2016 COMMUNITY TREE MANAGEMENT PLAN

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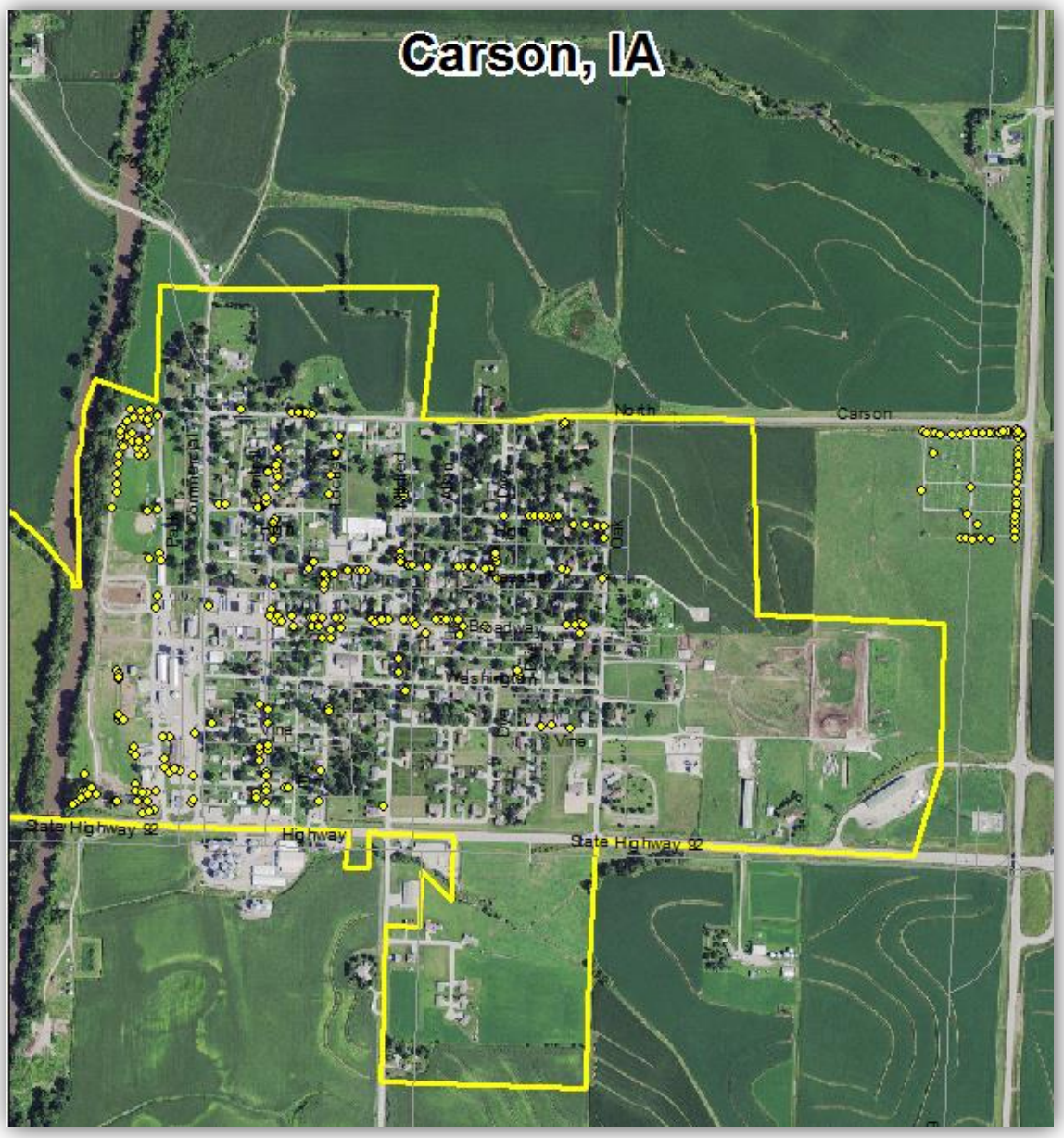

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Executive Summary

Overview

This plan was developed to assist the City of Carson with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities 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 possibility that 9.5% of your municipally managed trees will die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over years, mitigating public safety issues.

Inventory and Results

In 2016, a tree inventory was conducted using Global Positioning System (GPS) data collectors. The inventory was a complete inventory of street right of way and park trees. Below are some key findings of the 304 trees inventoried.

- Each of Carson's municipal trees provides an average of $180 worth of benefits to the community each year
- There are over 39 species of trees
- The top three genus are: Maple – 33.9%, Oak – 11.2%, Ash – 9.5%
- 8% of trees are in need of some type of management
- 20 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 findings:

- Of the 20 trees needing removal, 5 trees should be addressed as soon as possible in 2017. There are 11 mature trees and 2 young trees that will need removal in the next 3 years. Of the 5 trees recommended for critical concern removal, 4 trees are over 24" in diameter. *City ownership of the trees recommended for removal should be verified prior to any removal*
- 1 of the 29 ash trees is in need of follow up because it is displaying signs and symptoms associated with EAB.
- All trees should be pruned on a routine schedule- one third of the city every two years.
- The costs of removing and replacing all 27 (29 total ash trees, 2 are recommended for removal) city managed street and park ash trees is estimated to be $18,300 using contracted labor. Community tree grants can help offset the estimated $8,400 in replacement tree costs (hazard tree replacement and ash replacement). Budgeting approximately $3,200 to $4000 per year for contracted work or in-kind municipal time for the next 10 years should allow you to adequately prepare your community's budget for the repercussions of a potential EAB outbreak (for city maintained trees only). This

suggested yearly budget also includes the removal and replacement of the 20 trees recommended for removal.

Introduction

This plan was developed to assist Carson with the management, budgeting and future planning of their urban forest. Across the state, forestry budgets continue to decrease with more and more of that money spent on tree removal. With the anticipated arrival of Emerald Ash Borer (EAB), an invasive pest that kills native ash trees, it is time to prepare for the increased costs of tree removal and replacement planting. With proper planning and management of the current canopy in Carson, these costs can be extended over years and public safety issues from dead and dying ash trees mitigated.

Trees are an important component of Carson'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 Carson and future generations through good urban forestry management.

Good urban tree 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 Carson's urban forestry goals.

Inventory

In 2016, a tree inventory was conducted that included 100% of the city owned street right of way and park trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver. The data collector gives Geographic Information Systems (GIS) coordinates with an accuracy of 3 meters, which can be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document. Your community tree information is available for your use on a web-based GIS program. This GIS website, in addition to the fact sheet on how to operate the website, can be found at: http://www.iowadnr.gov/Conservation/Forestry/Urban-Forestry/Community-Tree-Inventories.

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 of 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 304 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STREETS) part of the i-Tree suite. The following are results from the i-Tree analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Carson's trees reduce energy related costs by approximately $14,451 annually (Appendix A, Table 1). These savings are both in Electricity (69.5 MWh) and in Natural Gas (9,366 Therms).

Annual Stormwater Benefits

Carson's trees intercept about 799,386 gallons of rainfall or snow melt each year (Appendix A, Table 2). This interception provides $21,633 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 mater (ozone). In Carson, it is estimated that trees remove 928.8 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 $2,636 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere. In Carson, trees sequester about 267,805 lbs of carbon a year with an associated value of $2,009 (Appendix A, Table 5). In addition, the trees store 3,416,379 lbs of carbon, with a yearly benefit of $25,623 (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. Carson receives $14,052 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, Carson's trees provide $54,811 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 304 trees in Carson provide approximately $180.30 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Carson has over 39 different tree species along city streets and parks (Appendix A, Figure 1). The distribution of trees by genus is as follows:

Carson Tree List by Genus		
Species	**Number**	**Percent of Total**
Maple	103	33.9%
Oak	34	11.2%
Ash	29	9.5%
Elm	19	6.3%
Apple	18	5.9%
Poplar	13	4.3%
Linden	12	3.9%
Spruce	11	3.6%
Pear	11	3.6%
Birch	9	3.0%
Hackberry	9	3.0%
Sycamore	9	3.0%
Walnut	8	2.6%
Other Hardwoods	8	2.6%
Pine	3	1.0%
Cherry/Plum	2	0.7%
Conifer	2	0.7%
Catalpa	2	0.7%
Broadleaf Evergreen	1	0.3%
Juniper	1	0.3%
TOTALS	**304**	**100.0%**

Age Class

30% of Carson's trees fall between 6 and 18 inches in diameter. For age, a Bell Curve is preferred and should show the highest amount of trees around 18 inches in diameter at 4.5 ft. The highest quantity of trees are centered between 12 and 18 inches, indicating a younger than average population of trees. Continue to plant trees, as feasible, to increase your canopy cover goals for the community.

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 Carson indicate that 96% of the trees were in good or fair health in 2016, with only 4% of the sampled trees in poor or dead/dying foliar health (Appendix A, Figure 3). Similarly, 92% of Carson's trees are in good or fair health for wood condition (appendix A, Figure 4). Wood condition that is in poor health or is considered dead or dying is about 5% of the population. This 8% is an estimate of trees that need management/follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix A, Figures 8 & 9).

TASK	**Number of Trees**	**% of Total trees**
Cleaning	33	11%
Removal	20	7%
Treat pest/disease	7	2%
Stake/Train	6	2%
Raise	2	<1%

Canopy Cover

The estimated canopy cover for the entire town of Carson is approximately 67.9 acres (as calculated by the Iowa DNR). The canopy cover estimated by i-tree for the inventoried right of way and park trees is 8 acres (Appendix A, Figure 5). According to the 2010 census, Carson occupies 453.79 acres. Thus the canopy cover on city parks and right of way areas is about 1.8%, and over the entire community is 15%.

Land Use and Location

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

<u>Land Use</u>	
Single Family Residential	58.6%
Park/Vacant/Other	37.8%
Small Commercial	3.6%

<u>Location</u>	
Front yard	58.9%
Planting Strip	37.2%
Median	3.6%

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

Carson has 5 critical concern trees that are in need of removal as soon as possible. These trees can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figures 4 and 5). In addition, there are 11 trees identified as needing removal in the next 1-3 years, and 4 trees needing removal in the next 5 years. There are 7 trees that needs follow-up due to a forest health issue. There is one tree that is recommended for cleaning ASAP, 12 trees that should be cleaned in in the next 3 years and 20 trees that should be cleaned in the next 5 years. There are 2 trees recommended for crown reductions in the next 5 years, and also 6 young trees recommended for staking/training/or corrective pruning in the next 5 years. These recommendations are summarized on the following table.

