubs, and picking up litter and debris. The abutting property owner may be liable for damages caused by failure to maintain the publicly owned property or right-of-way.†
(Code of Iowa, Sec. 364.12[2c])