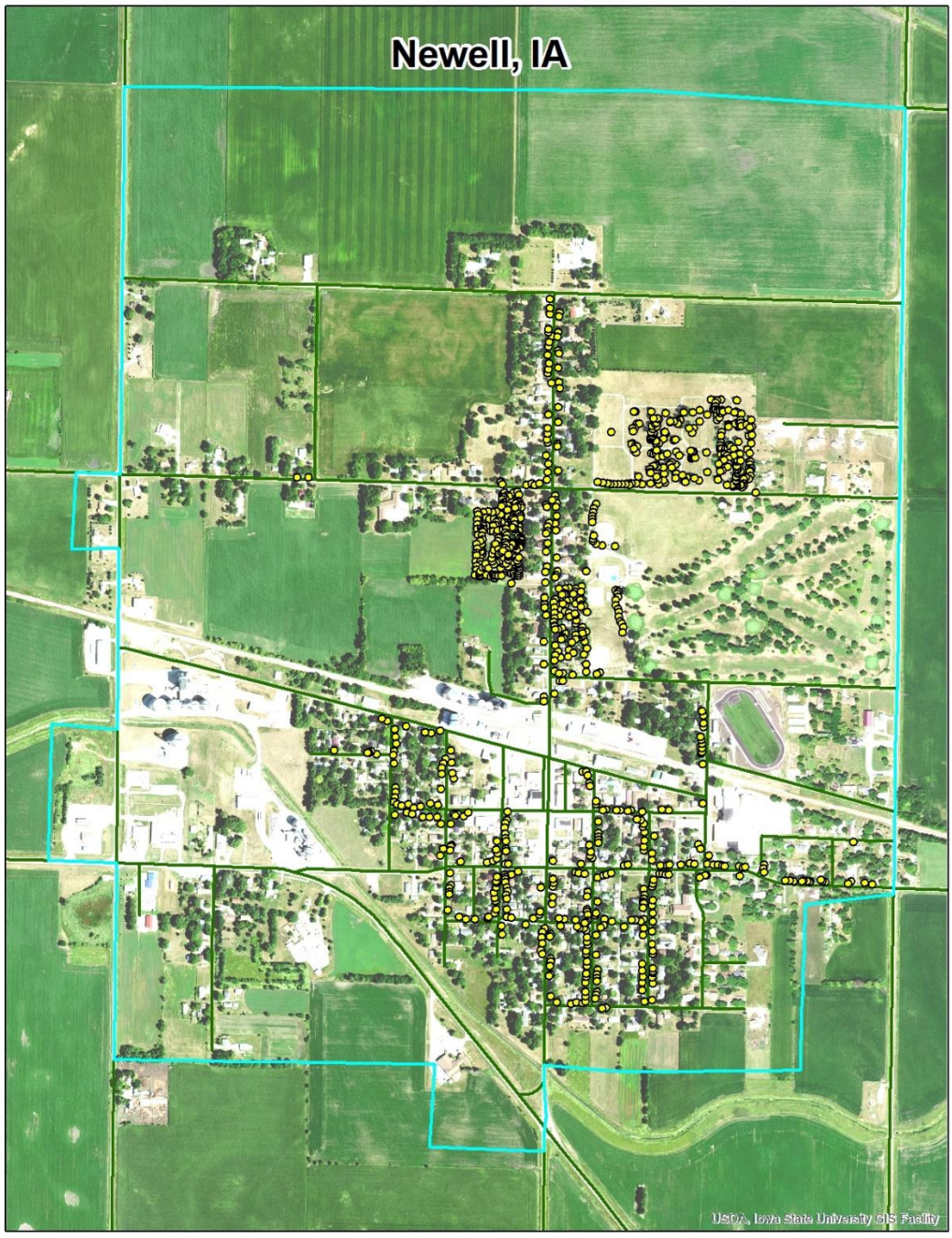
Newell, IA



2020 Urban Forest Management Plan
Prepared by Vince Grube
Iowa Department of Natural Resources

Table of Contents

Executive Summary

Overview

This plan was developed to assist the City of Newell 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 17% of Newell'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 2020, 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 952 trees inventoried.

- Newell's trees provide $162,644 of benefits annually, an average of $170.84 a tree
- There are over 50 species of trees from more than 29 genera
- The top three genera are: Maple 30%, Cedar 20%, and Ash 17%
- 15% of trees are in need of some type of management
- 55 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 55 trees needing removal, 29 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*
- 36 of the 157 ash trees should be carefully examined, as they have at least two symptoms that could be related to an EAB infestation.
- All trees should be pruned on a routine schedule- one third of the city every other year
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut
- Check ash trees with a visual survey yearly
- With the current budget it could take 28 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 Newell 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 Newell, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

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

Inventory

In 2020, 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 952 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. Newell's trees reduce energy related costs by approximately $40,585 annually (Appendix A, Table 1). These savings are both in Electricity (195.6 MWh) and in Natural Gas (26,263.9 Therms).

Annual Stormwater Benefits

Newell's trees intercept about 2,468,509 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $66,897 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 Newell, it is estimated that trees remove 2,239 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 $5,998 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Newell, trees sequester about 447,195 lbs of carbon a year with an associated value of $3,354 (Appendix A, Table 5). In addition, the trees store 7,403,846 lbs of carbon, with a yearly benefit of $55,529 (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. Newell receives $43,633 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, Newell's trees provide $162,644 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 952 trees in Newell provide approximately $170.84 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Newell has over 50 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Genus	Count	Percent
Maple	287	30%
Cedar	188	20%
Ash	157	17%
Spruce	103	11%
Basswood	44	5%
Hackberry	27	3%
Birch	24	3%
Apple	22	2%
Sycamore	14	1%
Walnut	12	1%
Locust	10	1%
Lilac	10	1%
Pine	9	1%
Oak	9	1%
Ketucky Coffeetree	5	1%
Elm	3	<1%
Ginkgo	3	<1%
Mountain Ash	3	<1%
Pear	3	<1%
Cherry	2	<1%
Cottonwood	2	<1%
Catalpa	2	<1%
Conifer Evergreen S/M/L	2	<1%
Redbud	2	<1%
Broadleaf deciduous S/M/L	1	<1%
Broadleaf Evergreen Large	1	<1%
Aspen	1	<1%
Magnolia	1	<1%
Yellowwood	1	<1%

Age Class

Most of Newell's trees (45%) are between 6 and 18 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), which can be observed in Newell's tree stand. However, while the majority of Newell's trees are less than 18 inches in diameter, only around 6% of the trees are between 0 and 6 inches. It is recommended that Newell continue planting new trees to bring these numbers up in order to prepare for natural mortality of larger trees and to maintain canopy cover.

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 Newell indicate that 87% of the trees are in good health, with only 3% of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 24% of Newell'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 13% of the population. This 13% 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	69	7%
Crown Raising	11	1%
Tree Staking	1	<1%
Tree Removal	55	6%
Crown Reduction	4	<1%

Canopy Cover

The total canopy with both private and public trees is 13%, 108.19 acres. The canopy cover included in the Newell inventory includes approximately 21.43 acres (Appendix A, Figure 4). The City's Canopy goal is to increase canopy by 3%, in 30 years. To achieve this goal it is estimated that 59 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Newell'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	41%
Park/vacant/other	57%
Industrial/Large commercial	<1%
Small commercial	1%
Multifamily residential	1%

Location	
Planting strip	39%
Front yard	61%

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

Newell has 9 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 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the six year maintenance plan at the end

of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 131 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 55 removals, 16 are ash trees. There are a total of 157 ash trees, and 36 of those have signs and symptoms that have been associated with EAB. In addition, there are 112 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 Newell.

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 (30%) and cedar (20%) (Appendix A, Figure 1). Neither should be planted until these percentages 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 or poplar, as outlined in section 9.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 9.02 (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 with No Additional Funding

Year 1

Removal: 8 largest critical concern trees
Planting and Replacement: 9 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 4 additional ash trees with poor health
*Or saving for ash tree treatment and/or future ash removal
Planting and Replacement: 6 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: 8 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: 9 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: 6 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: 7 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: 8 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: 9 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: 6 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: 7 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: Approximately 16 ash trees removed (approximately 10% of ash). It will take approximately 28 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 $22,500 a year. If the budget were increased to $10,000 a year all ash could be removed in 19 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. 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 9.02 (Appendix C). The new plantings will be a diverse mix and will not include cottonwood or poplar.

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 states "The city shall notify the owner of any tree, shrub, bush or other woody vegetation located on private property to remove the tree, bush, shrub or other woody vegetation when such plant constitutes a public nuisance or is a hazard to person or property, or harbors insects, other pests, or disease. The city shall notify in writing the property owner of the property on which such tree, shrub, bush or other woody vegetation is located of the necessity to remove same. Upon such notice, the owner shall remove the planting at the owner's expense within thirty (30) days. Notice shall either be given by personal service or by certified mail with return receipt barring the signature of the property owner. In the event the property owner fails to comply with the notice, the city may force compliance by legal process and if granted authority to perform the required action, may there after assess the costs against the property for collection in the same manner as a property tax."

Budget

Current Budget

Total $42,000 over 6 years ($7,000/year)

FY 2020 Budget

Removal: $5,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $900
Watering & Maintenance: $500

FY 2021 Budget

Removal: $4,200

*Or saving for ash tree treatment and/or future ash removal
Planting: $600
Routine trimming: $1,700
Watering & Maintenance: $500

FY 2022 Budget
Removal: $5,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $900
Watering & Maintenance: $500

FY 2023 Budget
Removal: $4,200
*Or saving for ash tree treatment and/or future ash removal
Planting: $600
Routine trimming: $1,700
Watering & Maintenance: $500

FY 2024 Budget
Removal: $5,600
*Or saving for ash tree treatment and/or future ash removal
Planting: $900
Watering & Maintenance: $500

FY 2025 Budget
Removal: $4,200
*Or saving for ash tree treatment and/or future ash removal
Planting: $600
Routine trimming: $1,700
Watering & Maintenance: $500

*Reduction of ash over 6 years: Approximately 16 ash trees removed (approximately 10% of ash). It will take approximately 28 years to remove all ash with the current budget. EAB could potentially kill all ash within 4 to 15 years of its arrival.

<u>Proposed Budget Increase</u>
EAB could potentially kill all ash trees in Newell within 4 years of its arrival. To remove all ash trees within 6 years the budget would need to be increased to $22,500 a year. If the budget were increased to $10,000 a year all ash could be removed within 19 years. Additionally, it is recommended that Newell 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 Newell would still need to find 104,300 for removal. Alternatively, if there are 50 treatable trees, it would cost approximately $7,500 a year for treatment and leave $74,900 for removal. These are alternatives to straight removal of ash trees. However, whether or not the treatment option is selected, there will be an increased cost of dealing with ash trees if EAB is found in Newell. It is suggested to consider increasing the budget to plan for this.

