Corwith, IA

2019 Urban Forest Management Plan
Prepared by Emma Hanigan
Iowa Department of Natural Resources

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Executive Summary

Overview

This plan was developed to assist the City of Corwith 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 28% of Corwith'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 2018, 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 76 trees inventoried.

- Corwith's trees provide $4,887 of benefits annually, an average of $65 a tree
- There are over 14 species of trees
- The top three genera are: Maple 37%, Ash 28%, and Spruce 11%
- 7% of trees are in need of some type of management
- No 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.

- 2 of the 21 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: any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.
- Check ash trees with a visual survey yearly
- Current funding levels are not enough to address emerald ash borer– Suggestion: request a budget to address pest and annually and apply for grants to plant replacement trees

Introduction

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

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

Inventory

In 2018, a tree inventory was conducted that included 100% of the city owned trees on both streets and parks. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

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

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

Inventory Results

The data collected for the 75 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

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Corwith's trees reduce energy related costs by approximately $3,711 annually (Appendix A, Table 1). These savings are both in Electricity (17.9 MWh) and in Natural Gas (2,400.9 Therms).

Annual Stormwater Benefits

Corwith's trees intercept about 232,888 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $6,311 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 Corwith, it is estimated that trees remove 230.9 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 $647 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Corwith, trees sequester about 50,884 lbs of carbon a year with an associated value of $382 (Appendix A, Table 5). In addition, the trees store 910,796 lbs of carbon, with a yearly benefit of $6,831 (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. Corwith receives $4,887 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, Corwith's trees provide $4,887of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 75 trees in Corwith provide approximately $65 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Corwith has over 14 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Maple	28	37%
Ash	21	28%

Spruce	8	11%
Apple (crabapple)	6	8%
Birch	3	4%
Linden	3	4%
Honeylocust	2	3%
Walnut	1	1%
Mulberry	1	1%
White Cedar	1	1%
Elm	1	1%

Age Class

Most of Corwith's trees (52%) are between 6 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Corwith's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Corwith indicate that 93% of the trees are in good health, with none of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3).Additionally, 21% of Corwith'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 3% of the population. This 3% 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	5	7%
Crown Raising	0	0%
Tree Staking	0	0%
Tree Removal	0	0%
Crown Reduction	0	0%

Canopy Cover

The total canopy with both private and public trees is 4%, 41 acres. The canopy cover included in the Corwith inventory includes approximately 2 acres (Appendix A, Figure 4). If the City's Canopy goal is to increase canopy by 3%, in 30 years, it is estimated that 69 trees need to be planted annually on public and private lands.

Land Use and Location

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

Land Use	
Single family residential	15%
Multi-family residential	0%
Small commercial	0%
Industrial/Large commercial	0%
Park/vacant/other	85%

Location	
Planting strip	2%
Other maintained locations	0%
Cutout (surrounded by pavement)	0%
Front yard	73%

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

Corwith has no 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. 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.

Poor tree species

Ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). There are a total of 21 ash trees, and 2 of those have signs and symptoms that have been associated with EAB. In addition, none of the ash trees that are in poor health.

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 Corwith.

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 (37%) (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: any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree decline and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Six Year Maintenance Plan if Budget is around $1000 annually

Year 1

- Removal: none
- Planting and Replacement: 1 tree
- Trimming: 5 trees
- Visual Survey for signs and symptoms of EAB

Year 2

- Removal: 2 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
- Young Tree Pruning & Maintenance:
- Visual Survey for signs and symptoms of EAB

Year 3

- Removal: none
- Planting and Replacement: 1 tree
- Young Tree Pruning & Maintenance: Trim trees in need in 1/3 of the city
- Visual Survey for signs and symptoms of EAB

Year 4

- Removal: 2 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
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

Year 5
Removal: none
Planting and Replacement: 1 tree
Young Tree Pruning & Maintenance: Trim trees in need in 1/3 of the city
Visual Survey for signs and symptoms of EAB

Year 6
Removal: 2 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
Young Tree Pruning & Maintenance:
Visual Survey for signs and symptoms of EAB

*Reduction of ash over 6 years: Approximately 6 ash trees removed (approximately 29% of ash). It will take approximately 20 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.

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. In order to stay ahead of this hard to detect beetle, the USDA is attempting to contain the beetle before it spreads beyond its known positions by regulating articles.