PRIORITY TASK	CRITICAL CONCERN	MATURE TREE IMMEDIATE	MATURE TREE ROUTINE	YOUNG TREE IMMEDIATE	YOUNG TREE ROUTINE	TOTAL
NONE:	2		161		73	**236**
STAKE/TRAIN					6	**6**
CLEAN	1	12	18		2	**33**
RAISE						
REDUCE			2			**2**
REMOVE	5	11	2		2	**20**
TREAT PEST/DISEASE			7			**7**
TOTAL	**8**	**23**	**190**		**83**	**304**

Poor tree species

After the removal of the critical concern and immediate concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 1 & Appendix B, Figure 3). Of the 20 trees recommended for removal, 2 are ash trees. There are a total of 29 ash trees, and 1 tree has signs and symptoms that have been associated with EAB. Two of the ash trees are considered to be in poor health or dead/dying. EAB symptomatic trees should be examined as soon as possible. *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 five main maintenance issues to be addressed: routine pruning, crown cleaning, crown raising, crown reduction, and treat pest/disease. 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. Treat pest/disease trees showed indications of foliar or structural decline due to insect, disease, or rot. These trees should be investigated further by a certified arborist who can look into the integrity of the tree. It is recommended that all trees be pruned on a routine schedule every five to seven years.

Planting

It is suggested that for every tree removed, a replanting rate of 1.2 should be used, since survival rates will not be 100%. 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 canopy cover in Carson.

It is important to plant a diverse mix of species in Carson 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, Carson is heavily planted with Maple (33.9%) and Oak species (11.2%) (Appendix A, Figure 1). *Maples should not be planted until this percentage can be lowered.* Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, Chinese and Siberian elms, willow, and black walnut. All trees planted must meet the restrictions in city ordinance (Appendix C).

Bur oak, chinkapin oak, white oak, red oak, black oak, Kentucky coffee tree, American linden (basswood), thornless honey locust, black cherry, sycamore, and hackberry are all suited to Carson's upland soils – and are presently underutilized. In addition, ironwood (*Ostrya virginiana*), eastern redbud (*Cercis canadensis)*, and serviceberry (*Amalanchier arborea*) would make great alternatives to low growing trees for right of ways.

Recommended Species to plant in Western Iowa:

COMMON NAME	SCIENTIFIC NAME	CULTIVARS / SELECTIONS
LARGE SHADE TREES – Plant 35 feet apart and away from overhead power lines.		
White Oak	*Quercus alba*	
Bur Oak	*Quercus macrocarpa*	
Red Oak	*Quercus rubra*	
Black Oak	*Quercus veluntina*	
Chinkapin Oak	*Quercus muehlenbergii*	
American Basswood (Linden)	*Tilia Americana*	Boulevard, Front Yard, Legend, Redmond
Thornless Honey locust	*Gleditsia triacanthos var.*	Shademaster, Skyline

	inermis	
American elm	*Ulmus Americana*	Princeton, Valley Forge
Kentucky coffee tree	*Gymnocladus diocius*	Expresso
Black Cherry	*Prunus serotina*	
Hackberry	*Celtis occidentalis*	Chicagoland, Prairie Pride, Windy City
LOW GROWING TREES (less than 30 feet tall) planted as close as 12 feet.		
Eastern redbud	*Cercis canadensis*	
Downy Hawthorn	*Crataegus mollis*	
Ironwood (hop hornbeam)	*Ostrya virginiana*	
American hornbeam	*Carpinus caroliniana*	
Serviceberry	*Amalanchier arborea*	Autumn brilliance, Cumulus, Princess Diana
Flowering crabapple	*Malus*	Prairiefire, Adams, Sentinel, Snowdrift
Red mulberry	*Morus rubra*	
American (wild) plum	*Prunus americana*	
EVERGREEN TREES – planted 25 feet apart and away from overhead power lines.		
Eastern White Pine	*Pinus strobes*	
Jack pine	*Pinus banksiana*	
Juniper (Eastern red cedar)	*Juniperus virginiana*	
Norway spruce	*Picea abies*	
Concolor fir	*Abies concolor*	

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 death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Emerald Ash Borer Plan

Ash Tree Removal

Tree removal should be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 3). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 1 & Appendix B, Figure 2). *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of over 25 million 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. The entire state of Iowa is under USDA quarantine for EAB.

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.

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? 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.

Canopy Replacement

As budget permits, all removed ash trees should be replaced. All trees should meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings should be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese/Siberian elm, 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 genus other than ash should 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 suggested that private property owners monitor the condition of their privately managed trees. There are numerous options available to them, including: removal and replanting, treating with insecticides, and monitoring until an issue arises. These options are spelled out in: https://store.extension.iastate.edu/Product/Emerald-Ash-Borer-Management-Options. Check your city tree ordinance to be sure additional actions are not required for these private trees.

Treating for EAB

Many landowners will want to treat their ash trees with insecticides to prolong the life of their ash trees. This is only recommended by Iowa State University Extension when EAB has been found within 15 miles of the tree in question. The closest known population of EAB to Carson is Omaha, Nebraska.

Insecticidal applications can have serious environmental side effects when improperly applied. "Do it yourself" insecticides (drenches, granulars) have application limits – like only treating 3 trees per acre, for instance. Encourage your residents to report ash treatments with the city or their neighbors – in order to prevent over-application of these insecticides. Please contact me if you have any questions.

My suggestion would be to start increasing the city tree budget for removals and replacements now. I would place all efforts and finances on replanting trees – and removing declining trees and EAB casualty trees as they arise. Your community should put heavy thought and consideration into your emerald ash borer plan. For instance, it may be more economical to budget for ash removals as they come, than it would be to treat each city-managed ash tree for the next 5 to 10 years.

Maintenance Plan and Budget

The following tasks are placed in order of yearly priority. These tasks should be fulfilled as your budget or personnel time allows. Critical concern trees should be treated immediately, and immediate mature tree tasks should be completed within 2-3 years (which is their expected lifetime before they become critical concern trees). Mature tree routine trees should be followed up on within 5 years. If you are interested in creating a scheduled maintenance and replanting plan, based on a set budget, please contact me. For now, a priority list looks like this:

2017: Clean the 1 tree identified for critical concern cleaning and remove the 5 critical concern trees (if they were not already removed in 2016). There are also 2 trees identified as critical concern with no task – this is likely due to their health. Please follow-up with these trees.

Discuss increasing tree removal and replacement time or financial budgets with city staff

Look into tree planting grants for community entities (Trees for Kids, Trees Forever grants)

2017-2019: Complete 11 mature tree immediate removals. Complete the crown cleaning of the 12 trees indicated as mature tree immediate – cleaning.

Determine how much money can be budgeted over the next 10 years for potential forest health issues.

Start replanting trees that you have removed, as time and finances permit. 24 trees should be replanted to replace the 18 hazard trees removed. 32 additional trees will be needed to replace all 27 remaining ash if an EAB infestation occurs. Plan on budgeting or requesting $150/tree for replanting and young tree maintenance costs (if you do not have a grant to cover the replanting costs).

Monitor for suspicious ash trees.

2019-2021:

Complete the crown cleaning of the 20 remaining young and mature trees, complete the removal of the two mature tree routine trees and the removal of the 2 young tree routine trees, and finally follow up with the 6 trees identified for staking/training needs.

Consider implementing a routine trimming (cleaning) regimen for the remaining city trees. Ideally, routine trimming should be done to 1/3 of the city's trees every 2 years. In other words, all public and right of way trees should be trimmed once every 6 years.

Also – consider evaluating Carson's street trees again for hazards by 2021 (if not before).

Monitor for tree health issues – all species.

<u>Proposed Budget Increase</u>

Emerald Ash Borer could potentially kill all ash trees in Carson within 4 years of its arrival. To remove and replace all 27 (29 total ash trees, 2 are recommended for removal) inventoried ash trees, you would need to budget an estimated $13,500 (calculated using $500/tree removal price and $150/tree replacement price). Your 20 trees recommended for removal (and replacement) would cost an additional $13,600 for a total estimated 10 year tree budget of $31,900 (which does not include trimming/cleaning costs). If municipal crews usually take

down right of way and park trees, the removal costs will undoubtedly be much less than this figure. However, if you rely on contractors to remove and replant your city trees – you will want to be budgeting for at least $3,200 to $4,000 per year for the next 10 years.

It is recommended that Carson 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. The Trees for Kids Grant will be a great option for your community to use for tree planting projects on public lands. Trees Forever may also have community improvement grants that can assist with replanting expenses.

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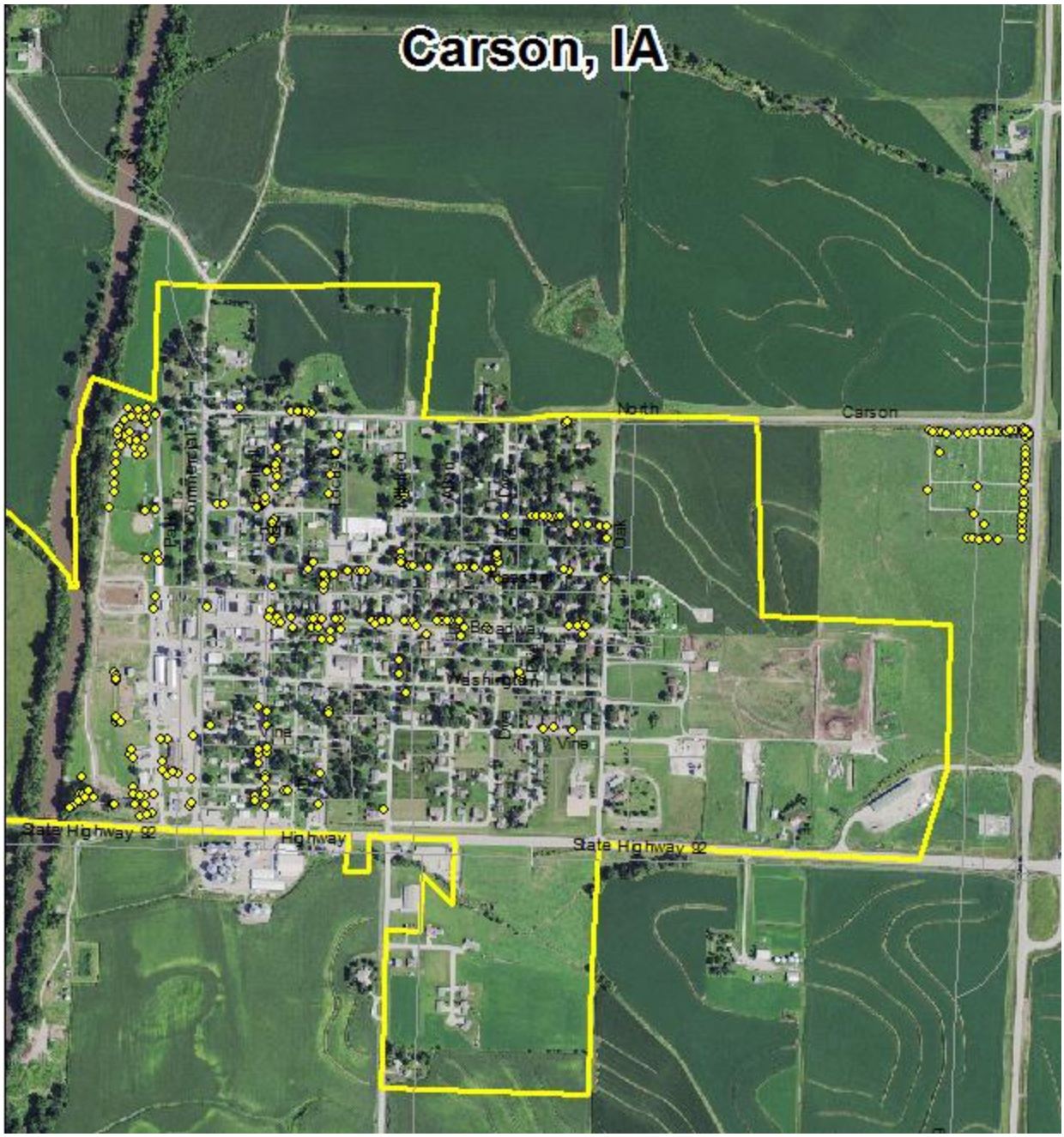
Carson, IA
North
Carson
Oak
Broadway
Washington
Vine
Vine
State Highway 92
Highway
State Highway 92

Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Carson

Annual Energy Benefits of Public Trees

1/9/2017

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	8.6	655	1,131.2	1,109	1,764	(N/A)	13.2	12.2	44.09
Silver maple	11.4	868	1,498.4	1,468	2,336	(N/A)	10.2	16.2	75.36
Green ash	8.7	663	1,177.1	1,154	1,816	(N/A)	9.2	12.6	64.87
Maple	3.0	229	405.0	397	626	(N/A)	7.9	4.3	26.09
Apple	1.5	116	234.7	230	346	(N/A)	5.9	2.4	19.23
Siberian elm	6.3	475	822.0	806	1,280	(N/A)	5.3	8.9	80.00
Cottonwood	5.7	434	763.5	748	1,182	(N/A)	4.3	8.2	90.91
American basswood	1.3	101	198.2	194	295	(N/A)	3.6	2.0	26.83
Callery pear	1.4	104	210.4	206	311	(N/A)	3.6	2.1	28.23
Blue spruce	0.8	62	111.4	109	171	(N/A)	3.3	1.2	17.10
White oak	0.0	2	4.7	5	7	(N/A)	3.3	0.0	0.66
American sycamore	3.0	231	423.1	415	646	(N/A)	3.0	4.5	71.74
Northern hackberry	3.3	253	468.0	459	712	(N/A)	3.0	4.9	79.08
Birch	1.1	80	147.5	145	224	(N/A)	3.0	1.6	24.92
Pin oak	2.6	199	356.9	350	549	(N/A)	3.0	3.8	61.02
Black walnut	2.5	189	338.5	332	520	(N/A)	2.6	3.6	65.06
Bur oak	0.4	28	45.8	45	73	(N/A)	2.0	0.5	12.11
Northern red oak	0.8	63	99.9	98	161	(N/A)	2.0	1.1	26.80
Sugar maple	1.2	94	162.6	159	253	(N/A)	1.3	1.8	63.25
Broadleaf Deciduous Small	0.0	1	1.9	2	3	(N/A)	1.0	0.0	0.87
Broadleaf Deciduous Mediu	0.6	46	85.9	84	130	(N/A)	1.0	0.9	43.31
Broadleaf Deciduous Large	0.8	63	112.7	110	173	(N/A)	0.7	1.2	86.52
Oak	0.1	7	14.2	14	21	(N/A)	0.7	0.1	10.65
Conifer Evergreen Small	0.0	1	1.3	1	2	(N/A)	0.7	0.0	0.93
Cherry plum	0.3	21	44.5	44	64	(N/A)	0.7	0.4	32.17
Eastern white pine	0.0	1	1.3	1	2	(N/A)	0.7	0.0	0.93
Northern catalpa	0.9	70	122.1	120	190	(N/A)	0.7	1.3	94.83
Elm	0.9	66	118.0	116	182	(N/A)	0.7	1.3	91.02
Red maple	0.5	39	60.1	59	98	(N/A)	0.7	0.7	48.95
Scotch pine	0.1	10	14.6	14	24	(N/A)	0.3	0.2	24.14
American elm	0.5	35	61.1	60	94	(N/A)	0.3	0.7	94.34
Boxelder	0.2	17	30.8	30	47	(N/A)	0.3	0.3	46.76
Spruce	0.0	0	0.7	1	1	(N/A)	0.3	0.0	0.93
Eastern red cedar	0.0	4	7.9	8	11	(N/A)	0.3	0.1	11.47
Littleleaf linden	0.1	6	12.5	12	18	(N/A)	0.3	0.1	18.25
Amur maple	0.0	0	0.6	1	1	(N/A)	0.3	0.0	0.87
White ash	0.1	7	13.3	13	20	(N/A)	0.3	0.1	20.10
Broadleaf Evergreen Mediur	0.4	28	46.9	46	74	(N/A)	0.3	0.5	73.91
Swamp white oak	0.1	8	16.9	17	24	(N/A)	0.3	0.2	24.47
Total	69.5	5,272	9,366.0	9,179	14,451	(N/A)	100.0	100.0	47.54

Table 2: Annual Stormwater Benefits

Carson

Annual Stormwater Benefits of Public Trees

1/9/2017

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	56,879	1,541	(N/A)	13.2	7.1	38.54
Silver maple	175,776	4,764	(N/A)	10.2	22.0	153.66
Green ash	99,900	2,707	(N/A)	9.2	12.5	96.69
Maple	23,520	637	(N/A)	7.9	2.9	26.56
Apple	6,823	185	(N/A)	5.9	0.9	10.27
Siberian elm	76,992	2,086	(N/A)	5.3	9.6	130.41
Cottonwood	85,565	2,319	(N/A)	4.3	10.7	178.37
American basswood	13,943	378	(N/A)	3.6	1.7	34.35
Callery pear	12,551	340	(N/A)	3.6	1.6	30.92
Blue spruce	12,158	329	(N/A)	3.3	1.5	32.95
White oak	179	5	(N/A)	3.3	0.0	0.48
American sycamore	42,395	1,149	(N/A)	3.0	5.3	127.65
Northern hackberry	37,948	1,028	(N/A)	3.0	4.7	114.27
Birch	7,988	216	(N/A)	3.0	1.0	24.05
Pin oak	26,056	706	(N/A)	3.0	3.3	78.46
Black walnut	28,533	773	(N/A)	2.6	3.6	96.65
Bur oak	2,299	62	(N/A)	2.0	0.3	10.38
Northern red oak	4,960	134	(N/A)	2.0	0.6	22.40
Sugar maple	17,883	485	(N/A)	1.3	2.2	121.16
Broadleaf Deciduous Small	22	1	(N/A)	1.0	0.0	0.20
Broadleaf Deciduous Medium	4,474	121	(N/A)	1.0	0.6	40.42
Broadleaf Deciduous Large	12,729	345	(N/A)	0.7	1.6	172.48
Oak	626	17	(N/A)	0.7	0.1	8.48
Conifer Evergreen Small	49	1	(N/A)	0.7	0.0	0.66
Cherry plum	1,439	39	(N/A)	0.7	0.2	19.49
Eastern white pine	97	3	(N/A)	0.7	0.0	1.32
Northern catalpa	14,478	392	(N/A)	0.7	1.8	196.17
Elm	14,478	392	(N/A)	0.7	1.8	196.17
Red maple	3,208	87	(N/A)	0.7	0.4	43.46
Scotch pine	1,539	42	(N/A)	0.3	0.2	41.70
American elm	4,551	123	(N/A)	0.3	0.6	123.33
Boxelder	2,233	61	(N/A)	0.3	0.3	60.52
Spruce	49	1	(N/A)	0.3	0.0	1.32
Eastern red cedar	659	18	(N/A)	0.3	0.1	17.86
Littleleaf linden	461	12	(N/A)	0.3	0.1	12.48
Amur maple	7	0	(N/A)	0.3	0.0	0.20
White ash	614	17	(N/A)	0.3	0.1	16.63
Broadleaf Evergreen Medium	4,740	128	(N/A)	0.3	0.6	128.45
Swamp white oak	586	16	(N/A)	0.3	0.1	15.88
Citywide total	799,386	21,663	(N/A)	100.0	100.0	71.26

Table 3: Annual Air Quality Benefits

Carson

Annual Air Quality Benefits of Public Trees

1/9/2017

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								
Norway maple	9.4	1.6	4.9	0.4	52	40.8	6.0	5.7	39.2	255	-2.4	-9	105.6	298	(N/A)	13.2	7.45
Silver maple	31.5	5.3	15.3	1.4	170	53.8	7.9	7.5	51.7	337	-16.1	-60	158.5	446	(N/A)	10.2	14.39
Green ash	13.2	2.1	6.2	0.6	70	41.5	6.1	5.8	39.6	259	0.0	0	115.1	329	(N/A)	9.2	11.76
Maple	5.3	0.9	2.5	0.2	28	14.3	2.1	2.0	13.7	89	-1.8	-7	39.3	111	(N/A)	7.9	4.63
Apple	2.1	0.3	1.0	0.1	11	7.5	1.1	1.0	6.9	46	0.0	0	20.1	58	(N/A)	5.9	3.20
Siberian elm	15.0	2.6	7.1	0.7	80	29.5	4.3	4.1	28.3	185	0.0	0	91.6	265	(N/A)	5.3	16.55
Cottonwood	15.9	2.5	7.0	0.7	83	27.1	4.0	3.8	25.9	169	0.0	0	86.8	252	(N/A)	4.3	19.39
American basswood	1.8	0.3	0.9	0.1	10	6.5	0.9	0.9	6.0	40	-1.6	-6	15.9	44	(N/A)	3.6	4.00
Callery pear	2.5	0.4	1.2	0.1	13	6.8	1.0	0.9	6.2	42	-0.6	-2	18.5	53	(N/A)	3.6	4.80
Blue spruce	1.9	0.4	1.5	0.2	12	3.9	0.6	0.5	3.7	24	-4.5	-17	8.1	19	(N/A)	3.3	1.94
White oak	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.3	1	(N/A)	3.3	0.08
American sycamore	6.0	1.0	2.7	0.3	32	14.6	2.1	2.0	13.8	91	0.0	0	42.6	123	(N/A)	3.0	13.62
Northern hackberry	7.0	1.2	3.4	0.3	38	16.0	2.3	2.2	15.1	100	0.0	0	47.7	138	(N/A)	3.0	15.29
Birch	1.4	0.2	0.7	0.1	8	5.1	0.7	0.7	4.8	31	-0.4	-1	13.4	38	(N/A)	3.0	4.21
Pin oak	4.2	0.7	2.2	0.2	23	12.5	1.8	1.7	11.9	78	-8.0	-30	27.3	71	(N/A)	3.0	7.92
Black walnut	3.6	0.6	1.7	0.2	19	11.9	1.7	1.6	11.3	74	0.0	0	32.6	93	(N/A)	2.6	11.64
Bur oak	0.1	0.0	0.1	0.0	1	1.7	0.3	0.2	1.7	11	0.0	0	4.1	12	(N/A)	2.0	1.92
Northern red oak	0.9	0.1	0.4	0.0	5	3.8	0.6	0.5	3.8	24	-1.2	-4	9.0	24	(N/A)	2.0	4.08
Sugar maple	3.1	0.5	1.4	0.1	16	5.8	0.9	0.8	5.6	36	-2.4	-9	15.9	44	(N/A)	1.3	10.98
Broadleaf Deciduous Small	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.0	0	0.0	0	0.1	0	(N/A)	1.0	0.11
Broadleaf Deciduous Medium	0.8	0.1	0.4	0.0	4	2.9	0.4	0.4	2.7	18	-0.2	-1	7.6	22	(N/A)	1.0	7.18
Broadleaf Deciduous Large	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)	0.7	17.37
Oak	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)	0.7	1.54
Conifer Evergreen Small	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.1	0	(N/A)	0.7	0.09
Cherry plum	0.5	0.1	0.2	0.0	3	1.4	0.2	0.2	1.2	8	0.0	0	3.8	11	(N/A)	0.7	5.45
Eastern white pine	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)	0.7	0.05
Northern catalpa	2.7	0.4	1.2	0.1	14	4.4	0.6	0.6	4.2	27	0.0	0	14.3	42	(N/A)	0.7	20.79
Elm	2.3	0.4	1.0	0.1	12	4.2	0.6	0.6	4.0	26	0.0	0	13.1	38	(N/A)	0.7	19.04
Red maple	0.6	0.1	0.3	0.0	3	2.4	0.4	0.3	2.3	15	-0.2	-1	6.2	18	(N/A)	0.7	8.75
Scotch pine	0.2	0.0	0.1	0.0	1	0.6	0.1	0.1	0.6	4	-0.5	-2	1.2	3	(N/A)	0.3	2.82
American elm	0.9	0.2	0.5	0.0	5	2.2	0.3	0.3	2.1	13	0.0	0	6.4	19	(N/A)	0.3	18.52
Boxelder	0.3	0.0	0.1	0.0	1	1.0	0.2	0.1	1.0	7	-0.1	0	2.7	8	(N/A)	0.3	7.54
Spruce	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)	0.3	0.05
Eastern red cedar	0.1	0.0	0.1	0.0	0	0.2	0.0	0.0	0.2	1	-0.3	-1	0.3	1	(N/A)	0.3	0.62
Littleleaf linden	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)	0.3	2.55
Amur maple	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)	0.3	0.11
White ash	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	2.91
Broadleaf Evergreen Medium	0.7	0.1	0.7	0.1	5	1.7	0.3	0.2	1.6	11	-1.3	-5	4.1	11	(N/A)	0.3	10.71
Swamp white oak	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)	0.3	3.47
Citywide total	136.2	22.8	66.0	6.3	732	330.3	48.2	46.0	314.7	2,061	-41.7	-157	928.8	2,636	(N/A)	100.0	8.67