Works Cited

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

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

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

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

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

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Newell

Annual Energy Benefits of Public Trees

8/3/2020

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	24.7	1,872	3,203.1	3,139	5,012	(N/A)	17.4	12.3	30.37
Green ash	42.1	3,192	5,724.6	5,610	8,803	(N/A)	16.1	21.7	57.53
Silver maple	43.9	3,333	5,758.7	5,644	8,976	(N/A)	13.7	22.1	69.05
Norway maple	15.4	1,169	2,168.0	2,125	3,294	(N/A)	8.1	8.1	42.78
Norway spruce	6.1	461	764.1	749	1,210	(N/A)	4.4	3.0	28.81
Sugar maple	9.2	695	1,199.3	1,175	1,870	(N/A)	3.5	4.6	56.66
Spruce	3.3	248	417.6	409	657	(N/A)	3.4	1.6	20.53
American basswood	5.8	440	785.1	769	1,210	(N/A)	3.0	3.0	43.21
Northern hackberry	7.0	532	991.8	972	1,504	(N/A)	2.8	3.7	55.72
Eastern red cedar	2.4	185	361.2	354	539	(N/A)	2.4	1.3	23.43
Apple	2.0	154	308.1	302	456	(N/A)	2.3	1.1	20.72
Blue spruce	1.7	130	227.0	222	353	(N/A)	2.2	0.9	16.79
Amur maple	1.2	90	199.1	195	285	(N/A)	1.7	0.7	17.84
Paper birch	3.0	227	385.6	378	605	(N/A)	1.7	1.5	37.84
Littleleaf linden	2.5	191	340.8	334	525	(N/A)	1.6	1.3	34.98
American sycamore	1.8	134	250.5	245	380	(N/A)	1.5	0.9	27.14
Black walnut	3.5	264	488.0	478	742	(N/A)	1.3	1.8	61.82
Maple	0.7	57	102.7	101	157	(N/A)	1.2	0.4	14.29
Red maple	0.9	70	120.0	118	187	(N/A)	1.1	0.5	18.73
Lilac	0.9	69	143.0	140	209	(N/A)	1.1	0.5	20.90
Honeylocust	3.0	227	378.1	371	598	(N/A)	1.1	1.5	59.78
Black maple	1.3	102	195.4	191	293	(N/A)	0.9	0.7	32.60
River birch	2.5	188	361.4	354	543	(N/A)	0.8	1.3	67.83
Black spruce	0.8	63	106.5	104	167	(N/A)	0.8	0.4	20.87
Northern red oak	1.2	94	171.3	168	262	(N/A)	0.7	0.6	37.42
Eastern white pine	1.1	84	147.1	144	229	(N/A)	0.7	0.6	32.66
Kentucky coffeetree	1.2	89	135.0	132	221	(N/A)	0.5	0.5	44.23
White ash	1.5	113	180.6	177	290	(N/A)	0.4	0.7	72.44
Pear	0.1	6	14.1	14	20	(N/A)	0.3	0.0	6.64
Ginkgo	0.4	32	53.9	53	85	(N/A)	0.3	0.2	28.41
Mountain ash	0.2	17	32.3	32	49	(N/A)	0.3	0.1	16.31
Eastern redbud	0.2	14	25.3	25	39	(N/A)	0.2	0.1	19.50
Catalpa	0.8	63	112.7	110	173	(N/A)	0.2	0.4	86.52
Bur oak	0.6	47	80.7	79	126	(N/A)	0.2	0.3	63.12
American elm	0.1	6	11.8	12	18	(N/A)	0.2	0.0	8.95
Conifer Evergreen Large	0.2	14	24.1	24	38	(N/A)	0.2	0.1	18.86
Quaking aspen	0.1	7	13.7	13	21	(N/A)	0.1	0.1	20.64
Plum	0.0	2	3.8	4	5	(N/A)	0.1	0.0	5.40
Black cherry	0.0	0	0.6	1	1	(N/A)	0.1	0.0	0.87
Southern magnolia	0.1	6	12.7	12	19	(N/A)	0.1	0.0	18.82
Basswood	0.2	18	27.0	26	44	(N/A)	0.1	0.1	44.23
Cottonwood	0.2	18	27.0	26	44	(N/A)	0.1	0.1	44.23
Siberian elm	0.4	34	58.3	57	91	(N/A)	0.1	0.2	91.06
Yellowwood	0.0	0	0.8	1	1	(N/A)	0.1	0.0	1.10
Black poplar	0.4	29	53.7	53	82	(N/A)	0.1	0.2	82.02
Red pine	0.1	4	9.5	9	14	(N/A)	0.1	0.0	13.58
Austrian pine	0.2	13	23.3	23	35	(N/A)	0.1	0.1	35.47
Boxelder	0.2	15	23.9	23	39	(N/A)	0.1	0.1	38.63
Broadleaf Deciduous Small	0.1	6	12.8	13	18	(N/A)	0.1	0.0	18.19
Broadleaf Evergreen Large	0.3	19	28.4	28	47	(N/A)	0.1	0.1	46.87
Broadleaf Deciduous Mediu	0.0	0	0.0	0	0	(N/A)	0.0	0.0	0.00
Total	195.6	14,846	26,263.9	25,739	40,585	(N/A)	100.0	100.0	42.81

Table 2: Annual Stormwater Benefits

Newell

Total Annual Benefits of Public Trees by Species ($)

8/3/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Northern white cedar	5,012	495	101	13,580	5,118	24,305	(N/A)	14.9
Green ash	8,803	1,206	1,552	12,528	8,263	32,350	(N/A)	19.9
Silver maple	8,976	1,849	1,681	17,500	14,321	44,328	(N/A)	27.3
Norway maple	3,294	343	569	3,414	2,230	9,851	(N/A)	6.1
Norway spruce	1,210	110	50	3,036	1,191	5,597	(N/A)	3.4
Sugar maple	1,870	249	302	2,669	2,062	7,153	(N/A)	4.4
Spruce	657	63	61	1,192	807	2,781	(N/A)	1.7
American basswood	1,210	168	184	1,302	1,067	3,931	(N/A)	2.4
Northern hackberry	1,504	140	253	1,532	1,182	4,612	(N/A)	2.8
Eastern red cedar	539	33	47	966	166	1,751	(N/A)	1.1
Apple	456	47	71	197	174	944	(N/A)	0.6
Blue spruce	353	30	40	573	406	1,401	(N/A)	0.9
Amur maple	285	28	41	115	103	572	(N/A)	0.4
Paper birch	605	83	98	587	665	2,039	(N/A)	1.3
Littleleaf linden	525	77	85	551	710	1,949	(N/A)	1.2
American sycamore	380	50	63	477	439	1,409	(N/A)	0.9
Black walnut	742	103	129	1,062	701	2,736	(N/A)	1.7
Maple	157	18	25	110	185	494	(N/A)	0.3
Red maple	187	22	31	140	228	608	(N/A)	0.4
Lilac	209	21	32	88	78	428	(N/A)	0.3
Honeylocust	598	72	102	808	1,196	2,776	(N/A)	1.7
Black maple	293	38	49	274	427	1,081	(N/A)	0.7
River birch	543	33	103	752	71	1,501	(N/A)	0.9
Black spruce	167	14	19	271	189	660	(N/A)	0.4
Northern red oak	262	18	37	362	51	730	(N/A)	0.4
Eastern white pine	229	16	-4	682	74	996	(N/A)	0.6
Kentucky coffeetree	221	31	37	199	229	717	(N/A)	0.4
White ash	290	55	68	572	497	1,482	(N/A)	0.9
Pear	20	2	3	8	6	39	(N/A)	0.0
Ginkgo	85	6	15	72	15	194	(N/A)	0.1
Mountain ash	49	5	8	22	20	104	(N/A)	0.1
Eastern redbud	39	4	7	18	16	84	(N/A)	0.1
Catalpa	173	22	35	345	125	700	(N/A)	0.4
Bur oak	126	17	23	189	112	468	(N/A)	0.3
American elm	18	2	3	12	22	56	(N/A)	0.0
Conifer Evergreen Large	38	4	4	58	48	151	(N/A)	0.1
Quaking aspen	21	3	3	16	29	71	(N/A)	0.0
Plum	5	1	1	2	2	11	(N/A)	0.0
Black cherry	1	0	0	0	0	1	(N/A)	0.0
Southern magnolia	19	1	2	18	22	63	(N/A)	0.0
Basswood	44	6	7	40	46	143	(N/A)	0.1
Cottonwood	44	6	7	40	46	143	(N/A)	0.1
Siberian elm	91	11	20	160	54	336	(N/A)	0.2
Yellowwood	1	0	0	0	3	4	(N/A)	0.0
Black poplar	82	11	16	149	67	324	(N/A)	0.2
Red pine	14	1	1	16	15	48	(N/A)	0.0
Austrian pine	35	3	4	79	13	135	(N/A)	0.1
Boxelder	39	6	6	39	39	129	(N/A)	0.1
Broadleaf Deciduous Sn	18	2	3	7	6	36	(N/A)	0.0
Broadleaf Evergreen La	47	6	5	68	97	224	(N/A)	0.1
Broadleaf Deciduous M	0	0	0	0	0	0	(N/A)	0.0
Citywide Total	40,585	5,530	5,998	66,897	43,633	162,644	(N/A)	100.0