A regulated article under the USDA's quarantine includes any of the following items:

- emerald ash borer
- firewood of all hardwood species (for example ash, oak, maple and hickory)

- nursery stock and green lumber of ash
- any other ash material, whether living, dead, cut or fallen, including logs, stumps, roots, branches, as well as composted and not composted chips of the genus ash (Mountain ash is not included)

In addition, any other article, product or means of conveyance not listed above may be designated as a regulated article if a USDA inspector determines that it presents a risk of spreading EAB once a quarantine is in effect for your county.

Wood Disposal

A very important aspect of planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include any fruit-bearing tree or any tree of the kinds commonly known as 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. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists on private property and that 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 fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Budget

Estimates if Budget is abour $1,000 annually
Total $6000 over 6 years ($1,000/year)

FY 2019 Budget
Removal: $0
Routine trimming: $900
Planting: $100

FY 2020 Budget
Removal: $700
*Or saving for ash tree treatment and/or future ash removal
Planting: $200
Routine trimming: $0

FY 2021 Budget
Removal: $0
Routine trimming: $900
Planting: $100

FY 2022 Budget
Removal: $700
*Or saving for ash tree treatment and/or future ash removal
Planting: $200
Routine trimming: $0

FY 2023 Budget
Removal: $0
Routine trimming: $900
Planting: $100

FY 2024 Budget
Removal: $700
*Or saving for ash tree treatment and/or future ash removal
Planting: $200
Routine trimming: $0

*Reduction of ash over 6 years: approximately 6 ash trees removed (approximately 29% of ash). **It will take approximately 20 years to remove all ash with the current budget.**

Budgeting for Emerald Ash Borer
EAB could potentially kill all ash trees in Corwith within 4 years of its arrival. To remove all ash trees within 6 years the increase funding needed would be about $3,500 a year. Additionally, it is recommended that Corwith apply for grants to fund replacement trees. Utility Company grants are

usually between $500 and $5,000 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 for $1,200, and Corwith would still need to find $9,100 for removal. Alternatively, if there are 15 treatable trees, it would cost approximately $2,250 a year for treatment and leave $4,200 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 Corwith. 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

Corwith

Annual Energy Benefits of Public Trees

1/16/2019

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	6.6	502	898.1	880	1,383	(N/A)	28.0	37.3	65.84
Silver maple	5.9	450	762.9	748	1,197	(N/A)	26.7	32.3	59.87
Apple	0.7	52	107.6	105	157	(N/A)	8.0	4.2	26.17
Spruce	0.9	67	118.3	116	183	(N/A)	8.0	4.9	30.47
Sugar maple	1.0	74	135.6	133	207	(N/A)	6.7	5.6	41.46
Littleleaf linden	0.4	27	48.9	48	75	(N/A)	4.0	2.0	25.07
Blue spruce	0.3	19	30.4	30	49	(N/A)	2.7	1.3	24.51
Paper birch	0.5	40	76.2	75	115	(N/A)	2.7	3.1	57.32
Honeylocust	0.7	56	94.8	93	149	(N/A)	2.7	4.0	74.28
Elm	0.1	7	13.7	13	21	(N/A)	1.3	0.6	20.64
River birch	0.0	0	0.8	1	1	(N/A)	1.3	0.0	1.10
Northern white cedar	0.0	2	4.0	4	6	(N/A)	1.3	0.2	5.61
Mulberry	0.0	2	3.8	4	5	(N/A)	1.3	0.1	5.40
Norway maple	0.1	8	16.9	17	24	(N/A)	1.3	0.7	24.47
Red maple	0.0	3	5.2	5	8	(N/A)	1.3	0.2	7.85
Maple	0.3	19	30.1	29	49	(N/A)	1.3	1.3	48.95
Black walnut	0.4	29	53.7	53	82	(N/A)	1.3	2.2	82.02
Total	17.9	1,358	2,400.9	2,353	3,711	(N/A)	100.0	100.0	49.48