Table 4: Annual Carbon Stored

Carson

Stored CO2 Benefits of Public Trees

1/9/2017

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	156,172	1,171	(N/A)	13.2	4.6	29.28
Silver maple	719,565	5,397	(N/A)	10.2	21.1	174.09
Green ash	436,117	3,271	(N/A)	9.2	12.8	116.82
Maple	58,937	442	(N/A)	7.9	1.7	18.42
Apple	33,574	252	(N/A)	5.9	1.0	13.99
Siberian elm	363,708	2,728	(N/A)	5.3	10.6	170.49
Cottonwood	547,270	4,105	(N/A)	4.3	16.0	315.73
American basswood	64,922	487	(N/A)	3.6	1.9	44.26
Callery pear	41,177	309	(N/A)	3.6	1.2	28.08
Blue spruce	14,978	112	(N/A)	3.3	0.4	11.23
White oak	122	1	(N/A)	3.3	0.0	0.09
American sycamore	197,387	1,480	(N/A)	3.0	5.8	164.49
Northern hackberry	113,308	850	(N/A)	3.0	3.3	94.42
Birch	23,425	176	(N/A)	3.0	0.7	19.52
Pin oak	106,963	802	(N/A)	3.0	3.1	89.14
Black walnut	118,151	886	(N/A)	2.6	3.5	110.77
Bur oak	4,928	37	(N/A)	2.0	0.1	6.16
Northern red oak	14,579	109	(N/A)	2.0	0.4	18.22
Sugar maple	92,850	696	(N/A)	1.3	2.7	174.09
Broadleaf Deciduous	41	0	(N/A)	1.0	0.0	0.10
Broadleaf Deciduous	12,670	95	(N/A)	1.0	0.4	31.68
Broadleaf Deciduous	65,202	489	(N/A)	0.7	1.9	244.51
Oak	1,047	8	(N/A)	0.7	0.0	3.93
Conifer Evergreen Sn	5	0	(N/A)	0.7	0.0	0.02
Cherry plum	7,651	57	(N/A)	0.7	0.2	28.69
Eastern white pine	5	0	(N/A)	0.7	0.0	0.02
Northern catalpa	95,241	714	(N/A)	0.7	2.8	357.15
Elm	78,517	589	(N/A)	0.7	2.3	294.44
Red maple	7,248	54	(N/A)	0.7	0.2	27.18
Scotch pine	1,170	9	(N/A)	0.3	0.0	8.78
American elm	19,728	148	(N/A)	0.3	0.6	147.96
Boxelder	7,945	60	(N/A)	0.3	0.2	59.59
Spruce	2	0	(N/A)	0.3	0.0	0.02
Eastern red cedar	277	2	(N/A)	0.3	0.0	2.08
Littleleaf linden	1,025	8	(N/A)	0.3	0.0	7.68
Amur maple	14	0	(N/A)	0.3	0.0	0.10
White ash	1,035	8	(N/A)	0.3	0.0	7.76
Broadleaf Evergreen I	8,324	62	(N/A)	0.3	0.2	62.43
Swamp white oak	1,101	8	(N/A)	0.3	0.0	8.26
Citywide total	3,416,379	25,623	(N/A)	100.0	100.0	84.29

Table 5: Annual Carbon Sequestered

Carson

Annual CO Benefits of Public Trees

1/9/2017

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
Norway maple	14,222	107	-750	-76	-6	14,475	109	27,870	209 (N/A)	13.2	10.4	5.23
Silver maple	50,447	378	-3,454	-129	-27	19,173	144	66,037	495 (N/A)	10.2	24.7	15.98
Green ash	19,858	149	-2,093	-90	-16	14,650	110	32,323	242 (N/A)	9.2	12.1	8.66
Maple	6,371	48	-283	-30	-2	5,068	38	11,126	83 (N/A)	7.9	4.2	3.48
Apple	2,373	18	-161	-22	-1	2,566	19	4,755	36 (N/A)	5.9	1.8	1.98
Siberian elm	12,414	93	-1,746	-69	-14	10,488	79	21,087	158 (N/A)	5.3	7.9	9.88
Cottonwood	9,345	70	-2,627	-67	-20	9,583	72	16,235	122 (N/A)	4.3	6.1	9.37
American basswood	3,982	30	-312	-17	-2	2,229	17	5,882	44 (N/A)	3.6	2.2	4.01
Callery pear	2,218	17	-199	-16	-2	2,307	17	4,310	32 (N/A)	3.6	1.6	2.94
Blue spruce	751	6	-72	-16	-1	1,366	10	2,029	15 (N/A)	3.3	0.8	1.52
White oak	26	0	-1	-2	0	44	0	67	1 (N/A)	3.3	0.0	0.05
American sycamore	7,577	57	-947	-34	-7	5,107	38	11,702	88 (N/A)	3.0	4.4	9.75
Northern hackberry	4,608	35	-544	-34	-4	5,592	42	9,622	72 (N/A)	3.0	3.6	8.02
Birch	1,829	14	-113	-11	-1	1,763	13	3,468	26 (N/A)	3.0	1.3	2.89
Pin oak	10,557	79	-513	-27	-4	4,406	33	14,423	108 (N/A)	3.0	5.4	12.02
Black walnut	5,890	44	-567	-26	-4	4,170	31	9,468	71 (N/A)	2.6	3.5	8.88
Bur oak	736	6	-24	-4	0	613	5	1,321	10 (N/A)	2.0	0.5	1.65
Northern red oak	1,185	9	-70	-9	-1	1,390	10	2,497	19 (N/A)	2.0	0.9	3.12
Sugar maple	3,613	27	-446	-15	-3	2,069	16	5,221	39 (N/A)	1.3	1.9	9.79
Broadleaf Deciduous Smal	26	0	0	-1	0	17	0	42	0 (N/A)	1.0	0.0	0.10
Broadleaf Deciduous Medi	1,080	8	-61	-6	0	1,011	8	2,024	15 (N/A)	1.0	0.8	5.06
Broadleaf Deciduous Large	1,872	14	-313	-9	-2	1,384	10	2,934	22 (N/A)	0.7	1.1	11.00
Oak	211	2	-5	-1	0	163	1	368	3 (N/A)	0.7	0.1	1.38
Conifer Evergreen Small	1	0	0	0	0	12	0	13	0 (N/A)	0.7	0.0	0.05
Cherry plum	592	4	-37	-4	0	459	3	1,011	8 (N/A)	0.7	0.4	3.79
Eastern white pine	7	0	0	0	0	12	0	19	0 (N/A)	0.7	0.0	0.07
Northern catalpa	1,391	10	-457	-11	-4	1,547	12	2,470	19 (N/A)	0.7	0.9	9.26
Elm	1,824	14	-377	-10	-3	1,469	11	2,906	22 (N/A)	0.7	1.1	10.90
Red maple	966	7	-35	-4	0	862	6	1,789	13 (N/A)	0.7	0.7	6.71
Scotch pine	116	1	-6	-2	0	216	2	324	2 (N/A)	0.3	0.1	2.43
American elm	566	4	-95	-4	-1	762	6	1,230	9 (N/A)	0.3	0.5	9.22
Boxelder	694	5	-38	-3	0	366	3	1,020	8 (N/A)	0.3	0.4	7.65
Spruce	4	0	0	0	0	6	0	9	0 (N/A)	0.3	0.0	0.07
Eastern red cedar	40	0	-1	-1	0	82	1	119	1 (N/A)	0.3	0.0	0.89
Littleleaf linden	223	2	-5	-1	0	134	1	351	3 (N/A)	0.3	0.1	2.63
Amur maple	9	0	0	0	0	6	0	14	0 (N/A)	0.3	0.0	0.10
White ash	182	1	-5	-1	0	156	1	331	2 (N/A)	0.3	0.1	2.49
Broadleaf Evergreen Medi	420	3	-40	-4	0	617	5	994	7 (N/A)	0.3	0.4	7.45
Swamp white oak	224	2	-5	-1	0	176	1	393	3 (N/A)	0.3	0.1	2.95
Citywide total	168,450	1,263	-16,403	-757	-129	116,515	874	267,805	2,009 (N/A)	100.0	100.0	6.61