Table 3: Annual Air Quality Benefits

Newell

Annual Air Quality Benefits of Public Trees

8/3/2020

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Northern white cedar	59.7	11.8	48.1	7.3	391	115.9	17.0	16.2	111.7	727	-271.1	-1,017	116.8	101	(N/A)	17.4	0.61
Green ash	56.7	9.1	27.2	2.5	302	200.5	29.2	27.9	190.6	1,250	0.0	0	543.7	1,552	(N/A)	16.1	10.14
Silver maple	112.2	19.0	54.9	5.0	605	206.8	30.3	28.9	198.6	1,294	-58.0	-218	597.8	1,681	(N/A)	13.7	12.93
Norway maple	23.9	4.1	12.0	1.1	130	74.2	10.8	10.3	69.9	461	-5.8	-22	200.4	569	(N/A)	8.1	7.39
Norway spruce	13.2	2.6	10.7	1.6	87	28.3	4.2	4.0	27.5	178	-57.4	-215	34.8	50	(N/A)	4.4	1.18
Sugar maple	13.0	2.2	6.5	0.6	70	43.2	6.3	6.0	41.5	270	-10.2	-38	109.0	302	(N/A)	3.5	9.16
Spruce	4.8	1.0	4.2	0.6	32	15.3	2.2	2.1	14.8	96	-17.9	-67	27.1	61	(N/A)	3.4	1.91
American basswood	5.6	1.0	3.0	0.2	31	27.7	4.0	3.8	26.3	173	-5.1	-19	66.5	184	(N/A)	3.0	6.58
Northern hackberry	7.7	1.3	4.1	0.3	43	33.8	4.9	4.7	31.8	210	0.0	0	88.8	253	(N/A)	2.8	9.36
Eastern red cedar	7.3	1.5	5.8	0.9	48	11.8	1.7	1.6	11.0	73	-19.7	-74	22.0	47	(N/A)	2.4	2.05
Apple	1.8	0.3	0.9	0.1	10	10.0	1.4	1.4	9.2	61	0.0	0	25.0	71	(N/A)	2.3	3.22
Blue spruce	2.5	0.5	2.2	0.3	17	8.1	1.2	1.1	7.8	51	-7.4	-28	16.3	40	(N/A)	2.2	1.89
Amur maple	0.8	0.1	0.4	0.0	4	6.0	0.9	0.8	5.4	37	0.0	0	14.5	41	(N/A)	1.7	2.57
Paper birch	1.7	0.3	1.0	0.1	10	14.1	2.1	2.0	13.6	88	0.0	0	34.8	98	(N/A)	1.7	6.12
Littleleaf linden	3.0	0.5	1.5	0.1	16	12.0	1.7	1.7	11.4	75	-1.5	-6	30.5	85	(N/A)	1.6	5.70
American sycamore	1.9	0.3	1.0	0.1	10	8.5	1.2	1.2	8.0	53	0.0	0	22.2	63	(N/A)	1.5	4.51
Black walnut	4.8	0.8	2.3	0.2	25	16.7	2.4	2.3	15.7	104	0.0	0	45.2	129	(N/A)	1.3	10.76
Maple	0.6	0.1	0.3	0.0	3	3.6	0.5	0.5	3.4	22	-0.2	-1	8.7	25	(N/A)	1.2	2.23
Red maple	0.8	0.1	0.4	0.0	5	4.3	0.6	0.6	4.2	27	-0.3	-1	10.9	31	(N/A)	1.1	3.05
Lilac	0.7	0.1	0.4	0.0	4	4.5	0.6	0.6	4.1	28	0.0	0	11.1	32	(N/A)	1.1	3.16
Honeylocust	5.7	0.9	2.6	0.3	30	14.0	2.1	2.0	13.6	88	-4.4	-17	36.7	102	(N/A)	1.1	10.15
Black maple	2.0	0.3	1.0	0.1	11	6.5	0.9	0.9	6.1	40	-0.7	-3	17.2	49	(N/A)	0.9	5.40
River birch	6.3	1.1	3.0	0.3	34	12.1	1.7	1.7	11.3	75	-1.4	-5	35.9	103	(N/A)	0.8	12.87
Black spruce	1.2	0.2	1.0	0.1	8	3.9	0.6	0.5	3.7	24	-3.5	-13	7.8	19	(N/A)	0.8	2.38
Northern red oak	2.9	0.5	1.4	0.1	16	5.9	0.9	0.8	5.6	37	-4.2	-16	14.0	37	(N/A)	0.7	5.26
Eastern white pine	3.1	0.6	2.4	0.4	20	5.3	0.8	0.7	5.0	33	-15.0	-56	3.2	-4	(N/A)	0.7	-0.51
Kentucky coffeetree	0.5	0.1	0.3	0.0	3	5.4	0.8	0.8	5.3	34	0.0	0	13.2	37	(N/A)	0.5	7.42
White ash	4.8	0.8	2.1	0.2	25	6.9	1.0	1.0	6.7	43	0.0	0	23.4	68	(N/A)	0.4	17.07
Pear	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	0.0	0	1.0	3	(N/A)	0.3	0.92
Ginkgo	0.7	0.1	0.3	0.0	4	2.0	0.3	0.3	1.9	13	-0.2	-1	5.4	15	(N/A)	0.3	5.13
Mountain ash	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.0	7	0.0	0	2.8	8	(N/A)	0.3	2.66
Eastern redbud	0.2	0.0	0.1	0.0	1	0.9	0.1	0.1	0.8	6	0.0	0	2.3	7	(N/A)	0.2	3.33
Catalpa	2.0	0.3	0.9	0.1	10	3.9	0.6	0.5	3.7	25	0.0	0	12.0	35	(N/A)	0.2	17.37
Bur oak	0.9	0.1	0.4	0.0	5	2.9	0.4	0.4	2.8	18	0.0	0	8.1	23	(N/A)	0.2	11.57
American elm	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	2	0.0	0	0.9	3	(N/A)	0.2	1.29
Conifer Evergreen Large	0.2	0.0	0.2	0.0	2	0.9	0.1	0.1	0.8	5	-0.7	-3	1.7	4	(N/A)	0.2	2.15
Quaking aspen	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	0.1	2.99
Plum	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	0.1	0.71
Black cherry	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.1	0.11
Southern magnolia	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.4	3	-0.2	-1	0.8	2	(N/A)	0.1	2.10
Basswood	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7	(N/A)	0.1	7.42
Cottonwood	0.1	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	0.0	0	2.6	7	(N/A)	0.1	7.42
Siberian elm	1.2	0.2	0.6	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.8	20	(N/A)	0.1	19.64
Yellowwood	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.1	0.14
Black poplar	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)	0.1	15.71
Red pine	0.1	0.0	0.1	0.0	0	0.3	0.0	0.0	0.3	2	-0.2	-1	0.6	1	(N/A)	0.1	1.48
Austrian pine	0.5	0.1	0.4	0.1	3	0.8	0.1	0.1	0.8	5	-1.1	-4	1.8	4	(N/A)	0.1	4.16
Boxelder	0.1	0.0	0.1	0.0	1	0.9	0.1	0.1	0.9	6	-0.1	0	2.3	6	(N/A)	0.1	6.37
Broadleaf Deciduous Small	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.9	3	(N/A)	0.1	2.55
Broadleaf Evergreen Large	0.2	0.0	0.2	0.0	1	1.1	0.2	0.2	1.1	7	-1.1	-4	2.0	5	(N/A)	0.1	4.77
Broadleaf Deciduous Medium	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.0	0.00
Citywide total	356.7	62.5	204.9	23.2	2,030	928.4	135.5	129.3	886.1	5,796	-487.3	-1,828	2,239.3	5,998	(N/A)	100.0	6.33

Table 4: Annual Carbon Stored

Newell

Stored CO2 Benefits of Public Trees

8/3/2020

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	684,303	5,132	(N/A)	17.4	9.2	31.10
Green ash	1,849,262	13,869	(N/A)	16.1	25.0	90.65
Silver maple	2,550,337	19,128	(N/A)	13.7	34.4	147.13
Norway maple	397,843	2,984	(N/A)	8.1	5.4	38.75
Norway spruce	142,498	1,069	(N/A)	4.4	1.9	25.45
Sugar maple	373,256	2,799	(N/A)	3.5	5.0	84.83
Spruce	40,130	301	(N/A)	3.4	0.5	9.41
American basswood	209,051	1,568	(N/A)	3.0	2.8	56.00
Northern hackberry	112,872	847	(N/A)	2.8	1.5	31.35
Eastern red cedar	23,698	178	(N/A)	2.4	0.3	7.73
Apple	29,099	218	(N/A)	2.3	0.4	9.92
Blue spruce	14,482	109	(N/A)	2.2	0.2	5.17
Amur maple	15,196	114	(N/A)	1.7	0.2	7.12
Paper birch	57,283	430	(N/A)	1.7	0.8	26.85
Littleleaf linden	65,748	493	(N/A)	1.6	0.9	32.87
American sycamore	65,747	493	(N/A)	1.5	0.9	35.22
Black walnut	153,514	1,151	(N/A)	1.3	2.1	95.95
Maple	7,851	59	(N/A)	1.2	0.1	5.35
Red maple	10,559	79	(N/A)	1.1	0.1	7.92
Lilac	12,607	95	(N/A)	1.1	0.2	9.46
Honeylocust	73,551	552	(N/A)	1.1	1.0	55.16
Black maple	23,595	177	(N/A)	0.9	0.3	19.66
River birch	103,585	777	(N/A)	0.8	1.4	97.11
Black spruce	6,444	48	(N/A)	0.8	0.1	6.04
Northern red oak	64,576	484	(N/A)	0.7	0.9	69.19
Eastern white pine	38,878	292	(N/A)	0.7	0.5	41.66
Kentucky coffeetree	18,359	138	(N/A)	0.5	0.2	27.54
White ash	67,671	508	(N/A)	0.4	0.9	126.88
Pear	935	7	(N/A)	0.3	0.0	2.34
Ginkgo	9,664	72	(N/A)	0.3	0.1	24.16
Mountain ash	3,393	25	(N/A)	0.3	0.0	8.48
Eastern redbud	3,051	23	(N/A)	0.2	0.0	11.44
Catalpa	65,202	489	(N/A)	0.2	0.9	244.51
Bur oak	29,615	222	(N/A)	0.2	0.4	111.06
American elm	922	7	(N/A)	0.2	0.0	3.46
Conifer Evergreen La	1,427	11	(N/A)	0.2	0.0	5.35
Quaking aspen	1,035	8	(N/A)	0.1	0.0	7.76
Plum	178	1	(N/A)	0.1	0.0	1.33
Black cherry	14	0	(N/A)	0.1	0.0	0.10
Southern magnolia	484	4	(N/A)	0.1	0.0	3.63
Basswood	3,672	28	(N/A)	0.1	0.0	27.54
Cottonwood	3,672	28	(N/A)	0.1	0.0	27.54
Siberian elm	29,353	220	(N/A)	0.1	0.4	220.15
Yellowwood	17	0	(N/A)	0.1	0.0	0.13
Black poplar	25,943	195	(N/A)	0.1	0.4	194.57
Red pine	257	2	(N/A)	0.1	0.0	1.93
Austrian pine	4,893	37	(N/A)	0.1	0.1	36.70
Boxelder	3,624	27	(N/A)	0.1	0.0	27.18
Broadleaf Deciduous	908	7	(N/A)	0.1	0.0	6.81
Broadleaf Evergreen l	3,595	27	(N/A)	0.1	0.0	26.96
Broadleaf Deciduous	0	0	(N/A)	0.0	0.0	0.00
Citywide total	7,403,846	55,529	(N/A)	100.0	100.0	58.57