Table 2: Annual Stormwater Benefits

Corwith

Annual Stormwater Benefits of Public Trees

1/16/2019

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	88,911	2,409	(N/A)	28.0	38.2	114.74
Silver maple	83,536	2,264	(N/A)	26.7	35.9	113.19
Apple	2,899	79	(N/A)	8.0	1.2	13.09
Spruce	17,815	483	(N/A)	8.0	7.6	80.46
Sugar maple	11,188	303	(N/A)	6.7	4.8	60.64
Littleleaf linden	2,181	59	(N/A)	4.0	0.9	19.70
Blue spruce	3,089	84	(N/A)	2.7	1.3	41.85
Paper birch	5,181	140	(N/A)	2.7	2.2	70.21
Honeylocust	9,370	254	(N/A)	2.7	4.0	126.96
Elm	608	16	(N/A)	1.3	0.3	16.47
River birch	12	0	(N/A)	1.3	0.0	0.33
Northern white cedar	213	6	(N/A)	1.3	0.1	5.77
Mulberry	69	2	(N/A)	1.3	0.0	1.86
Norway maple	586	16	(N/A)	1.3	0.3	15.88
Red maple	137	4	(N/A)	1.3	0.1	3.72
Maple	1,604	43	(N/A)	1.3	0.7	43.46
Black walnut	5,491	149	(N/A)	1.3	2.4	148.79
Citywide total	232,888	6,311	(N/A)	100.0	100.0	84.15

Table 3: Annual Air Quality Benefits

Corwith

Annual Air Quality Benefits of Public Trees

1/16/2019

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Green ash	12.7	2.0	5.8	0.6	67	31.5	4.6	4.4	30.0	197	0.0	0	91.5	263	(N/A)	28.0	12.53
Silver maple	14.0	2.4	6.9	0.6	76	27.8	4.1	3.9	26.8	174	-7.5	-28	79.0	222	(N/A)	26.7	11.09
Apple	0.8	0.1	0.4	0.0	4	3.4	0.5	0.5	3.1	21	0.0	0	8.8	25	(N/A)	8.0	4.18
Spruce	2.1	0.4	1.7	0.3	14	4.2	0.6	0.6	4.0	26	-8.3	-31	5.5	9	(N/A)	8.0	1.45
Sugar maple	1.5	0.3	0.7	0.1	8	4.7	0.7	0.6	4.4	29	-1.2	-4	11.8	33	(N/A)	6.7	6.56
Littleleaf linden	0.2	0.0	0.1	0.0	1	1.7	0.3	0.2	1.6	11	-0.1	-1	4.1	12	(N/A)	4.0	3.84
Blue spruce	0.4	0.1	0.3	0.0	3	1.2	0.2	0.2	1.1	7	-1.1	-4	2.4	6	(N/A)	2.7	2.89
Paper birch	0.5	0.1	0.3	0.0	3	2.5	0.4	0.4	2.4	16	0.0	0	6.6	19	(N/A)	2.7	9.34
Honeylocust	1.9	0.3	0.8	0.1	10	3.4	0.5	0.5	3.3	22	-1.5	-6	9.3	26	(N/A)	2.7	12.87
Elm	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)	1.3	2.99
River birch	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)	1.3	0.14
Northern white cedar	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	-0.1	0	0.2	1	(N/A)	1.3	0.56
Mulberry	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	1.3	0.71
Norway maple	0.1	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	1.3	3.47
Red maple	0.0	0.0	0.0	0.0	0	0.2	0.0	0.0	0.2	1	0.0	0	0.4	1	(N/A)	1.3	1.12
Maple	0.3	0.1	0.2	0.0	2	1.2	0.2	0.2	1.2	7	-0.1	0	3.1	9	(N/A)	1.3	8.75
Black walnut	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	1.3	15.71
Citywide total	35.3	5.9	17.7	1.8	192	84.9	12.4	11.8	81.0	530	-19.9	-75	230.9	647	(N/A)	100.0	8.62

Table 4: Annual Carbon Stored

Corwith

Stored CO2 Benefits of Public Trees

5/1/2019

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	420,438	3,153	(N/A)	28.0	46.2	150.16
Silver maple	330,528	2,479	(N/A)	26.7	36.3	123.95
Apple	13,411	101	(N/A)	8.0	1.5	16.76
Spruce	20,056	150	(N/A)	8.0	2.2	25.07
Sugar maple	44,922	337	(N/A)	6.7	4.9	67.38
Littleleaf linden	5,644	42	(N/A)	4.0	0.6	14.11
Blue spruce	2,236	17	(N/A)	2.7	0.2	8.39
Paper birch	16,915	127	(N/A)	2.7	1.9	63.43
Honeylocust	24,490	184	(N/A)	2.7	2.7	91.84
Elm	1,035	8	(N/A)	1.3	0.1	7.76
River birch	17	0	(N/A)	1.3	0.0	0.13
Northern white cedar	38	0	(N/A)	1.3	0.0	0.29
Mulberry	178	1	(N/A)	1.3	0.0	1.33
Norway maple	1,101	8	(N/A)	1.3	0.1	8.26
Red maple	218	2	(N/A)	1.3	0.0	1.64
Maple	3,624	27	(N/A)	1.3	0.4	27.18
Black walnut	25,943	195	(N/A)	1.3	2.8	194.57
Citywide total	910,796	6,831	(N/A)	100.0	100.0	91.08