Table 6: Annual Social and Aesthetic Benefits

Carson

Annual Aesthetic/Other Benefits of Public Trees

1/9/2017

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,445	(N/A)	13.2	10.3	36.12
Silver maple	3,795	(N/A)	10.2	27.0	122.43
Green ash	1,592	(N/A)	9.2	11.3	56.84
Maple	833	(N/A)	7.9	5.9	34.72
Apple	136	(N/A)	5.9	1.0	7.56
Siberian elm	780	(N/A)	5.3	5.6	48.76
Cottonwood	612	(N/A)	4.3	4.4	47.06
American basswood	307	(N/A)	3.6	2.2	27.94
Callery pear	232	(N/A)	3.6	1.7	21.09
Blue spruce	137	(N/A)	3.3	1.0	13.72
White oak	53	(N/A)	3.3	0.4	5.26
American sycamore	537	(N/A)	3.0	3.8	59.67
Northern hackberry	555	(N/A)	3.0	4.0	61.68
Birch	188	(N/A)	3.0	1.3	20.92
Pin oak	859	(N/A)	3.0	6.1	95.49
Black walnut	470	(N/A)	2.6	3.3	58.76
Bur oak	105	(N/A)	2.0	0.7	17.49
Northern red oak	105	(N/A)	2.0	0.7	17.51
Sugar maple	338	(N/A)	1.3	2.4	84.41
Broadleaf Deciduous Small	0	(N/A)	1.0	0.0	0.03
Broadleaf Deciduous Medium	108	(N/A)	1.0	0.8	36.14
Broadleaf Deciduous Large	125	(N/A)	0.7	0.9	62.47
Oak	34	(N/A)	0.7	0.2	16.91
Conifer Evergreen Small	9	(N/A)	0.7	0.1	4.27
Cherry plum	35	(N/A)	0.7	0.3	17.60
Eastern white pine	12	(N/A)	0.7	0.1	5.76
Northern catalpa	87	(N/A)	0.7	0.6	43.45
Elm	117	(N/A)	0.7	0.8	58.34
Red maple	132	(N/A)	0.7	0.9	65.89
Scotch pine	32	(N/A)	0.3	0.2	32.32
American elm	74	(N/A)	0.3	0.5	74.47
Boxelder	52	(N/A)	0.3	0.4	51.63
Spruce	6	(N/A)	0.3	0.0	5.76
Eastern red cedar	21	(N/A)	0.3	0.2	21.34
Littleleaf linden	31	(N/A)	0.3	0.2	31.20
Amur maple	0	(N/A)	0.3	0.0	0.03
White ash	33	(N/A)	0.3	0.2	33.42
Broadleaf Evergreen Medium	38	(N/A)	0.3	0.3	38.47
Swamp white oak	26	(N/A)	0.3	0.2	26.22
Citywide total	14,052	(N/A)	100.0	100.0	46.23

Table 7: Summary of Benefits in Dollars

Carson

Total Annual Benefits of Public Trees by Species ($)

1/9/2017

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	1,764	209	298	1,541	1,445	5,257	(N/A)	9.6
Silver maple	2,336	495	446	4,764	3,795	11,836	(N/A)	21.6
Green ash	1,816	242	329	2,707	1,592	6,687	(N/A)	12.2
Maple	626	83	111	637	833	2,291	(N/A)	4.2
Apple	346	36	58	185	136	760	(N/A)	1.4
Siberian elm	1,280	158	265	2,086	780	4,570	(N/A)	8.3
Cottonwood	1,182	122	252	2,319	612	4,486	(N/A)	8.2
American basswood	295	44	44	378	307	1,068	(N/A)	1.9
Callery pear	311	32	53	340	232	968	(N/A)	1.8
Blue spruce	171	15	19	329	137	672	(N/A)	1.2
White oak	7	1	1	5	53	65	(N/A)	0.1
American sycamore	646	88	123	1,149	537	2,542	(N/A)	4.6
Northern hackberry	712	72	138	1,028	555	2,505	(N/A)	4.6
Birch	224	26	38	216	188	693	(N/A)	1.3
Pin oak	549	108	71	706	859	2,294	(N/A)	4.2
Black walnut	520	71	93	773	470	1,928	(N/A)	3.5
Bur oak	73	10	12	62	105	261	(N/A)	0.5
Northern red oak	161	19	24	134	105	444	(N/A)	0.8
Sugar maple	253	39	44	485	338	1,158	(N/A)	2.1
Broadleaf Deciduous Sn	3	0	0	1	0	4	(N/A)	0.0
Broadleaf Deciduous M	130	15	22	121	108	396	(N/A)	0.7
Broadleaf Deciduous La	173	22	35	345	125	700	(N/A)	1.3
Oak	21	3	3	17	34	78	(N/A)	0.1
Conifer Evergreen Smal	2	0	0	1	9	12	(N/A)	0.0
Cherry plum	64	8	11	39	35	157	(N/A)	0.3
Eastern white pine	2	0	0	3	12	16	(N/A)	0.0
Northern catalpa	190	19	42	392	87	729	(N/A)	1.3
Elm	182	22	38	392	117	751	(N/A)	1.4
Red maple	98	13	18	87	132	348	(N/A)	0.6
Scotch pine	24	2	3	42	32	103	(N/A)	0.2
American elm	94	9	19	123	74	320	(N/A)	0.6
Boxelder	47	8	8	61	52	174	(N/A)	0.3
Spruce	1	0	0	1	6	8	(N/A)	0.0
Eastern red cedar	11	1	1	18	21	52	(N/A)	0.1
Littleleaf linden	18	3	3	12	31	67	(N/A)	0.1
Amur maple	1	0	0	0	0	1	(N/A)	0.0
White ash	20	2	3	17	33	76	(N/A)	0.1
Broadleaf Evergreen Me	74	7	11	128	38	259	(N/A)	0.5
Swamp white oak	24	3	3	16	26	73	(N/A)	0.1
Citywide Total	14,451	2,009	2,636	21,663	14,052	54,811	(N/A)	100.0