Table 5: Annual Carbon Sequestered

Newell

Annual CO_2 Benefits of Public Trees

8/3/2020

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	28,323	212	-3,285	-455	-28	41,381	310	65,964	495 (N/A)	17.4	8.9	3.00
Green ash	99,517	746	-8,876	-436	-70	70,551	529	160,755	1,206 (N/A)	16.1	21.8	7.88
Silver maple	185,587	1,392	-12,242	-488	-95	73,657	552	246,514	1,849 (N/A)	13.7	33.4	14.22
Norway maple	21,952	165	-1,912	-157	-16	25,838	194	45,721	343 (N/A)	8.1	6.2	4.45
Norway spruce	5,233	39	-684	-111	-6	10,194	76	14,632	110 (N/A)	4.4	2.0	2.61
Sugar maple	19,791	148	-1,792	-96	-14	15,350	115	33,252	249 (N/A)	3.5	4.5	7.56
Spruce	3,183	24	-193	-55	-2	5,471	41	8,407	63 (N/A)	3.4	1.1	1.97
American basswood	13,685	103	-1,003	-62	-8	9,732	73	22,351	168 (N/A)	3.0	3.0	5.99
Northern hackberry	7,512	56	-542	-63	-5	11,767	88	18,675	140 (N/A)	2.8	2.5	5.19
Eastern red cedar	465	3	-114	-43	-1	4,088	31	4,396	33 (N/A)	2.4	0.6	1.43
Apple	3,048	23	-140	-27	-1	3,403	26	6,284	47 (N/A)	2.3	0.9	2.14
Blue spruce	1,214	9	-70	-29	-1	2,875	22	3,991	30 (N/A)	2.2	0.5	1.43
Amur maple	1,824	14	-73	-18	-1	1,997	15	3,729	28 (N/A)	1.7	0.5	1.75
Paper birch	6,349	48	-275	-29	-2	5,027	38	11,072	83 (N/A)	1.7	1.5	5.19
Littleleaf linden	6,406	48	-316	-29	-3	4,217	32	10,277	77 (N/A)	1.6	1.4	5.14
American sycamore	4,005	30	-316	-21	-3	2,971	22	6,640	50 (N/A)	1.5	0.9	3.56
Black walnut	8,640	65	-737	-37	-6	5,826	44	13,692	103 (N/A)	1.3	1.9	8.56
Maple	1,142	9	-38	-8	0	1,249	9	2,346	18 (N/A)	1.2	0.3	1.60
Red maple	1,493	11	-51	-9	0	1,542	12	2,975	22 (N/A)	1.1	0.4	2.23
Lilac	1,370	10	-61	-13	-1	1,523	11	2,820	21 (N/A)	1.1	0.4	2.12
Honeylocust	4,913	37	-354	-22	-3	5,022	38	9,559	72 (N/A)	1.1	1.3	7.17
Black maple	3,004	23	-113	-14	-1	2,253	17	5,130	38 (N/A)	0.9	0.7	4.27
River birch	756	6	-497	-31	-4	4,165	31	4,393	33 (N/A)	0.8	0.6	4.12
Black spruce	569	4	-31	-13	0	1,383	10	1,908	14 (N/A)	0.8	0.3	1.79
Northern red oak	661	5	-310	-16	-2	2,079	16	2,413	18 (N/A)	0.7	0.3	2.59
Eastern white pine	424	3	-187	-24	-2	1,866	14	2,079	16 (N/A)	0.7	0.3	2.23
Kentucky coffeetree	2,227	17	-88	-10	-1	1,964	15	4,093	31 (N/A)	0.5	0.6	6.14
White ash	5,166	39	-325	-12	-3	2,493	19	7,322	55 (N/A)	0.4	1.0	13.73
Pear	131	1	-5	-2	0	135	1	260	2 (N/A)	0.3	0.0	0.65
Ginkgo	150	1	-46	-6	0	717	5	815	6 (N/A)	0.3	0.1	2.04
Mountain ash	344	3	-16	-3	0	383	3	707	5 (N/A)	0.3	0.1	1.77
Eastern redbud	276	2	-15	-2	0	314	2	574	4 (N/A)	0.2	0.1	2.15
Catalpa	1,872	14	-313	-9	-2	1,384	10	2,934	22 (N/A)	0.2	0.4	11.00
Bur oak	1,405	11	-142	-6	-1	1,043	8	2,299	17 (N/A)	0.2	0.3	8.62
American elm	118	1	-4	-1	0	139	1	251	2 (N/A)	0.2	0.0	0.94
Conifer Evergreen Large	168	1	-7	-3	0	311	2	469	4 (N/A)	0.2	0.1	1.76
Quaking aspen	209	2	-5	-1	0	159	1	361	3 (N/A)	0.1	0.0	2.71
Plum	38	0	-1	-1	0	37	0	74	1 (N/A)	0.1	0.0	0.55
Black cherry	9	0	0	0	0	6	0	14	0 (N/A)	0.1	0.0	0.10
Southern magnolia	56	0	-2	-1	0	141	1	194	1 (N/A)	0.1	0.0	1.45
Basswood	445	3	-18	-2	0	393	3	819	6 (N/A)	0.1	0.1	6.14
Cottonwood	445	3	-18	-2	0	393	3	819	6 (N/A)	0.1	0.1	6.14
Siberian elm	911	7	-141	-5	-1	749	6	1,514	11 (N/A)	0.1	0.2	11.36
Yellowwood	5	0	0	0	0	7	0	12	0 (N/A)	0.1	0.0	0.09
Black poplar	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	0.1	0.2	11.11
Red pine	53	0	-1	-1	0	94	1	145	1 (N/A)	0.1	0.0	1.08
Austrian pine	189	1	-23	-4	0	280	2	441	3 (N/A)	0.1	0.1	3.31
Boxelder	418	3	-17	-2	0	336	3	735	6 (N/A)	0.1	0.1	5.51
Broadleaf Deciduous Smal	114	1	-4	-1	0	124	1	232	2 (N/A)	0.1	0.0	1.74
Broadleaf Evergreen Large	419	3	-17	-2	0	421	3	821	6 (N/A)	0.1	0.1	6.15
Broadleaf Deciduous Medi	0	0	0	0	0	0	0	0	0 (N/A)	0.0	0.0	0.00
Citywide total	447,195	3,354	-35,544	-2,389	-284	328,100	2,461	737,361	5,530 (N/A)	100.0	100.0	5.83

Table 6: Annual Social and Aesthetic Benefits

Newell

Annual Aesthetic/Other Benefits of Public Trees

8/3/2020

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Northern white cedar	5,118	(N/A)	17.4	11.7	31.02
Green ash	8,263	(N/A)	16.1	18.9	54.00
Silver maple	14,321	(N/A)	13.7	32.8	110.16
Norway maple	2,230	(N/A)	8.1	5.1	28.97
Norway spruce	1,191	(N/A)	4.4	2.7	28.36
Sugar maple	2,062	(N/A)	3.5	4.7	62.49
Spruce	807	(N/A)	3.4	1.9	25.23
American basswood	1,067	(N/A)	3.0	2.4	38.12
Northern hackberry	1,182	(N/A)	2.8	2.7	43.79
Eastern red cedar	166	(N/A)	2.4	0.4	7.21
Apple	174	(N/A)	2.3	0.4	7.89
Blue spruce	406	(N/A)	2.2	0.9	19.33
Amur maple	103	(N/A)	1.7	0.2	6.43
Paper birch	665	(N/A)	1.7	1.5	41.59
Littleleaf linden	710	(N/A)	1.6	1.6	47.35
American sycamore	439	(N/A)	1.5	1.0	31.35
Black walnut	701	(N/A)	1.3	1.6	58.39
Maple	185	(N/A)	1.2	0.4	16.79
Red maple	228	(N/A)	1.1	0.5	22.79
Lilac	78	(N/A)	1.1	0.2	7.78
Honeylocust	1,196	(N/A)	1.1	2.7	119.62
Black maple	427	(N/A)	0.9	1.0	47.45
River birch	71	(N/A)	0.8	0.2	8.83
Black spruce	189	(N/A)	0.8	0.4	23.67
Northern red oak	51	(N/A)	0.7	0.1	7.29
Eastern white pine	74	(N/A)	0.7	0.2	10.57
Kentucky coffeetree	229	(N/A)	0.5	0.5	45.86
White ash	497	(N/A)	0.4	1.1	124.26
Pear	6	(N/A)	0.3	0.0	2.16
Ginkgo	15	(N/A)	0.3	0.0	4.94
Mountain ash	20	(N/A)	0.3	0.0	6.53
Eastern redbud	16	(N/A)	0.2	0.0	7.76
Catalpa	125	(N/A)	0.2	0.3	62.47
Bur oak	112	(N/A)	0.2	0.3	56.23
American elm	22	(N/A)	0.2	0.0	10.90
Conifer Evergreen Large	48	(N/A)	0.2	0.1	23.87
Quaking aspen	29	(N/A)	0.1	0.1	28.56
Plum	2	(N/A)	0.1	0.0	2.06
Black cherry	0	(N/A)	0.1	0.0	0.03
Southern magnolia	22	(N/A)	0.1	0.1	21.93
Basswood	46	(N/A)	0.1	0.1	45.86
Cottonwood	46	(N/A)	0.1	0.1	45.86
Siberian elm	54	(N/A)	0.1	0.1	53.50
Yellowwood	3	(N/A)	0.1	0.0	2.74
Black poplar	67	(N/A)	0.1	0.2	66.60
Red pine	15	(N/A)	0.1	0.0	15.42
Austrian pine	13	(N/A)	0.1	0.0	12.81
Boxelder	39	(N/A)	0.1	0.1	39.36
Broadleaf Deciduous Small	6	(N/A)	0.1	0.0	6.40
Broadleaf Evergreen Large	97	(N/A)	0.1	0.2	97.24
Broadleaf Deciduous Medium	0	(N/A)	0.0	0.0	0.00
Citywide total	43,633	(N/A)	100.0	100.0	46.03

Table 7: Summary of Benefits in Dollars

Newell

Total Annual Benefits of Public Trees by Species ($)