Table 5: Annual Carbon Sequestered

Corwith

Annual CO_2 Benefits of Public Trees

1/16/2019

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	15,186	114	-2,018	-73	-16	11,104	83	24,200	181	(N/A)	28.0	31.7	8.64
Silver maple	24,187	181	-1,587	-65	-12	9,942	75	32,476	244	(N/A)	26.7	42.6	12.18
Apple	723	5	-64	-10	-1	1,140	9	1,788	13	(N/A)	8.0	2.3	2.24
Spruce	1,124	8	-96	-16	-1	1,478	11	2,490	19	(N/A)	8.0	3.3	3.11
Sugar maple	2,255	17	-216	-11	-2	1,644	12	3,672	28	(N/A)	6.7	4.8	5.51
Littleleaf linden	961	7	-27	-4	0	604	5	1,533	12	(N/A)	4.0	2.0	3.83
Blue spruce	181	1	-11	-4	0	426	3	592	4	(N/A)	2.7	0.8	2.22
Paper birch	1,319	10	-81	-5	-1	883	7	2,115	16	(N/A)	2.7	2.8	7.93
Honeylocust	2,972	22	-118	-5	-1	1,230	9	4,078	31	(N/A)	2.7	5.3	15.29
Elm	209	2	-5	-1	0	159	1	361	3	(N/A)	1.3	0.5	2.71
River birch	5	0	0	0	0	7	0	12	0	(N/A)	1.3	0.0	0.09
Northern white cedar	18	0	0	-1	0	38	0	55	0	(N/A)	1.3	0.1	0.41
Mulberry	38	0	-1	-1	0	37	0	74	1	(N/A)	1.3	0.1	0.55
Norway maple	224	2	-5	-1	0	176	1	393	3	(N/A)	1.3	0.5	2.95
Red maple	39	0	-1	-1	0	60	0	97	1	(N/A)	1.3	0.1	0.73
Maple	483	4	-17	-2	0	431	3	895	7	(N/A)	1.3	1.2	6.71
Black walnut	960	7	-125	-4	-1	650	5	1,481	11	(N/A)	1.3	1.9	11.11
Citywide total	50,884	382	-4,373	-205	-34	30,008	225	76,314	572	(N/A)	100.0	100.0	7.63

Table 6: Annual Social and Aesthetic Benefits

Corwith

Annual Aesthetic/Other Benefits of Public Trees

1/16/2019

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	1,139	(N/A)	28.0	23.3	54.24
Silver maple	1,918	(N/A)	26.7	39.3	95.92
Apple	41	(N/A)	8.0	0.8	6.85
Spruce	282	(N/A)	8.0	5.8	47.08
Sugar maple	239	(N/A)	6.7	4.9	47.77
Littleleaf linden	117	(N/A)	4.0	2.4	39.16
Blue spruce	50	(N/A)	2.7	1.0	25.23
Paper birch	115	(N/A)	2.7	2.4	57.69
Honeylocust	778	(N/A)	2.7	15.9	388.90
Elm	29	(N/A)	1.3	0.6	28.56
River birch	3	(N/A)	1.3	0.1	2.74
Northern white cedar	7	(N/A)	1.3	0.1	6.83
Mulberry	2	(N/A)	1.3	0.0	2.06
Norway maple	26	(N/A)	1.3	0.5	26.22
Red maple	7	(N/A)	1.3	0.1	7.28
Maple	66	(N/A)	1.3	1.3	65.89
Black walnut	67	(N/A)	1.3	1.4	66.60
Citywide total	4,887	(N/A)	100.0	100.0	65.16

Table 7: Summary of Benefits in Dollars

Corwith

Total Annual Benefits of Public Trees by Species ($)