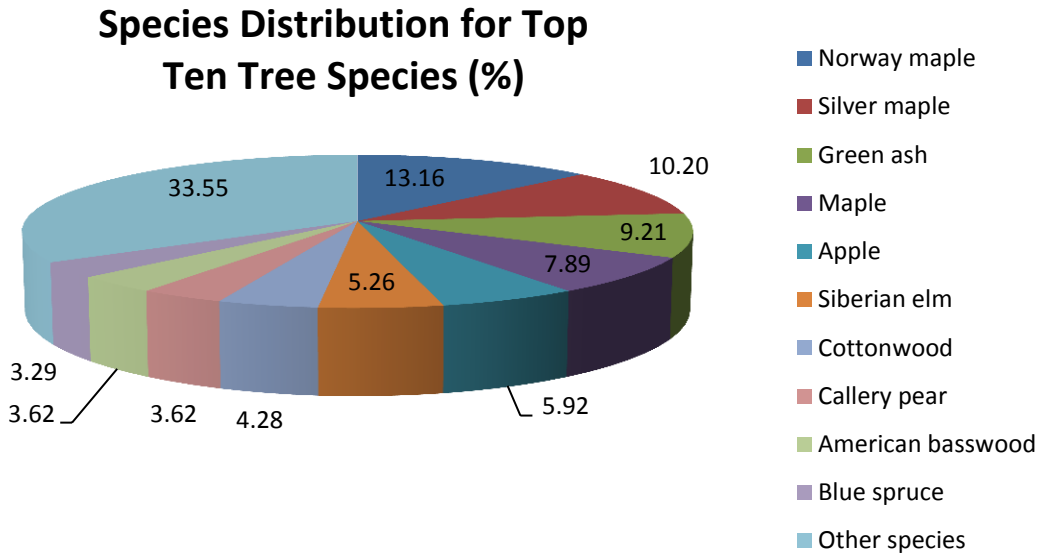

Figure 1: Species Distribution

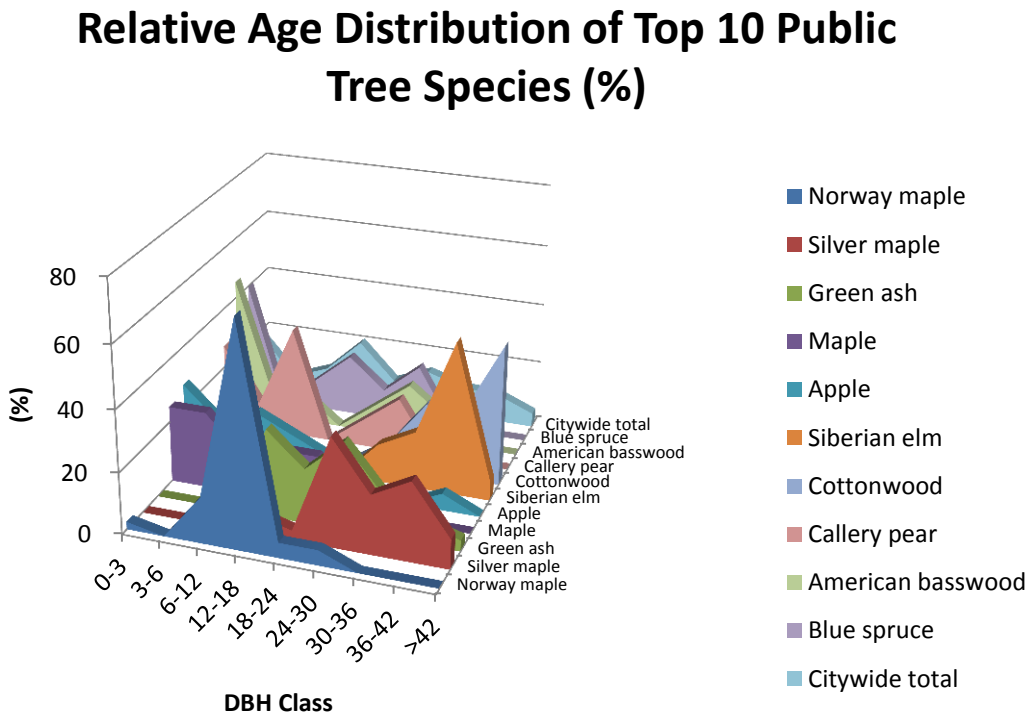

Figure 2: Relative Age Class

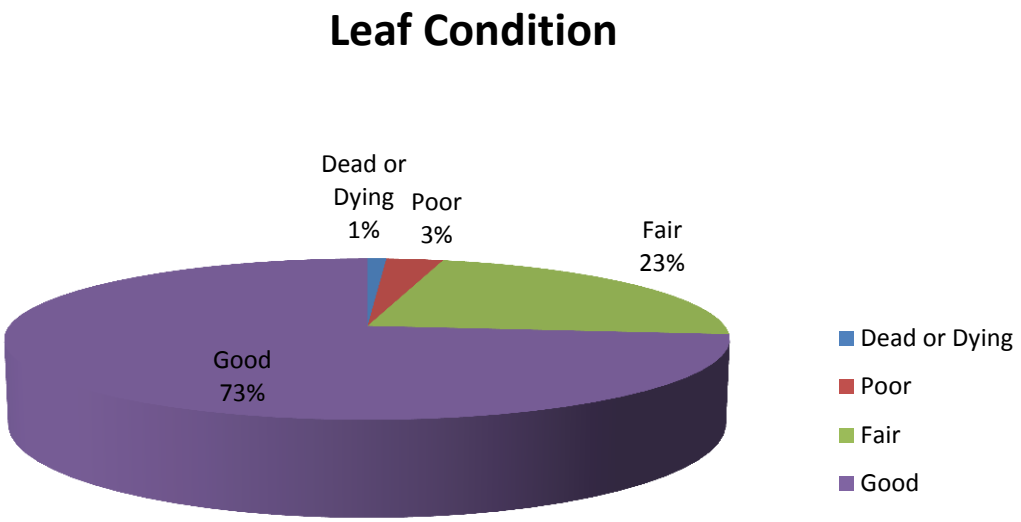

Figure 3: Foliage Condition

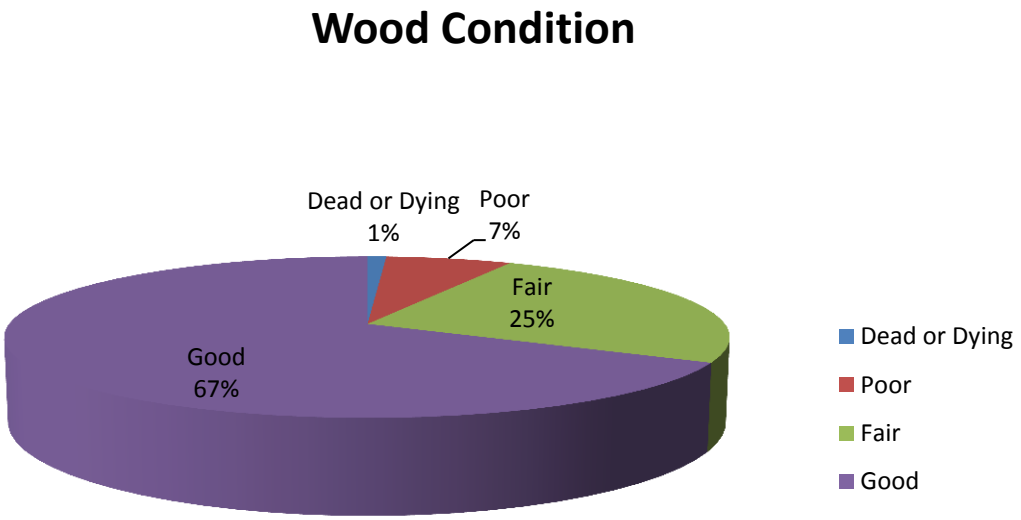

Figure 4: Wood Condition

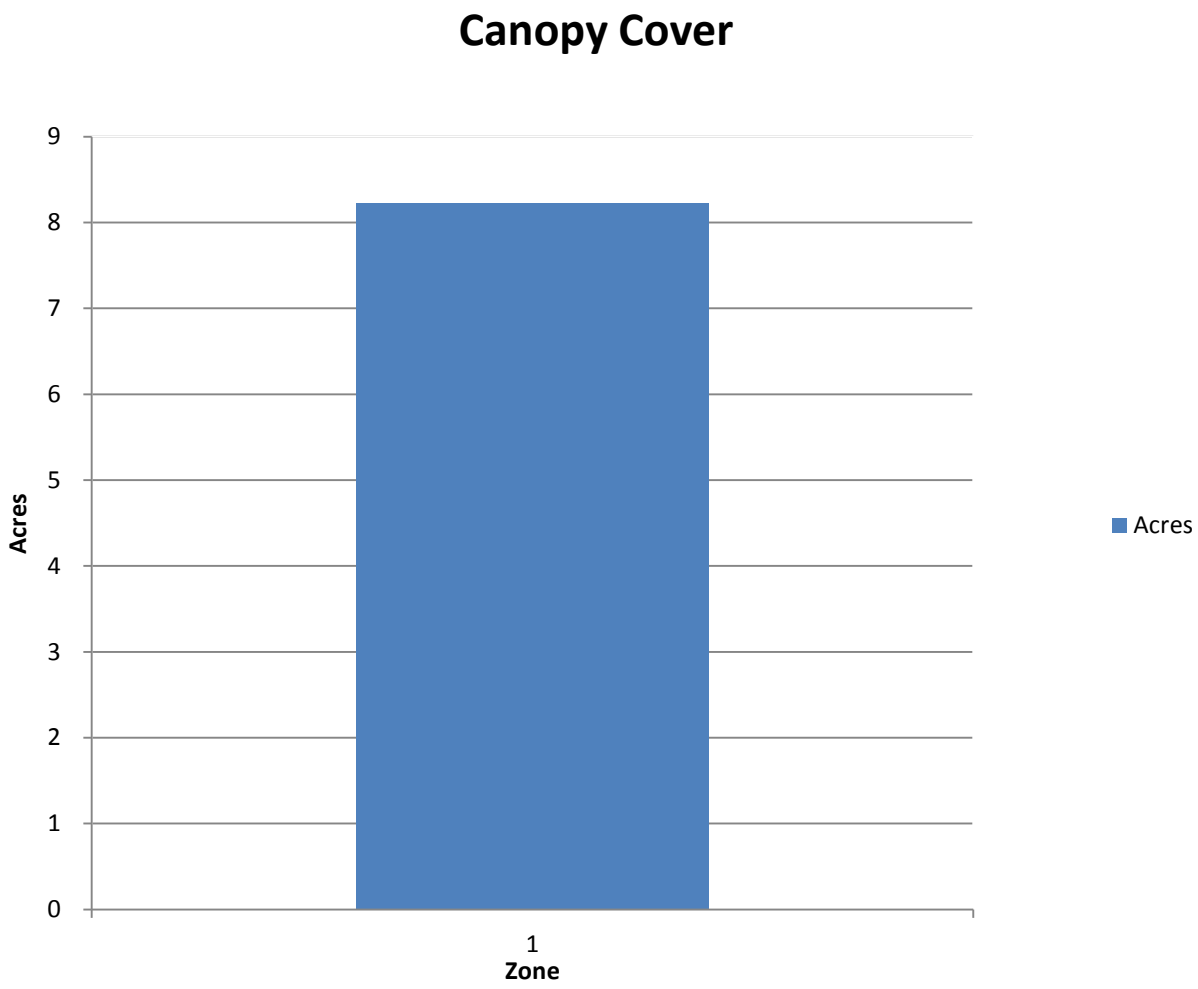

Figure 5: Canopy Cover in Acres

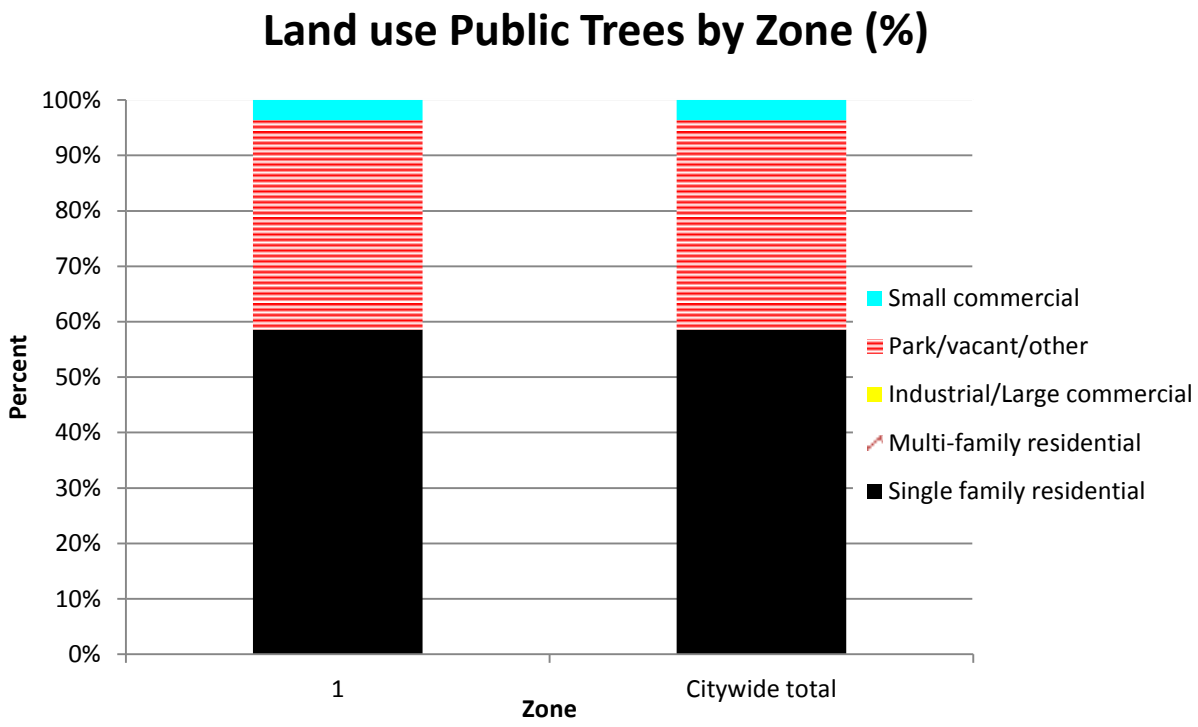

Figure 6: Land Use of city/park trees

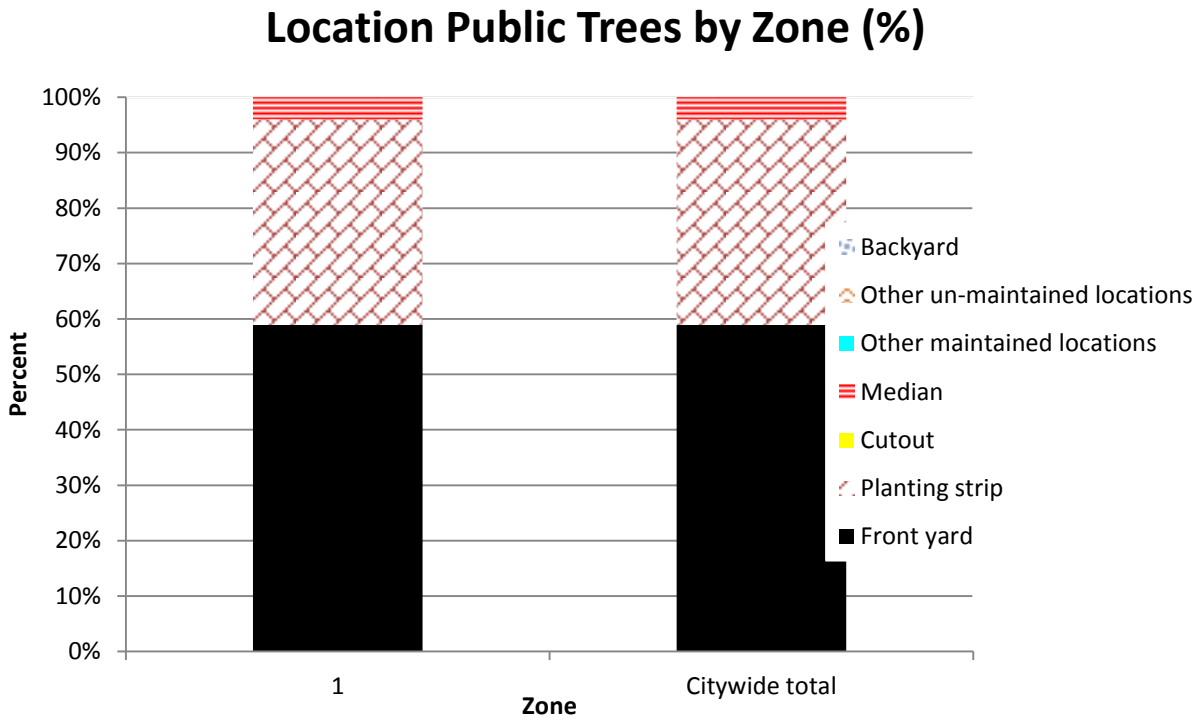

Figure 7: Location of city/park trees

Carson, IA

Recommended Maintenance for Public Trees (None)

1/9/2017

DBH Class (in)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
1	0	0	0	0	0	0	0	0	0	0
Citywide total	0	0	0	0	0	0	0	0	0	0

DBH Class (in)

Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	0	0	0	0	0	0	0	0	0	0	0.00
Young tree (routine)	54	15	9	2	3	0	0	0	0	83	27.30
Young tree (immediate)	0	0	0	0	0	0	0	0	0	0	0.00
Mature tree (routine)	0	0	18	55	21	36	26	22	12	190	62.50
Mature tree (immediate)	0	0	2	6	2	3	4	5	1	23	7.57
Critical concern (public safety)	0	0	0	0	1	3	1	2	1	8	2.63
Citywide total	54	15	29	63	27	42	31	29	14	304	100.00

Figure 8: Carson's trees by diameter class and recommended maintenance.