8/3/2020

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Northern white cedar	5,012	495	101	13,580	5,118	24,305	(N/A)	14.9
Green ash	8,803	1,206	1,552	12,528	8,263	32,350	(N/A)	19.9
Silver maple	8,976	1,849	1,681	17,500	14,321	44,328	(N/A)	27.3
Norway maple	3,294	343	569	3,414	2,230	9,851	(N/A)	6.1
Norway spruce	1,210	110	50	3,036	1,191	5,597	(N/A)	3.4
Sugar maple	1,870	249	302	2,669	2,062	7,153	(N/A)	4.4
Spruce	657	63	61	1,192	807	2,781	(N/A)	1.7
American basswood	1,210	168	184	1,302	1,067	3,931	(N/A)	2.4
Northern hackberry	1,504	140	253	1,532	1,182	4,612	(N/A)	2.8
Eastern red cedar	539	33	47	966	166	1,751	(N/A)	1.1
Apple	456	47	71	197	174	944	(N/A)	0.6
Blue spruce	353	30	40	573	406	1,401	(N/A)	0.9
Amur maple	285	28	41	115	103	572	(N/A)	0.4
Paper birch	605	83	98	587	665	2,039	(N/A)	1.3
Littleleaf linden	525	77	85	551	710	1,949	(N/A)	1.2
American sycamore	380	50	63	477	439	1,409	(N/A)	0.9
Black walnut	742	103	129	1,062	701	2,736	(N/A)	1.7
Maple	157	18	25	110	185	494	(N/A)	0.3
Red maple	187	22	31	140	228	608	(N/A)	0.4
Lilac	209	21	32	88	78	428	(N/A)	0.3
Honeylocust	598	72	102	808	1,196	2,776	(N/A)	1.7
Black maple	293	38	49	274	427	1,081	(N/A)	0.7
River birch	543	33	103	752	71	1,501	(N/A)	0.9
Black spruce	167	14	19	271	189	660	(N/A)	0.4
Northern red oak	262	18	37	362	51	730	(N/A)	0.4
Eastern white pine	229	16	-4	682	74	996	(N/A)	0.6
Kentucky coffeetree	221	31	37	199	229	717	(N/A)	0.4
White ash	290	55	68	572	497	1,482	(N/A)	0.9
Pear	20	2	3	8	6	39	(N/A)	0.0
Ginkgo	85	6	15	72	15	194	(N/A)	0.1
Mountain ash	49	5	8	22	20	104	(N/A)	0.1
Eastern redbud	39	4	7	18	16	84	(N/A)	0.1
Catalpa	173	22	35	345	125	700	(N/A)	0.4
Bur oak	126	17	23	189	112	468	(N/A)	0.3
American elm	18	2	3	12	22	56	(N/A)	0.0
Conifer Evergreen Large	38	4	4	58	48	151	(N/A)	0.1
Quaking aspen	21	3	3	16	29	71	(N/A)	0.0
Plum	5	1	1	2	2	11	(N/A)	0.0
Black cherry	1	0	0	0	0	1	(N/A)	0.0
Southern magnolia	19	1	2	18	22	63	(N/A)	0.0
Basswood	44	6	7	40	46	143	(N/A)	0.1
Cottonwood	44	6	7	40	46	143	(N/A)	0.1
Siberian elm	91	11	20	160	54	336	(N/A)	0.2
Yellowwood	1	0	0	0	3	4	(N/A)	0.0
Black poplar	82	11	16	149	67	324	(N/A)	0.2
Red pine	14	1	1	16	15	48	(N/A)	0.0
Austrian pine	35	3	4	79	13	135	(N/A)	0.1
Boxelder	39	6	6	39	39	129	(N/A)	0.1
Broadleaf Deciduous Sn	18	2	3	7	6	36	(N/A)	0.0
Broadleaf Evergreen La	47	6	5	68	97	224	(N/A)	0.1
Broadleaf Deciduous M	0	0	0	0	0	0	(N/A)	0.0
Citywide Total	40,585	5,530	5,998	66,897	43,633	162,644	(N/A)	100.0

