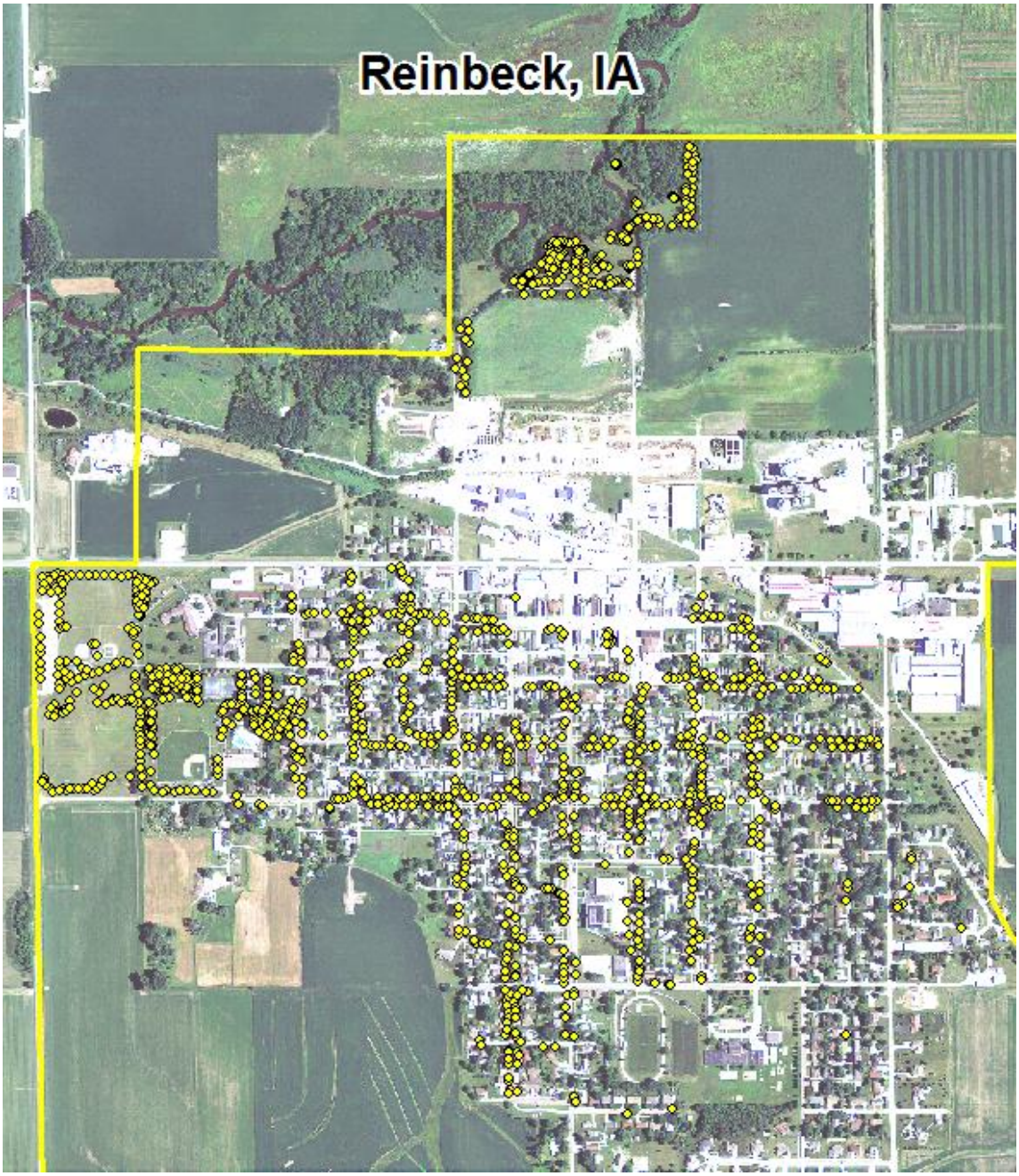
Reinbeck, IA



2014 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of Reinbeck 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). 14% of Reinbeck's city owned trees (ash) will die once EAB becomes established in the community if the trees are not treated. 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 2013, 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 1,334 trees inventoried.