1/16/2019

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Green ash	1,383	181	263	2,409	1,139	5,376	(N/A)	33.3
Silver maple	1,197	244	222	2,264	1,918	5,845	(N/A)	36.2
Apple	157	13	25	79	41	315	(N/A)	2.0
Spruce	183	19	9	483	282	975	(N/A)	6.0
Sugar maple	207	28	33	303	239	810	(N/A)	5.0
Littleleaf linden	75	12	12	59	117	275	(N/A)	1.7
Blue spruce	49	4	6	84	50	193	(N/A)	1.2
Paper birch	115	16	19	140	115	405	(N/A)	2.5
Honeylocust	149	31	26	254	778	1,237	(N/A)	7.7
Elm	21	3	3	16	29	71	(N/A)	0.4
River birch	1	0	0	0	3	4	(N/A)	0.0
Northern white cedar	6	0	1	6	7	19	(N/A)	0.1
Mulberry	5	1	1	2	2	11	(N/A)	0.1
Norway maple	24	3	3	16	26	73	(N/A)	0.5
Red maple	8	1	1	4	7	21	(N/A)	0.1
Maple	49	7	9	43	66	174	(N/A)	1.1
Black walnut	82	11	16	149	67	324	(N/A)	2.0
Citywide Total	3,711	572	647	6,311	4,887	16,128	(N/A)	100.0