Carson, IA

Priority Task Summary for Public Trees (None)

1/9/2017

DBH Class (in)

Zone	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
1	47	15	24	51	21	27	22	19	10	236
Citywide total	47	15	24	51	21	27	22	19	10	236

DBH Class (in)

Maintenance Type	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total	% of Total Population
None	47	15	24	51	21	27	22	19	10	236	77.63
Stake/Train	6	0	0	0	0	0	0	0	0	6	1.97
Clean	1	0	2	6	2	6	4	8	4	33	10.86
Raise	0	0	0	0	0	0	0	0	0	0	0.00
Reduce	0	0	0	1	0	1	0	0	0	2	0.66
Remove	0	0	3	4	3	3	5	2	0	20	6.58
Treat pest/disease	0	0	0	1	1	5	0	0	0	7	2.30
Citywide total	54	15	29	63	27	42	31	29	14	304	100.00

Figure 9: Carson's trees organized by diameter class and recommended maintenance task.

Appendix B: ArcGIS Mapping

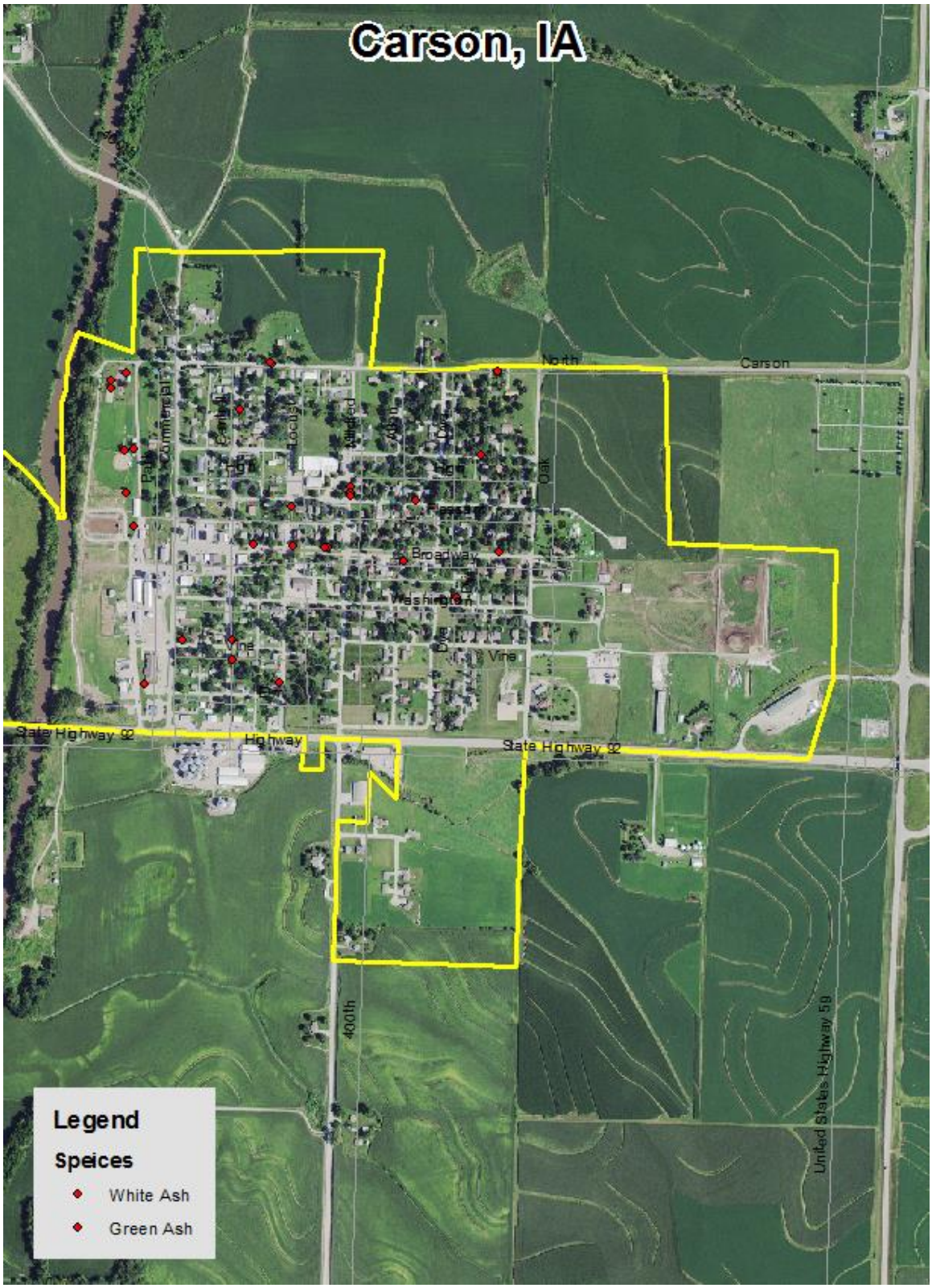

Figure 1: Location of Ash Trees

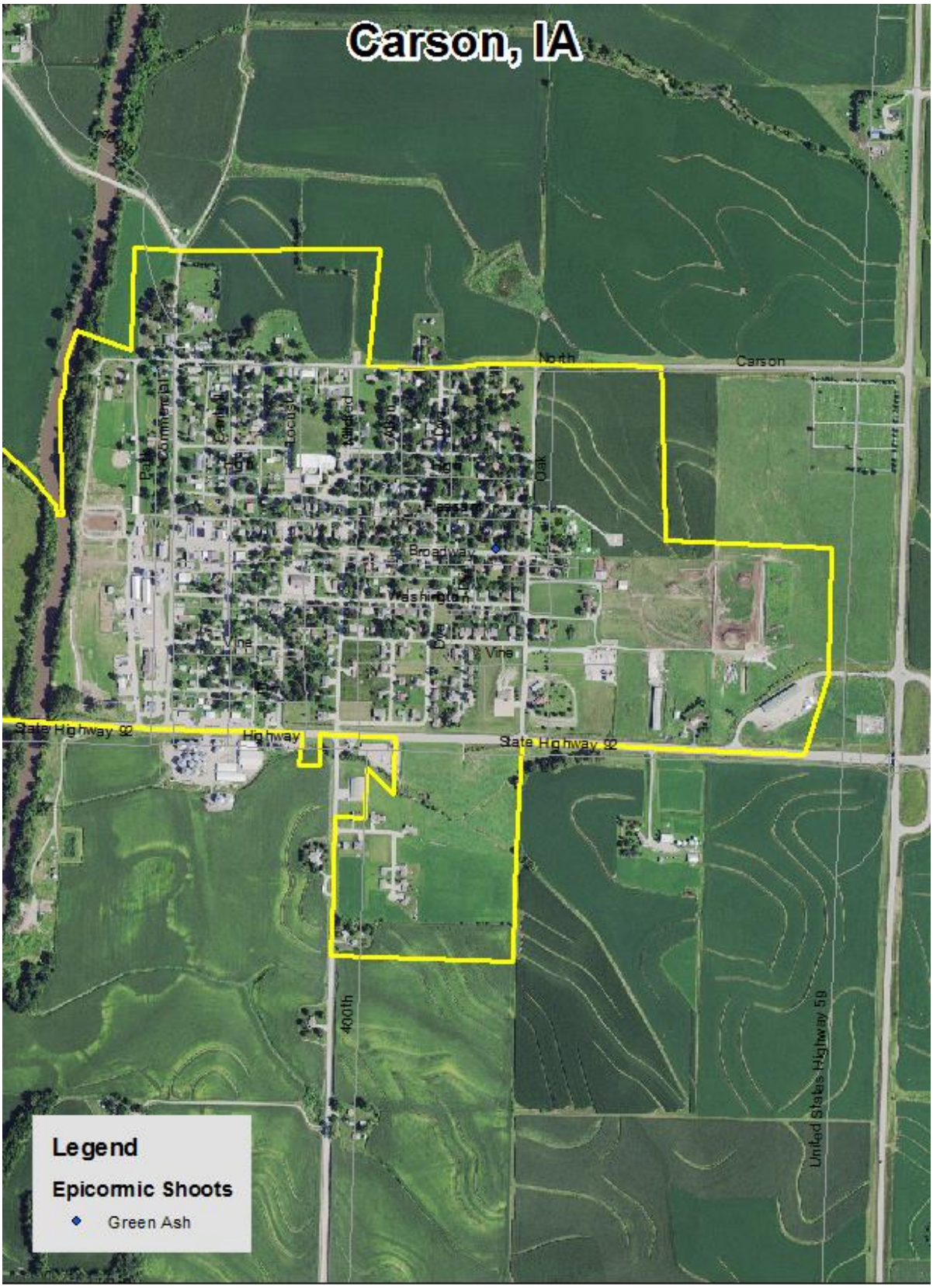

Figure 2: Location of EAB symptoms