- Reinbeck's trees provide $232,293 of benefits annually, an average of $174 a tree
- There are over 51 species of trees
- The top three genera are: Maple 42%, Ash 14%, and Oak 11%
- 4% of trees are in need of some type of management
- 27 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 27 trees needing removal, 15 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*
- 40 of the 185 ash trees are in need of follow up because they are displaying signs and symptoms associated with EAB
- 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

Introduction

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

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

Inventory

In 2013, 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 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 1334 city trees was entered into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM), part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Reinbeck's trees reduce energy related costs by approximately $62,562 annually (Appendix A, Table 1). These savings are both in Electricity (297.5 MWh) and in Natural Gas (40,799.9 Therms).

Annual Stormwater Benefits

Reinbeck's trees intercept about 3,160,230 gallons of rainfall or snow melt a year (Appendix A, Table 2). This interception provides $85,648 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 Reinbeck, it is estimated that trees remove 3,701.0lbs 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 $10,321 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Reinbeck, trees sequester about 672,836 lbs of carbon a year with an associated value of $8,391 (Appendix A, Table 4). In addition, the trees store 10,980,407 lbs of carbon, with a yearly benefit of $82,353 (Appendix A, Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. Reinbeck receives $65,371 in annual social benefits from trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, Reinbeck's trees provide $232,293 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 1,334 trees in Reinbeck provide approximately $174 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

Reinbeck has over 51 different tree species along city streets and parks (Appendix A, Figure 1).
The distribution of trees by genera is as follows:

Maple	560	42%
Ash	185	14%
Oak	145	11%
Spruce	73	5%
Hackberry	69	5%
Apple (crabapple)	64	5%
Honeylocust	49	4%
Linden	36	3%
Pine	25	2%
Birch	20	1%
Walnut	20	1%
Willow	19	1%
Popular/Cottonwood	12	1%
Lilac	10	1%
Elm	9	1%
Pear	6	<1%
White Cedar	6	<1%
Other	5	<1%
Mulberry	4	<1%
Ginkgo	3	<1%
Magnolia	3	<1%
Red bud	2	<1%
Sycamore	2	<1%
Mountain ash	2	<1%
Ohio buckeye	1	<1%
Hickory	1	<1%
Corktree	1	<1%
Plum	1	<1%
Black locust	1	<1%

Age Class

Most of Reinbeck's trees (38%) are over 24 inches in diameter at 4.5 ft (Appendix A, Figure 2). For age, it is preferred that the highest amounts of trees are in the smallest size category (a downward slope) to prepare for natural mortality and to maintain canopy cover. Reinbeck's size curve is on the large side, indicating an older than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the overall health of the urban forest. The foliage condition results for Reinbeck indicate that 92% of the trees are in good health, with none of the foliage in poor health, dead or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Also, 38% of Reinbeck's trees are in good health for wood condition (appendix A, Figure 4 & Appendix B, Figure 3). Wood condition that is in poor health is about 5% of the population. This 5% 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).

Tree Removal	27	2%
Crown Cleaning	18	1%
Crown Reduction	3	<1%
Tree Staking	2	<1%

Canopy Cover

The canopy cover of Reinbeck is approximately 33 acres (Appendix A, Figure 4).

Land Use and Location

The majority of Reinbeck'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	58%
Park/vacant/other	41%
Industrial/Large commercial	<1%
Small commercial	<1%
Multifamily residential	<1%

Location	
Front yard	51%
Planting strip	49%
Median	<1%
Cutout (surrounded by pavement)	<1%

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

Reinbeck has 1 critical concern tree that need immediate removal. This tree can be seen on the Location of Trees with Recommended Maintenance map (Appendix B, Figure 4). Please refer to the six year maintenance plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 49 trees with these needs.

Poor tree species

After the removal of the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). There are a total of 185 ash trees, and 40 of those have signs and symptoms that have been associated with EAB. In addition, there are 4 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 Reinbeck.

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 (42%) (Appendix A, Figure 1). Maples should not be planted until this percentage can be lowered. Also, ash trees have not been recommended since 2002, due to the threat of EAB. Other species to avoid because they are public nuisances include: cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut, as outlined in section 151.02 of the city ordinance (Appendix C). All trees planted must meet the restrictions in city ordinance 151.02 (Appendix C).