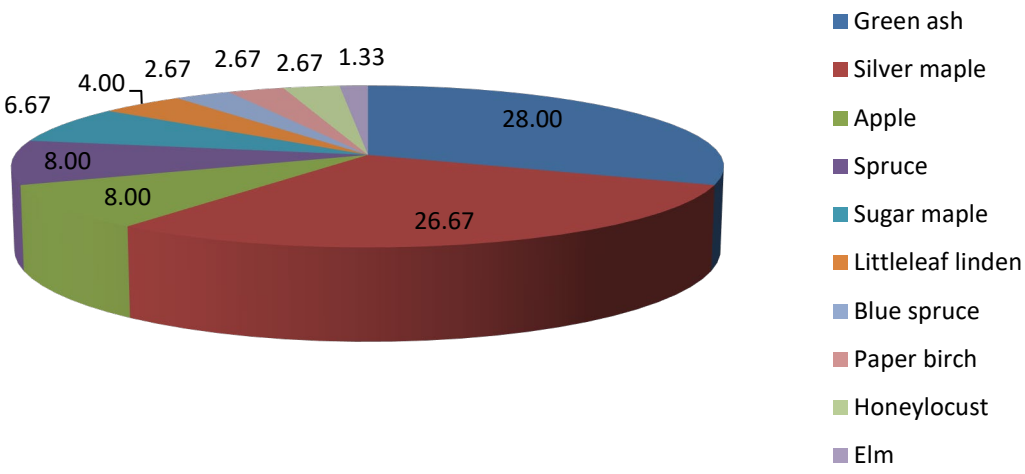

Figure 1: Species Distribution

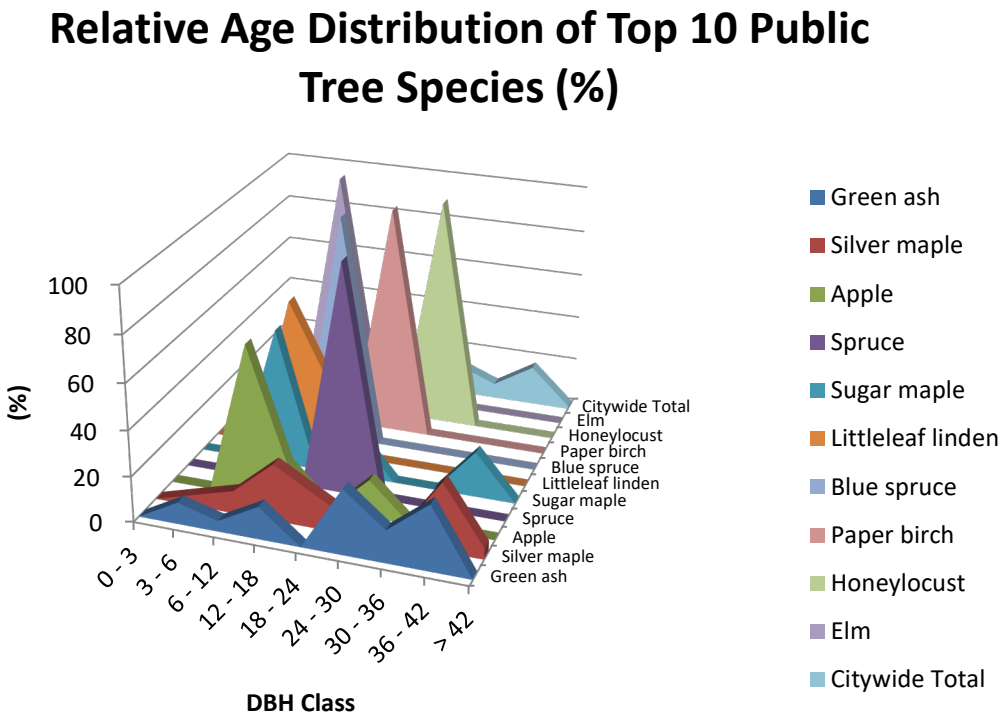

Figure 2: Relative Age Class

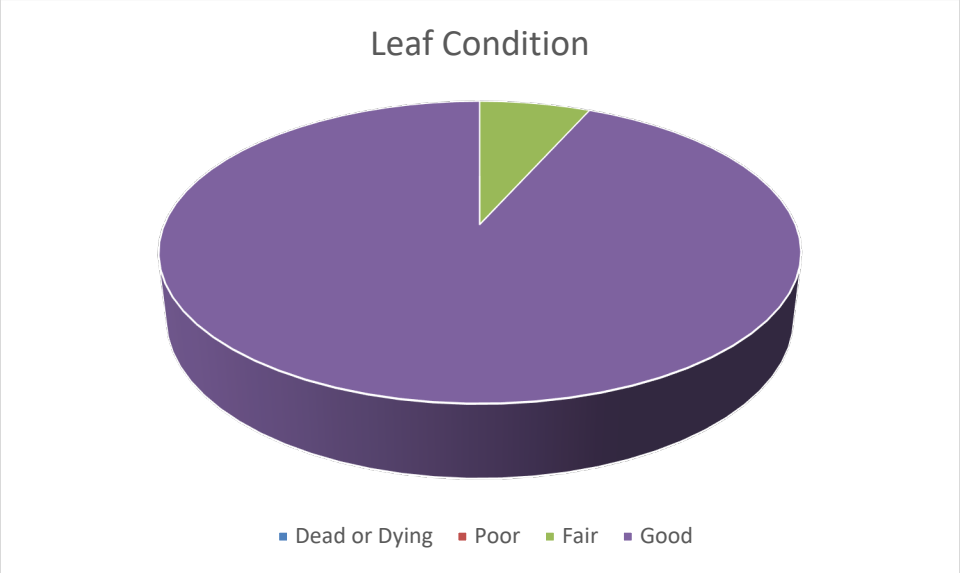

Figure 3: Foliage Condition

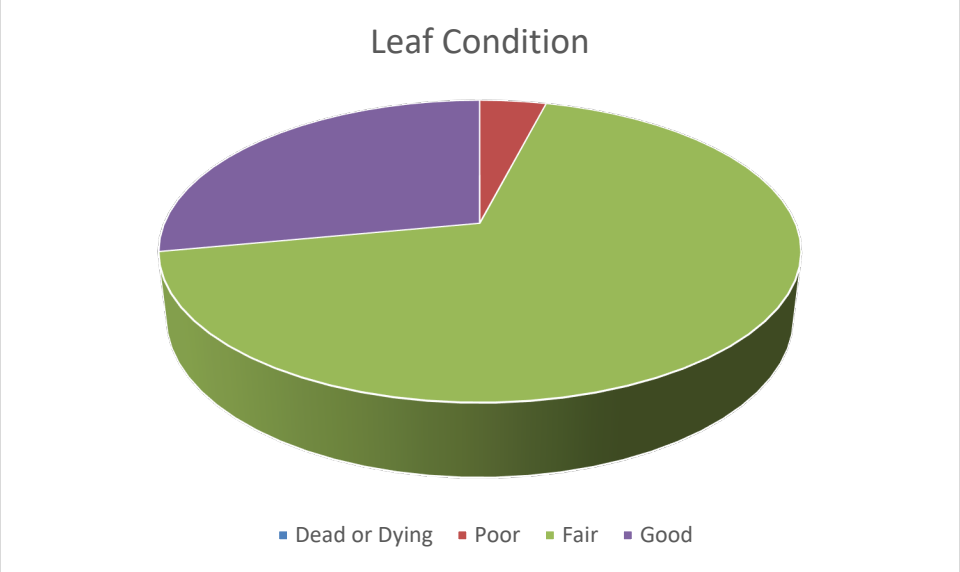

Figure 4: Wood Condition

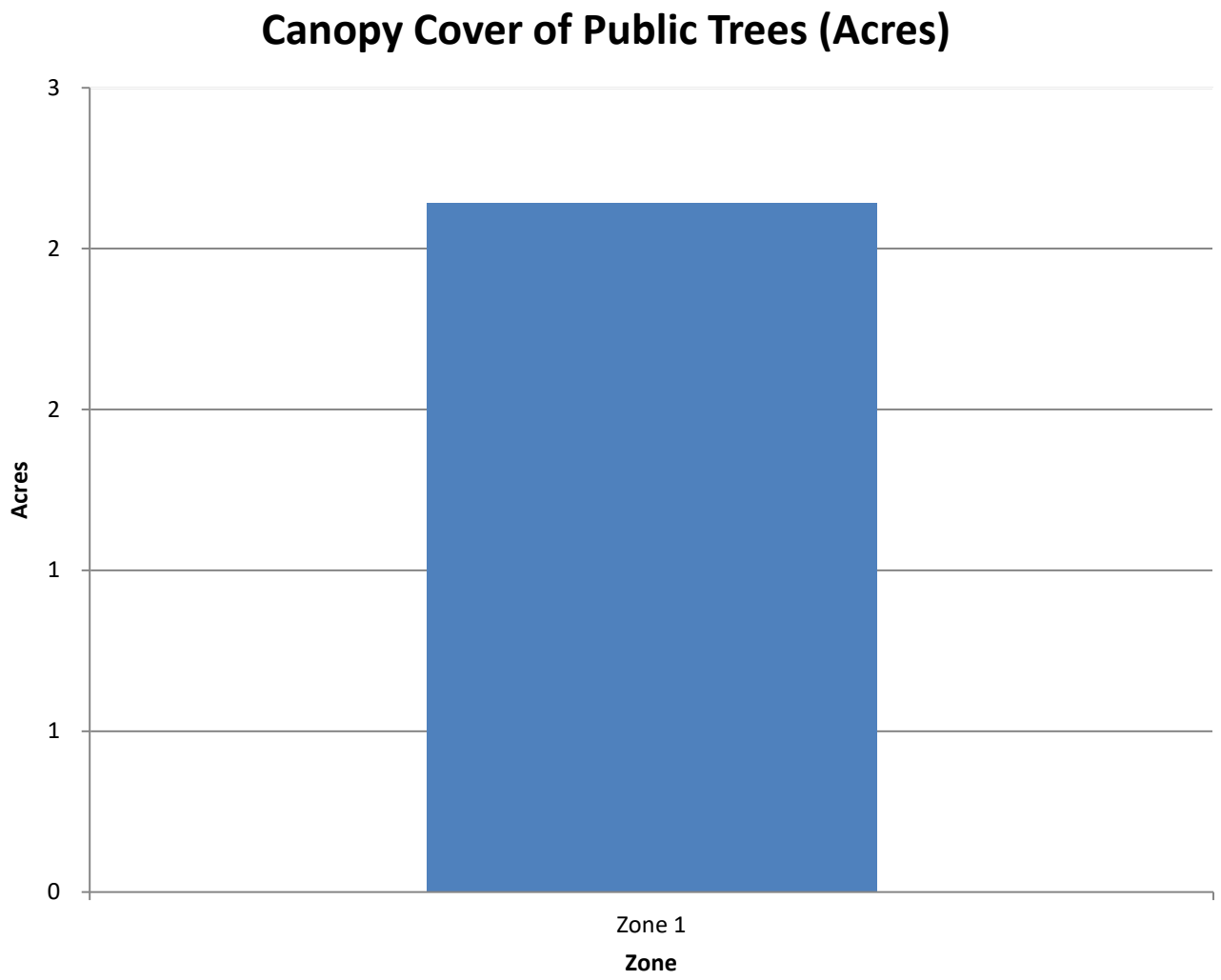

Figure 5: Canopy Cover in Acres

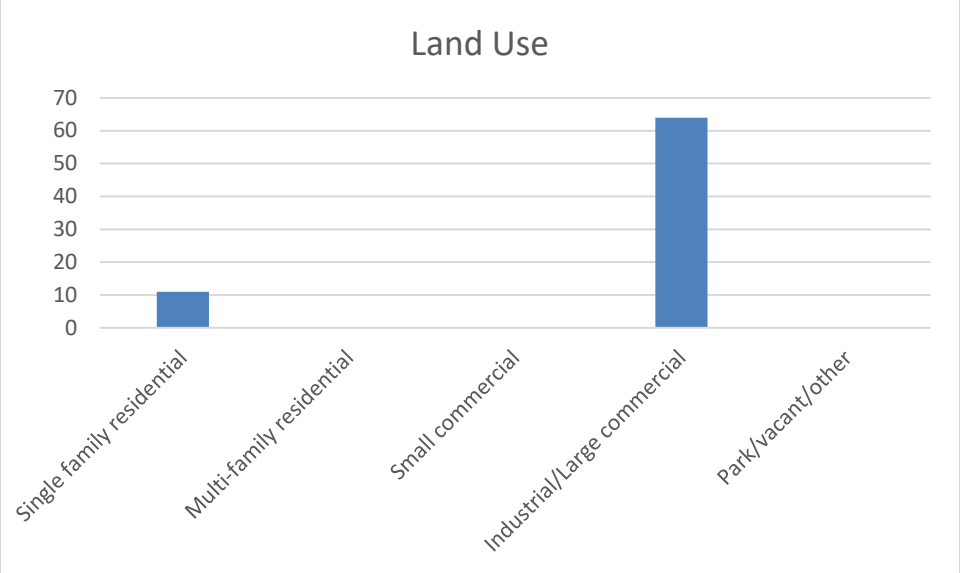

Figure 6: Land Use of city/park trees

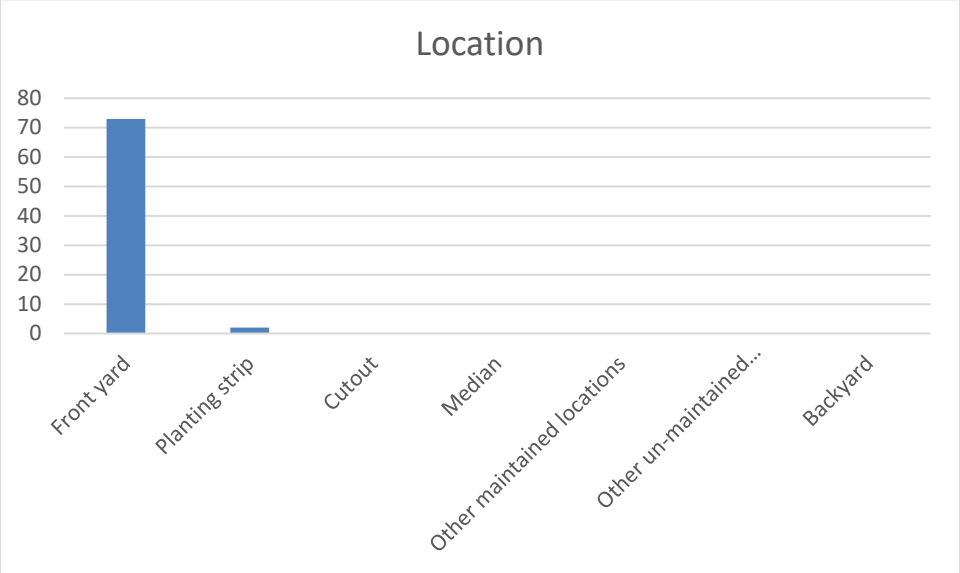

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

Figure 1: Location of Ash Trees

Figure 2: Location of EAB symptoms

Figure 3: Location of Poor Condition Trees

NONE

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***

CHAPTER 151

TREES

151.01 DEFINITION. For use in this chapter, "parking" means that part of the street, avenue or highway in the City not covered by sidewalk and lying between the lot line and the curb line; or, on unpaved streets, that part of the street, avenue or highway lying between the lot line and that portion of the street usually traveled by vehicular traffic.