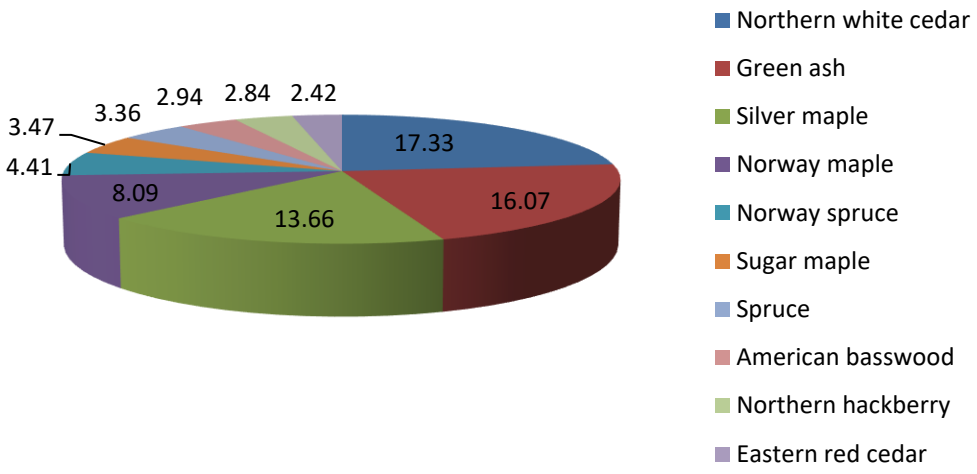


Figure 1: Species Distribution

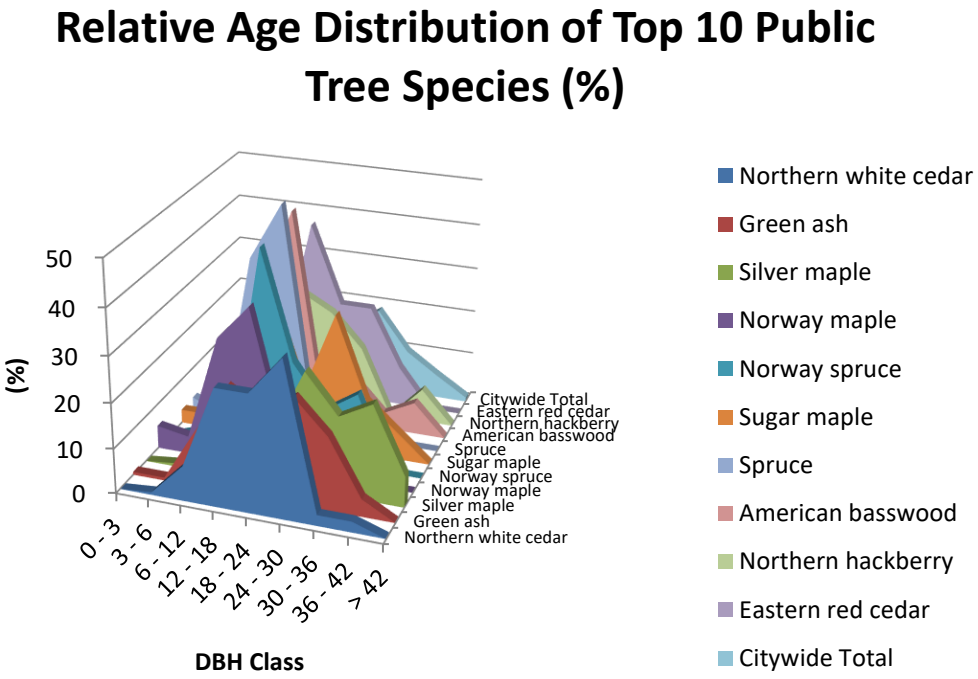


Figure 2: Relative Age Class

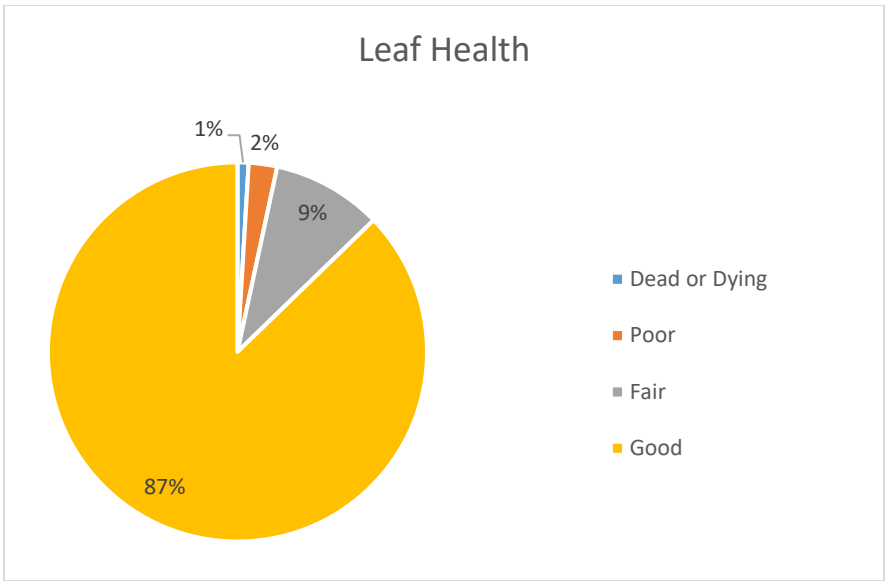


Figure 3: Foliage Condition

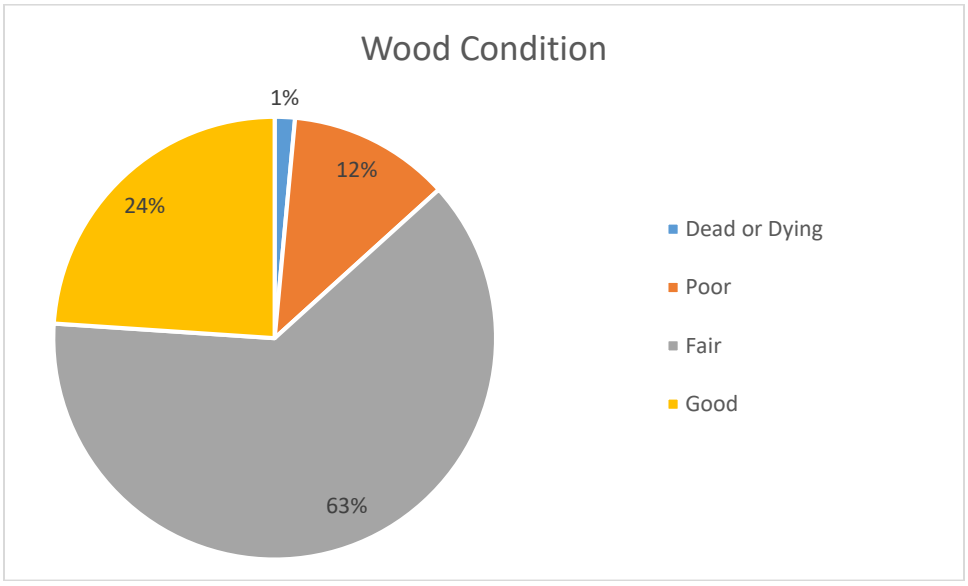


Figure 4: Wood Condition

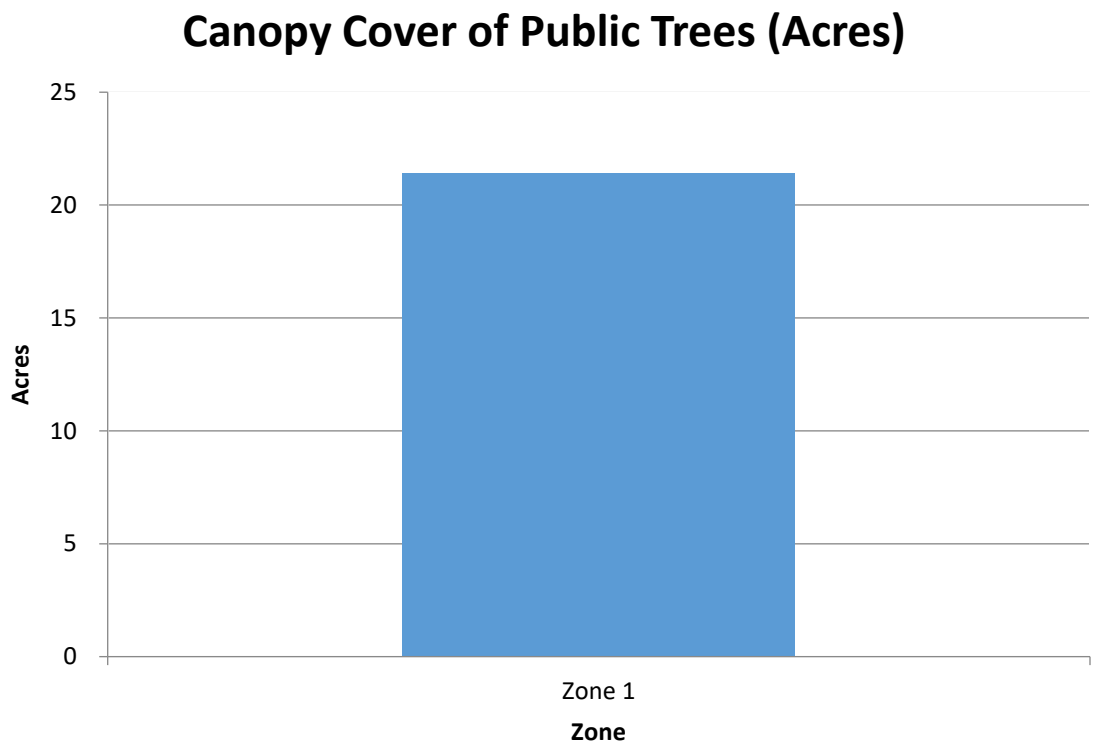


Figure 5: Canopy Cover in Acres

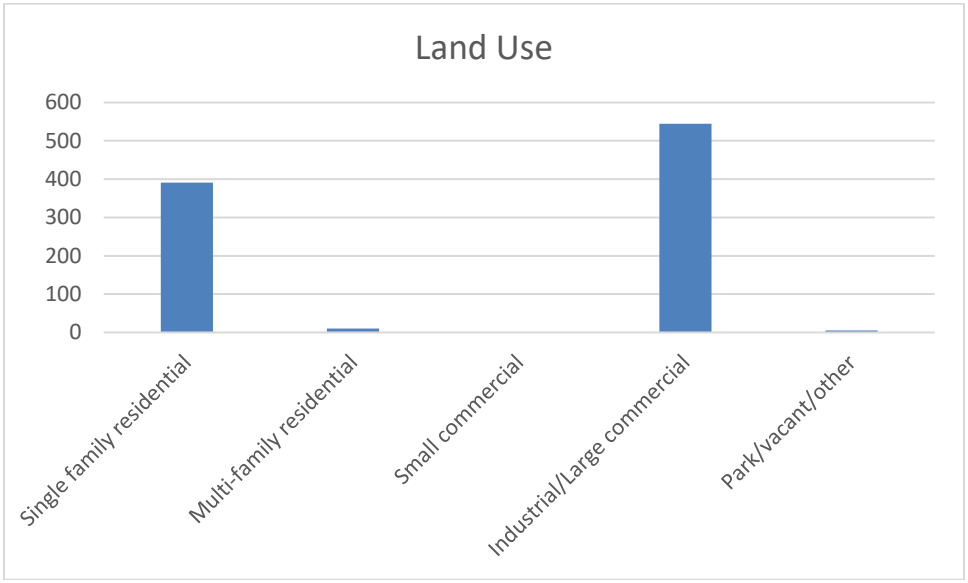


Figure 6: Land Use of city/park trees

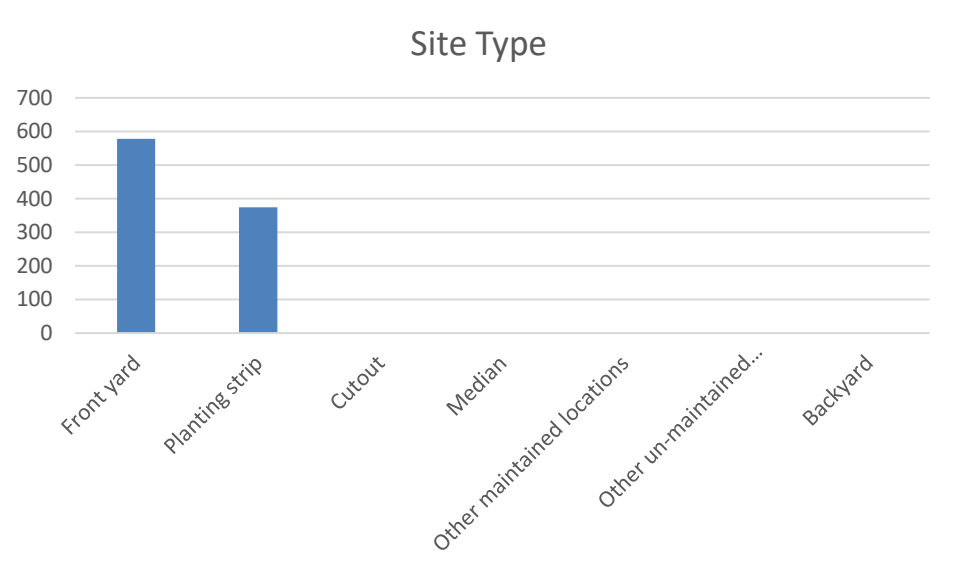


Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

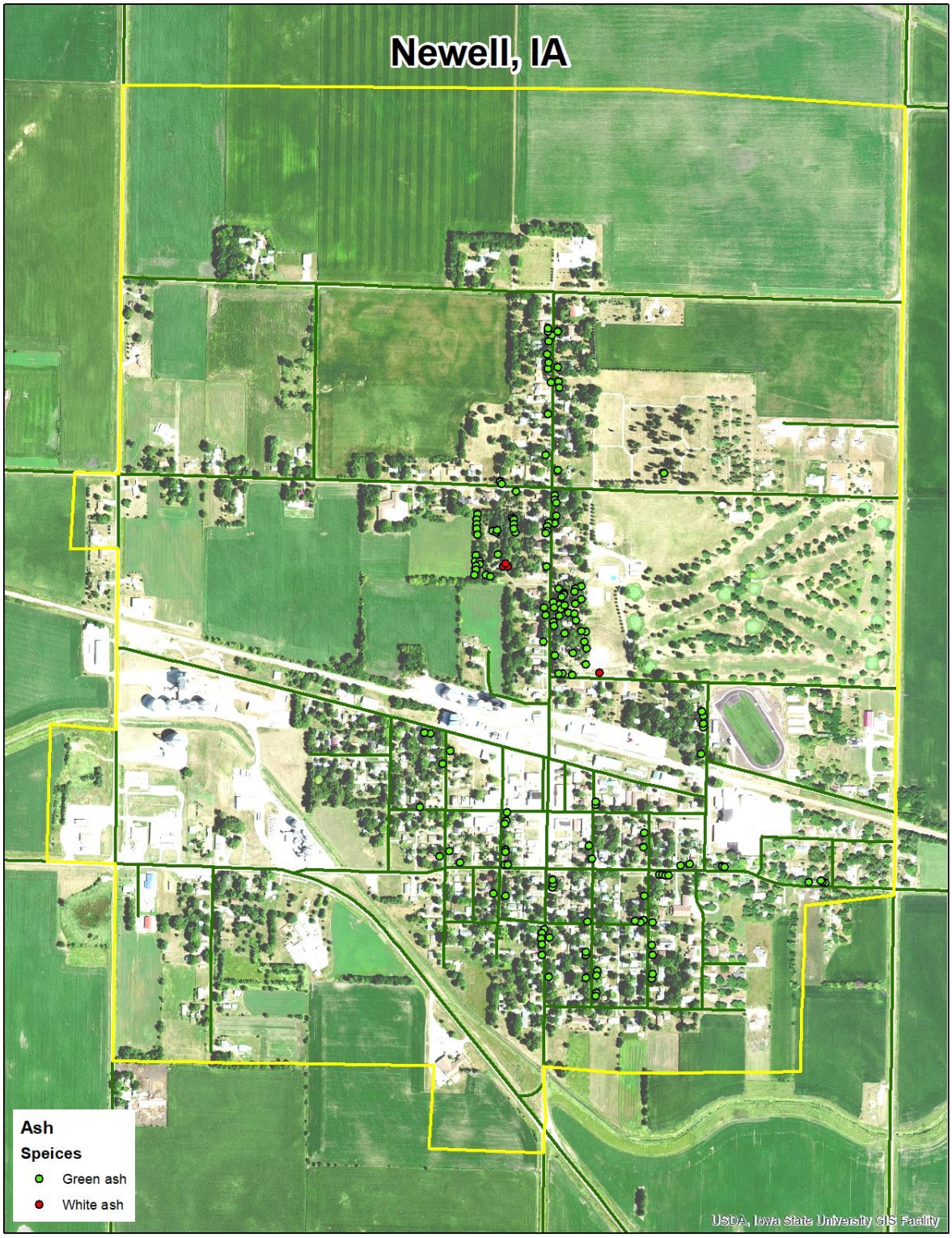


Figure 1: Location of Ash Trees

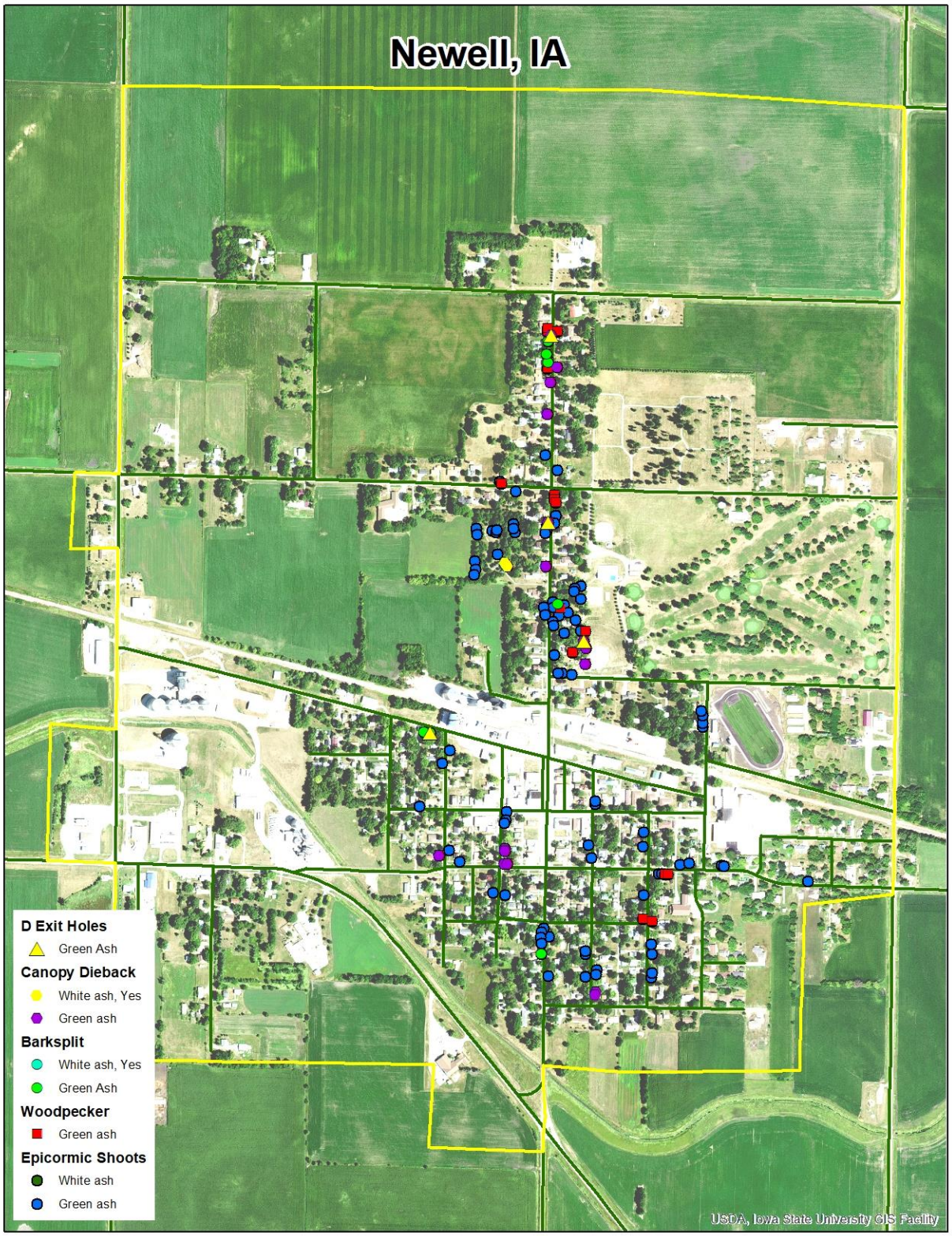


Figure 2: Location of EAB symptoms

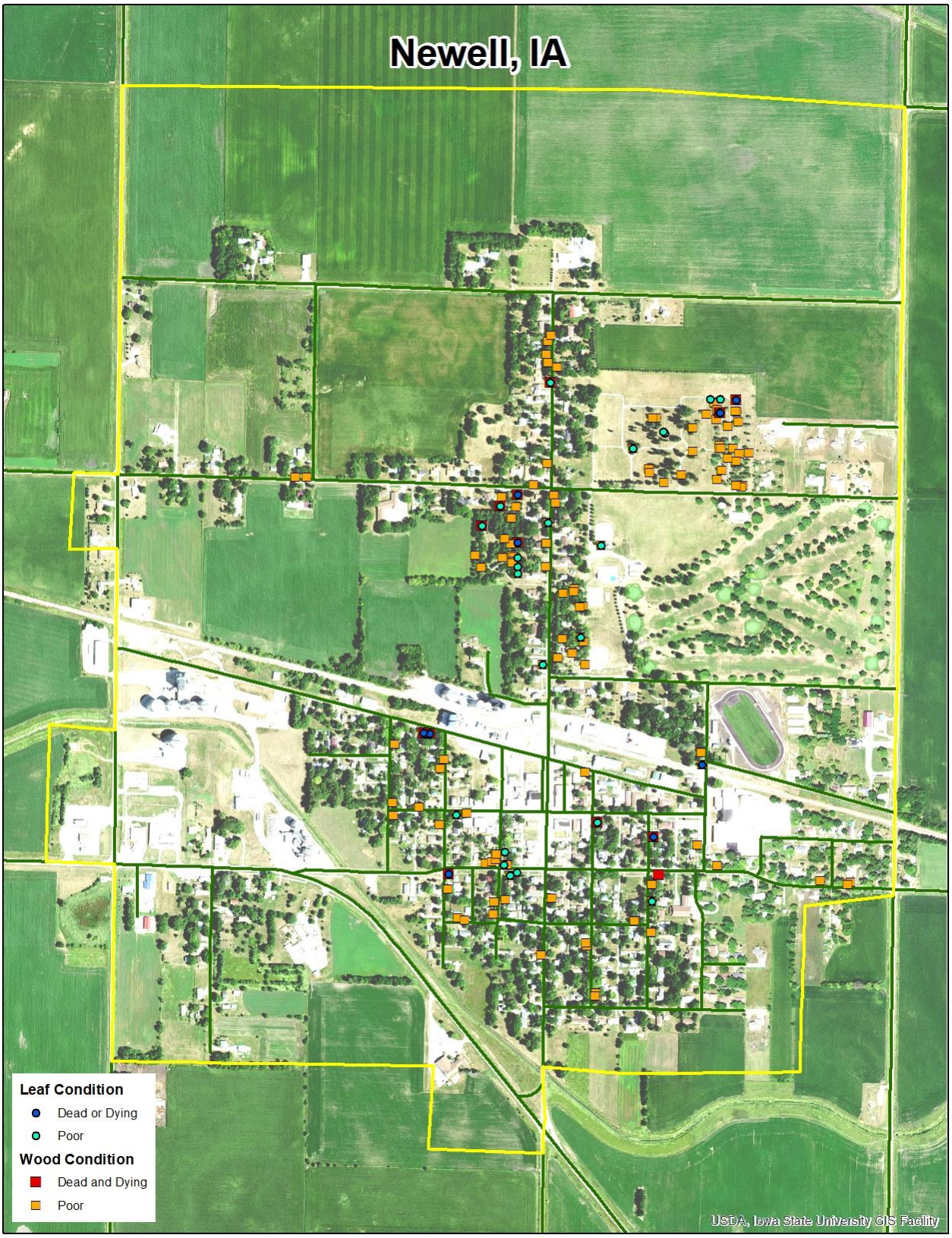


Figure 3: Location of Poor Condition Trees

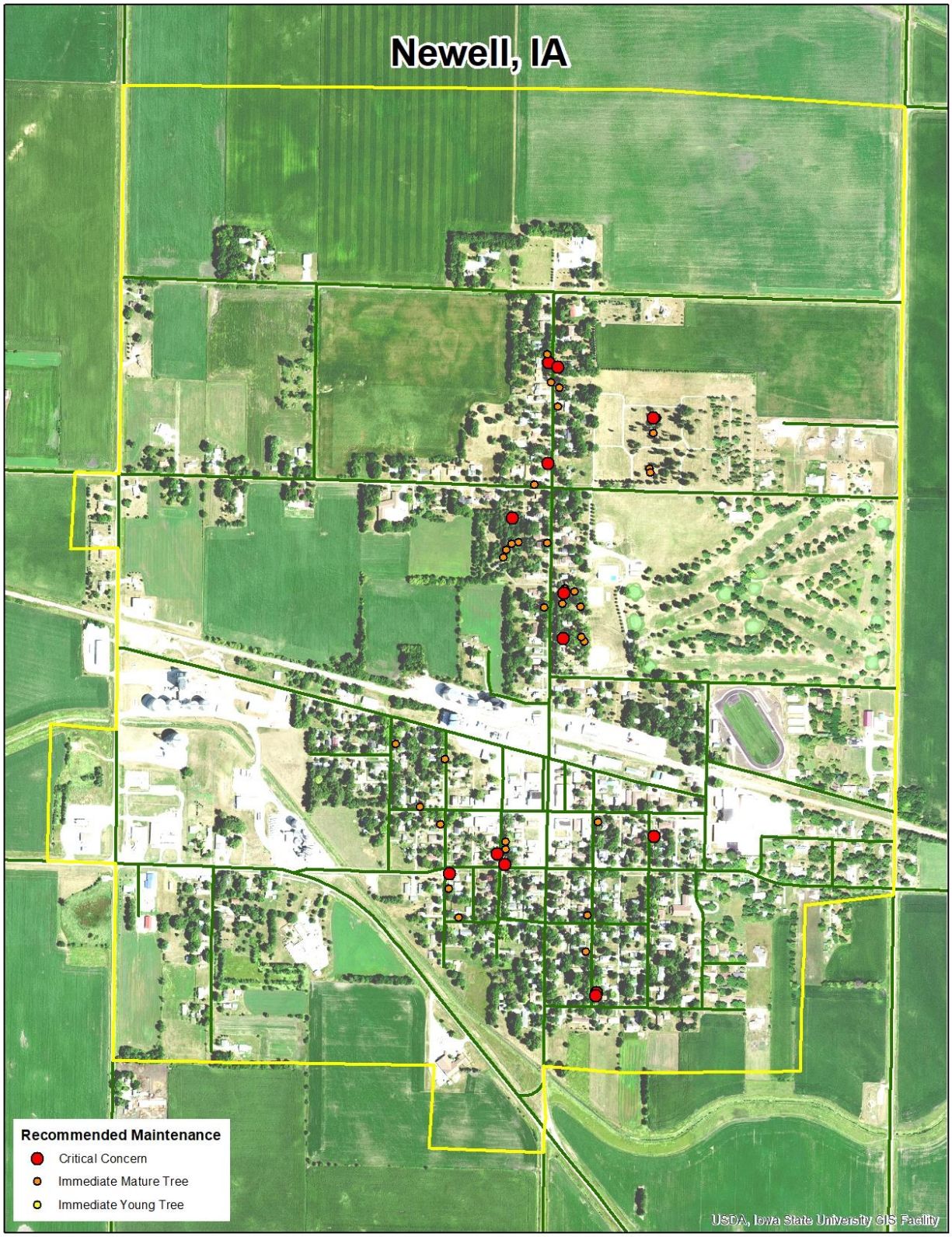


Figure 4: Location of Trees with Recommended Maintenance

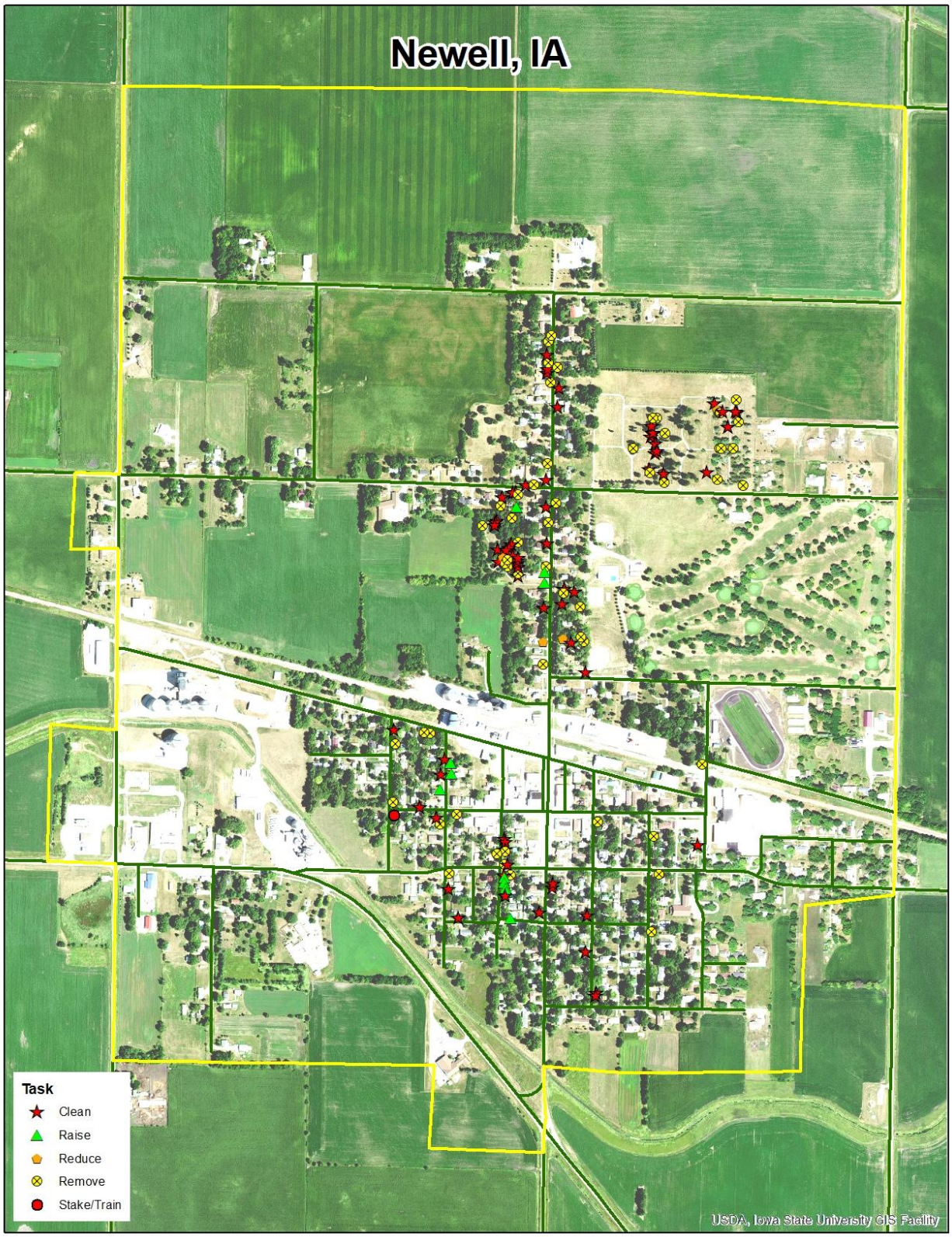


Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal***

Appendix C: Newell Tree Ordinances

CHAPTER 4: TREES

ARTICLE 4 - GENERAL PROVISIONS

4.01 DEFINITIONS. For use in this chapter, the following term is defined:

1. "Parking" or 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.

4.02 ARBORICULTURAL SPECIFICATIONS AND STANDARDS OF PRACTICE.

1. SPACING. All trees hereafter planted in any street or parking midway between the outer line of the sidewalk and 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. PLANTING. The following regulations shall be followed in the planting of trees within the city.

a. Size. All trees planted on the streets shall be of sufficient size to warrant satisfactory results and stand the abuse common to street trees.

b. Grade. Unless otherwise allowed for substantial reasons, all standard sized trees shall have comparatively straight trunks, well-developed leaders, and tip and root characteristics of the species or variety showing evidence of proper nursery pruning. All trees must be free of insect, disease, mechanical injuries and other objectionable features at the time of planting. To compensate for any serious loss of roots, the top of the tree should be reduced by thinning or cutting back as determined by the growth characteristics of the tree species. The leader shall not be cut off in such trimming.

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

d. Method of support. Trees may be guyed or supported in an upright position according to accepted arboricultural practices. The guys or supports shall be fastened in such a way that they will not girdle or cause serious injury to the trees or endanger public safety.

3. TRIMMING OR PRUNING. Trees shall be trimmed or pruned according to the following:

a. All cuts are to be made sufficiently close to the parent stem so that healing can readily start under normal conditions.

b. All dead and diseased wood shall be removed.

c. All limbs one inch in diameter or more must be precut to prevent splitting.

All branches in danger of injuring the tree in falling shall be lowered by ropes.

d. A crossed or rubbing branch shall be removed where practicable, but removal shall not leave large holes in the general outline of the tree.

Crossed or rubbing branches may be cabled apart.

e. All cuts, old or new, one inch in diameter or more, shall be painted with an approved tree wound dressing. On old wounds, care shall be taken to paint exposed wood only.