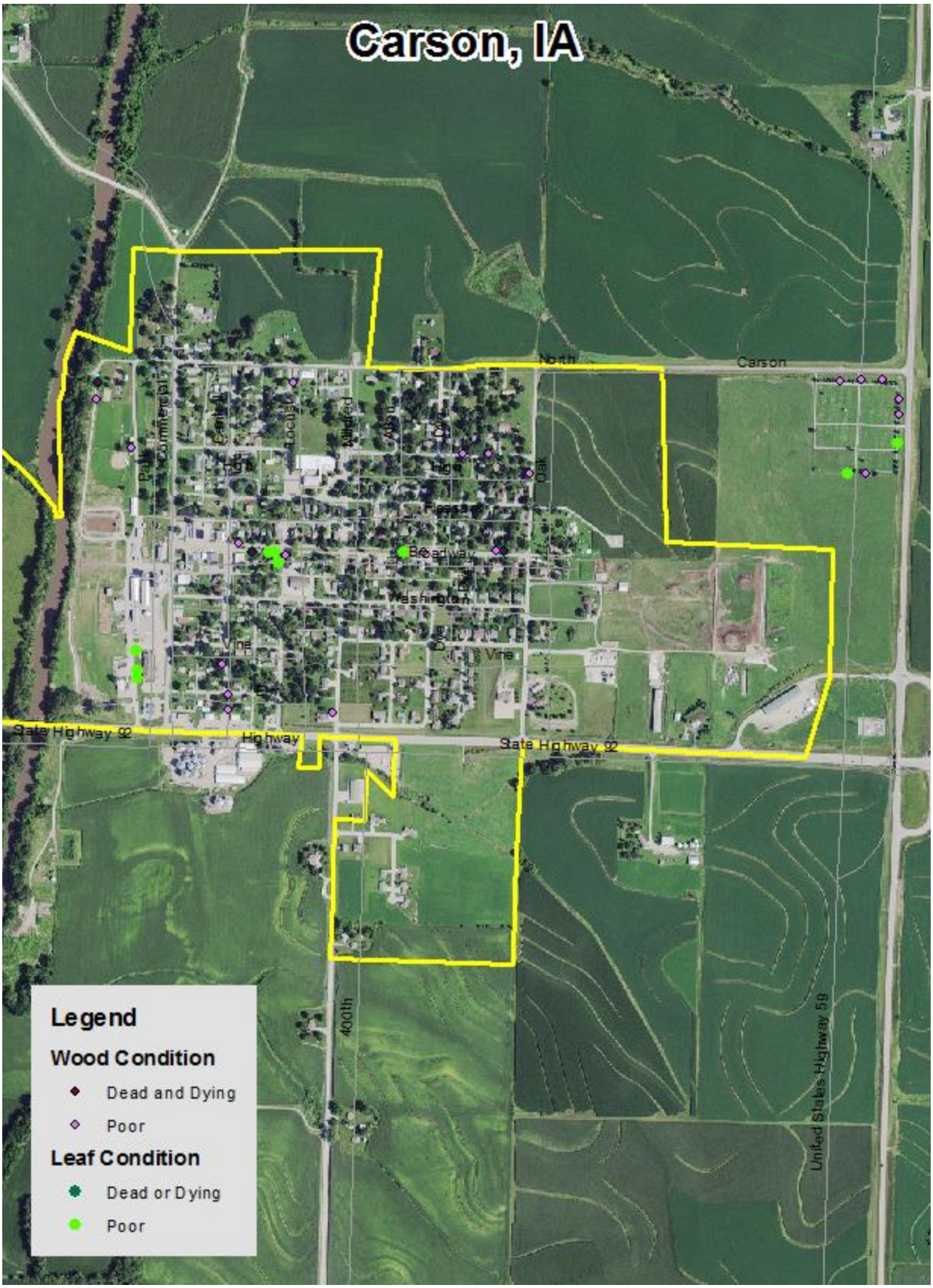

Figure 3: Location of Poor Condition Trees

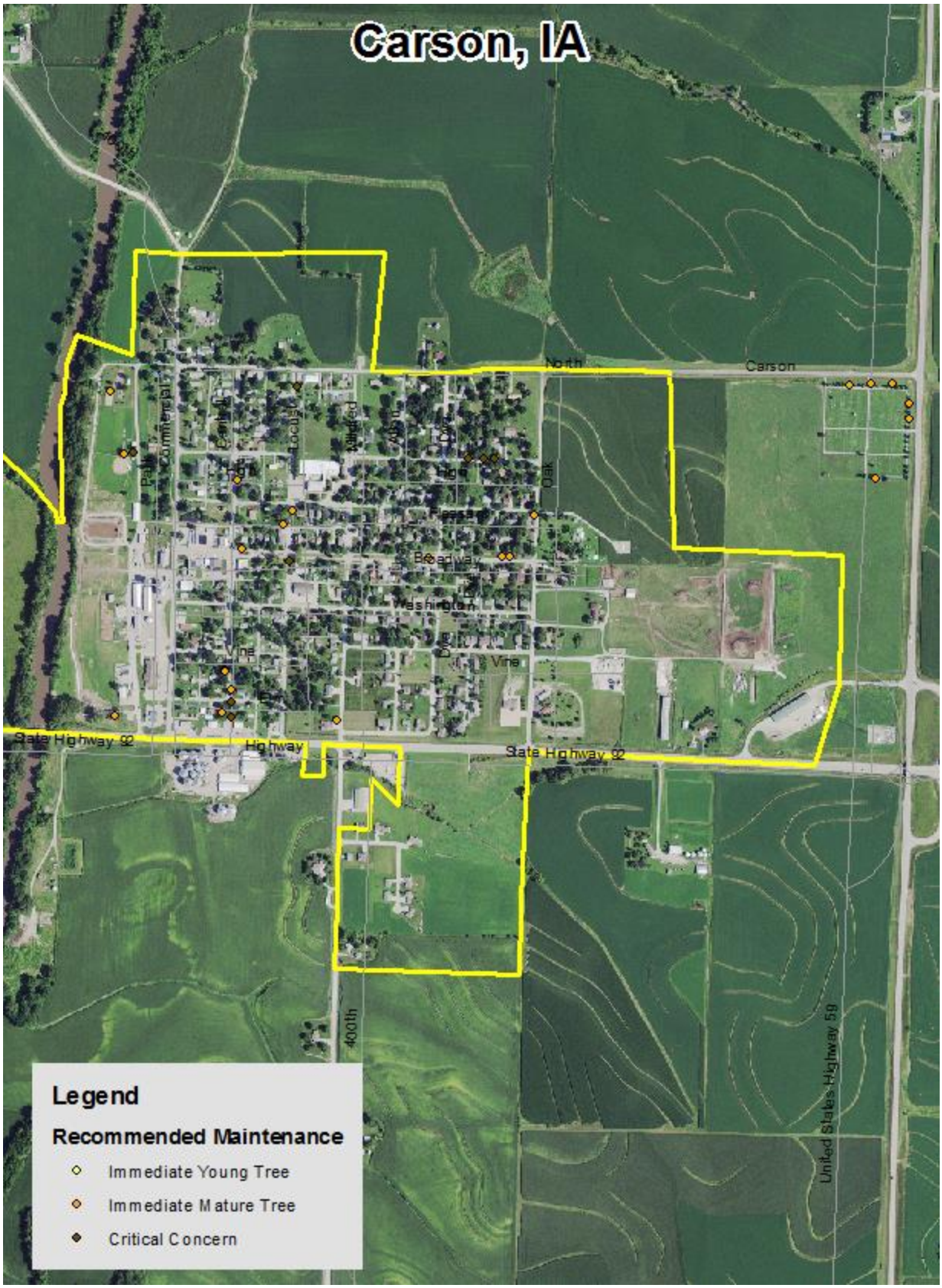

Figure 4: Location of Trees with Recommended Maintenance

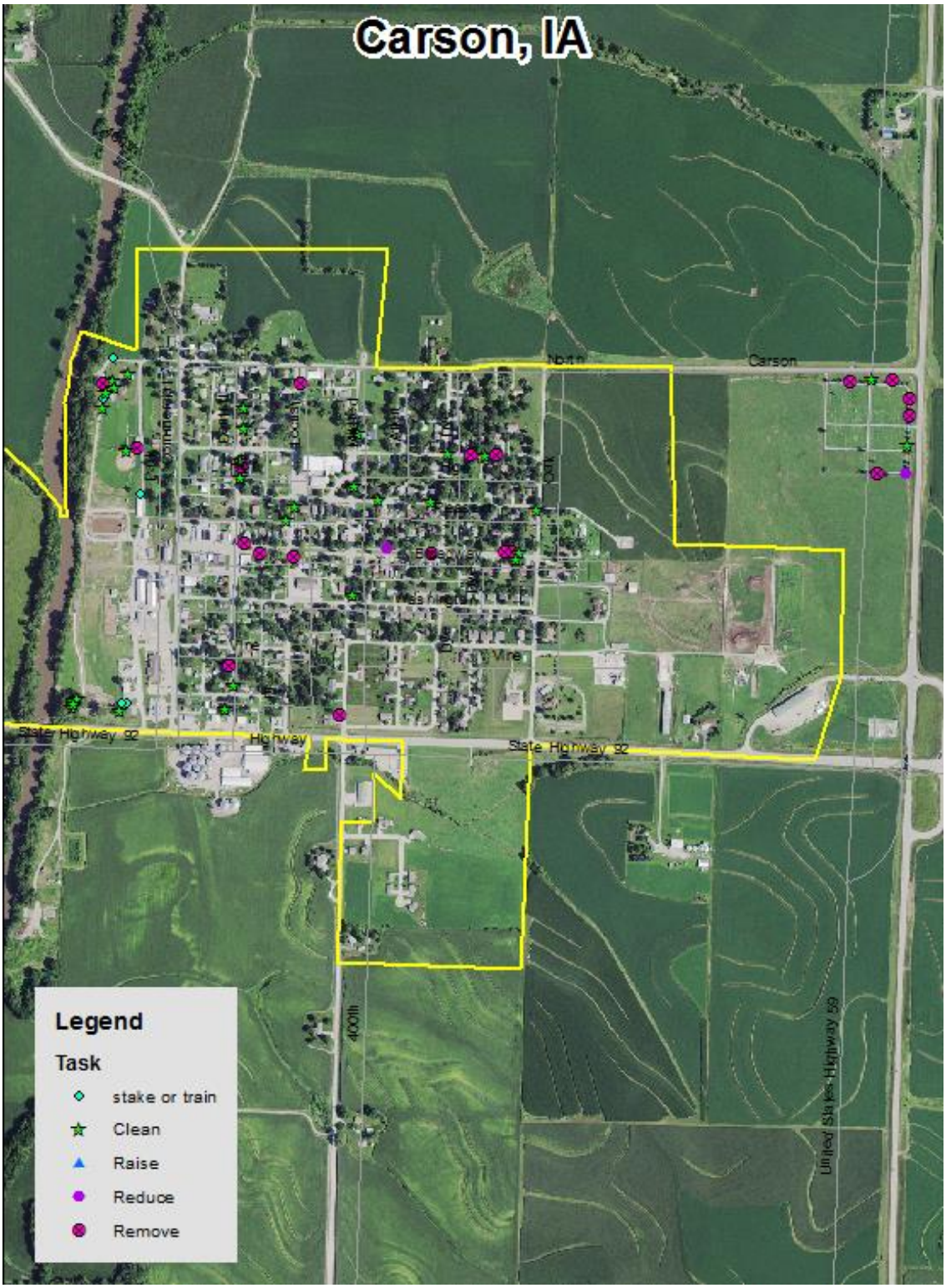

Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: Carson Tree Ordinances

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 in any parking or street except in accordance with the following:

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.

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.

151.03 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street or sidewalk, 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. *(Ord. 224 – Jan. 15 Supp.)*

(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])

[The next page is 675]

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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.