151.02 PLANTING RESTRICTIONS. No tree shall be planted on any City property without first obtaining approval from the City Council.

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

2. Spacing. Trees shall not be planted on any parking which is less than nine (9) feet in width, or contains less than eighty-one (81) square feet of exposed soil surface per tree. Trees shall not be planted closer than twenty (20) feet from street intersections (property lines extended) and ten (10) feet from driveways. If it is at all possible trees should be planted inside the property lines and not between the sidewalk and the curb. Trees must be planted ten (10) feet from the property line.

3. Prohibited Trees. No person shall plant in any street any fruit-bearing tree or any tree of the kinds commonly known as cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

(Ord. 186 – Dec. 05 Supp.)

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least fifteen (15) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

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

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is 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.

151.05 DISEASE CONTROL. Any dead, diseased or damaged tree or shrub which may harbor serious insect or disease pests or disease injurious to other trees is hereby declared to be a nuisance.

151.06 INSPECTION AND REMOVAL. The Council shall inspect or cause to be inspected any trees or shrubs in the City reported or suspected to be dead, diseased or damaged, and such trees and shrubs shall be subject to the following:

1. City Property. If it is determined that any such condition exists on any public property, including the strip between the curb and the lot line of private property, the Council may cause such condition to be corrected by treatment or removal. The Council may also order the removal of any trees on the streets of the City which interfere with the making of improvements or with travel thereon.

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that 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 fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

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

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