f. Where there is a known danger of transmitting disease by tools, said tools shall be disinfected with alcohol before use on another tree.

g. Improperly healed scars, where callous growth is not established, are to be traced and painted, unless the city designates other treatment.

h. No topping or dehorning of trees shall be permitted except by special written permission of the city. Trees becoming stag-headed may have the dead portions removed back to sound green wood, with a proper forty-five (45) degree cut only.

i. Elm wood trimmed, pruned or removed shall not be used for any purpose, but shall be disposed of immediately by burning or burying.

4.03 REMOVAL OF TREES. The city shall have removed, on the order of the council, any tree on the streets of the city which interferes with the making of improvements or with travel thereon. He shall additionally remove any trees on the street, not on private property, which have become diseased, or which constitute a danger to the public or which may otherwise be declared a nuisance.
(Code of Iowa, Sec. 364.12(2c))

4.04 MAINTENANCE OF TREES, SHRUBS, AND FLOWERS ON THE PARKING IN RESIDENTIAL AREAS. All responsibility for the care, maintenance, removal and replacement of trees, including stumps, shrubs, and flowers on the parking in a residential zone shall be at the abutting property owner's expense. The abutting property owners shall prune the trees and bushes on the parking and on their own property so that all branches will be at least fifteen (15') feet above the surface of the street and eight (8') feet above the sidewalk. The abutting property owner shall remove broken branches from trees and shrubs and remove fallen trees from the parking and from their own private property.

4.05 ASSESSMENT. If the abutting property owner fails to trim, remove, care for, and maintain the trees, shrubs and flowers, including replacement of trees and shrubs and the removal of stumps as required in this chapter, the city may serve notice on the abutting property owner requiring the abutting property owner to do so within five (5) days. If the abutting property owner fails to trim the trees within that time, the city may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12(2d&e))

4.06 TREE BRANCHES NEAR UTILITY LINES. Trees shall be trimmed so that no branch hangs over, between, or parallel to within a distance of ten (10) feet, any utility, wire, cable, line or other suspended utility, or appurtenance. For the purpose of this chapter, utility shall include, but not be limited to, power, telephone, telegraph, cable television, or other public service or facility requiring or utilizing suspended appurtenances for the delivery of the service.

CHAPTER 4: TREES

ARTICLE 5 – DISEASE & DEAD TREE CONTROL

5.01 DEAD OR DISEASED TREE REMOVAL ON PRIVATE PROPERTY. The city shall notify the owner of any tree, shrub, bush or other woody vegetation located on private property to remove the tree, bush, shrub or other woody vegetation when such plant constitutes a public nuisance or is a hazard to person or property, or harbors insects, other pests, or disease. The city shall notify in writing the property owner of the property on which such tree, shrub, bush or other woody vegetation is located of the necessity to remove same. Upon such notice, the owner shall remove the planting at the owner’s expense within thirty (30) days. Notice shall either be given by personal service or by certified mail with return receipt barring the signature of the property owner. In the event the property owner fails to comply with the notice, the city may force compliance by legal process and if granted authority to perform the required action, may there after assess the costs against the property for collection in the same manner as a property tax.