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree 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 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, spreading 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 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.

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 ash trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and will not include ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genus 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. City Code 151.6 states “If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant, or person in charge of said property fails to comply

within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the."

PROPOSED WORK SCHEDULE AND ESTIMATED COSTS

Year 1

Remove 1 critical concern and 11 immediate tree	$12,000
Plant 15 trees in open locations	$2,000
Visual survey for signs of Emerald Ash Borer	

Year 2

Remove 11 mark trees	$11,000
Plant 14 trees in open locations	$1,900
Prune 1/3 of trees of immediate needs	$2,000
Visual survey for signs of Emerald Ash Borer	

Year 3

Remove 12 mark trees	$12,000
Plant 15 trees in open locations	$2,000
Visual survey for signs of Emerald Ash Borer	

Year 4

Remove 12 ash in poor health or other trees	$12,000
*Or use to treat ash	
Plant 14 trees in open locations	$1,900
Prune 1/3 of trees of immediate needs	$2,000
Visual survey for signs of Emerald Ash Borer	

Year 5

Remove 12 ash in poor health or other trees	$12,000
*Or use to treat ash	
Plant 15 trees in open locations	$2,000
Visual survey for signs of Emerald Ash Borer	

Year 6

Remove 12 ash in poor health or other trees	$12,000
*Or use to treat ash	
Plant 14 trees in open locations	$1,900
Prune 1/3 of trees of immediate needs	$2,000
Visual survey for signs of Emerald Ash Borer	

*** It will take approximately 11 years to remove all ash with this schedule.**

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Reinbeck

Annual Energy Benefits of Public Trees by Species

3/14/2014

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	51.5	3,909	7,408.3	7,260	11,169	(N/A)	15.4	17.9	54.48
Green ash	46.9	3,558	6,344.2	6,217	9,775	(N/A)	13.6	15.6	54.01
Silver maple	50.5	3,834	6,626.0	6,493	10,327	(N/A)	13.0	16.5	59.70
Sugar maple	34.6	2,624	4,597.2	4,505	7,129	(N/A)	9.2	11.4	58.43
Northern hackberry	20.1	1,527	2,913.1	2,855	4,382	(N/A)	5.2	7.0	63.51
Apple	3.4	261	532.8	522	784	(N/A)	4.8	1.3	12.24
Northern red oak	11.1	845	1,510.8	1,481	2,325	(N/A)	4.7	3.7	37.51
Pin oak	20.1	1,526	2,709.1	2,655	4,181	(N/A)	4.4	6.7	72.09
Spruce	2.3	176	289.8	284	460	(N/A)	4.1	0.7	8.37
Honeylocust	11.2	849	1,487.7	1,458	2,307	(N/A)	3.7	3.7	47.08
Maple	3.5	264	475.7	466	730	(N/A)	2.9	1.2	18.73
Littleleaf linden	5.0	376	712.4	698	1,074	(N/A)	1.7	1.7	46.71
Eastern white pine	3.9	299	521.4	511	810	(N/A)	1.7	1.3	36.84
Black walnut	4.2	315	586.5	575	890	(N/A)	1.5	1.4	44.51
Willow	2.8	214	404.0	396	610	(N/A)	1.4	1.0	32.09
Red maple	3.1	237	409.1	401	638	(N/A)	1.2	1.0	39.85
River birch	4.4	336	644.8	632	968	(N/A)	1.1	1.6	64.54
Other street trees	18.8	1,427	2,626.9	2,574	4,001	(N/A)	10.6	6.4	28.18
Citywide total	297.5	22,578	40,799.9	39,984	62,562	(N/A)	100.0	100.0	46.90