Code of Iowa, Chapter 364.12(3)(h) allows the City in an emergency to perform any action which may be required to abate the emergency without prior notice, and assess the costs as provided in Chapter 364.12, after notice to the property owner and hearing.

5.02 DUTY TO REMOVE. No person, firm or corporation shall permit any diseased tree, dead wood to remain on the premises owned, controlled or occupied by the person within the City. (Code of Iowa, Sec, 364.12(3b))

5.03 INSPECTION. The City shall inspect or cause to be inspected all premises and places within the City to determine whether any condition as defined in Article 5.01 of this
Article exists thereon, and shall also inspect or cause to be inspected any trees reported or suspected to constitute a public nuisance, a hazard to person or property, or harbors insects, other pests, or disease.

5.04 REMOVAL FROM CITY PROPERTY. If the City, upon inspection or examination, in person or by some qualified person acting for the City, shall determine that any condition as herein defined exists in or upon any public street, alley, park or any public place, including the strip between the curb and the lot line of private property within the City, and that the danger of other trees, shrubs, bushes, or woody vegetation within the City is imminent, the City shall immediately cause the tree, shrub, bush or woody vegetation to be removed and burned or otherwise correct the same in such manner as to destroy or prevent as fully as possible the spread of disease, or insect pests, or vectors known to carry such disease, insects, and/or fungus.

5.05 REMOVAL FROM PRIVATE PROPERTY. If the City upon inspection or examination, in person or by some qualified person acting for the City, shall determine with reasonable certainty that any condition as herein defined exists in or upon private premises, and that he danger to other trees within the City is imminent, he/she shall immediately notify by certified mail or personal delivery to the occupant or person in charge of such property, to correct such condition within thirty (30) days of said notification. If such owner, occupant or person in charge of said property fails to comply within thirty (30) days of receipt thereof, the Council may cause the nuisance to be removed and the cost assessed against the property for collection in the same manner as a property tax.
(Code of Iowa, Sec. 364.12(3b&h))

5.06 REASONABLE CERTAINTY. If the City is unable to determine with reasonable certainty whether or not a tree in or upon private premises is infected, diseased, or harboring insects or pests, a City representative is authorized to remove or cut specimens from said tree, and obtain a diagnosis of such specimens

The State of Iowa is an Equal Opportunity Employer and provider of ADA services.

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

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