Table 2: Annual Stormwater Benefits

Reinbeck

Annual Stormwater Benefits of Public Trees by Species

3/14/2014

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	497,807	13,492	(N/A)	15.4	15.8	65.81
Green ash	504,756	13,680	(N/A)	13.6	16.0	75.58
Silver maple	618,942	16,774	(N/A)	13.0	19.6	96.96
Sugar maple	382,667	10,371	(N/A)	9.2	12.1	85.01
Northern hackberry	168,081	4,555	(N/A)	5.2	5.3	66.02
Apple	12,941	351	(N/A)	4.8	0.4	5.48
Northern red oak	102,601	2,781	(N/A)	4.7	3.3	44.85
Pin oak	230,571	6,249	(N/A)	4.4	7.3	107.74
Spruce	33,628	911	(N/A)	4.1	1.1	16.57
Honeylocust	102,067	2,766	(N/A)	3.7	3.2	56.45
Maple	20,991	569	(N/A)	2.9	0.7	14.59
Littleleaf linden	54,242	1,470	(N/A)	1.7	1.7	63.92
Eastern white pine	94,959	2,574	(N/A)	1.7	3.0	116.98
Black walnut	48,320	1,310	(N/A)	1.5	1.5	65.48
Willow	26,831	727	(N/A)	1.4	0.9	38.27
Red maple	25,891	702	(N/A)	1.2	0.8	43.86
River birch	48,573	1,316	(N/A)	1.1	1.5	87.76
Other street trees	186,361	5,051	(N/A)	10.6	5.9	35.57
Citywide total	3,160,230	85,648	(N/A)	100.0	100.0	64.20

Table 3: Annual Air Quality Benefits

Reinbeck

Annual Air Quality Benefits of Public Trees by Species

3/14/2014

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	104.2	18.0	50.9	4.6	562	249.5	36.1	34.3	233.6	1,546	-24.2	-91	707.1	2,017	(N/A)	15.4	9.84
Green ash	61.7	9.9	29.7	2.8	329	223.2	32.5	31.0	212.5	1,392	0.0	0	603.2	1,721	(N/A)	13.6	9.51
Silver maple	94.3	16.0	47.8	4.2	513	238.0	34.9	33.3	228.6	1,490	-51.0	-191	646.0	1,811	(N/A)	13.0	10.47
Sugar maple	51.1	8.7	25.4	2.3	277	163.7	23.9	22.8	156.6	1,023	-40.1	-150	414.4	1,149	(N/A)	9.1	9.42
Northern hackberry	22.9	4.0	12.3	1.0	127	97.7	14.1	13.4	91.3	605	0.0	0	256.7	731	(N/A)	5.2	10.60
Apple	3.2	0.5	1.6	0.1	17	17.0	2.4	2.3	15.6	104	0.0	0	42.8	122	(N/A)	4.8	1.90
Northern red oak	21.1	3.6	10.3	0.9	114	52.9	7.7	7.4	50.4	330	-30.0	-113	124.4	331	(N/A)	4.6	5.35
Pin oak	41.2	7.2	21.0	1.9	225	95.5	13.9	13.3	91.1	596	-76.2	-286	208.9	536	(N/A)	4.3	9.23
Spruce	3.6	0.7	3.1	0.4	24	10.8	1.6	1.5	10.5	68	-14.6	-55	17.6	37	(N/A)	4.1	0.67
Honeylocust	18.7	3.1	8.8	0.9	100	52.9	7.7	7.4	50.6	331	-14.3	-54	135.8	377	(N/A)	3.7	7.69
Maple	3.5	0.6	1.8	0.2	19	16.6	2.4	2.3	15.8	103	-1.4	-5	41.8	118	(N/A)	2.9	3.02
Littleleaf linden	9.6	1.7	4.7	0.4	52	24.0	3.5	3.3	22.5	149	-4.6	-17	65.1	183	(N/A)	1.7	7.97
Eastern white pine	11.7	2.3	9.2	1.4	76	18.6	2.7	2.6	17.9	117	-57.7	-216	8.7	-24	(N/A)	1.6	-1.10
Black walnut	6.0	1.0	2.9	0.3	32	20.0	2.9	2.8	18.8	124	0.0	0	54.6	156	(N/A)	1.5	7.81
Willow	5.6	1.0	2.7	0.2	30	13.6	2.0	1.9	12.8	85	-1.3	-5	38.5	110	(N/A)	1.4	5.78
Red maple	6.2	1.1	2.9	0.3	33	14.7	2.2	2.1	14.1	92	-2.1	-8	41.4	117	(N/A)	1.2	7.32
River birch	10.9	1.9	5.2	0.5	58	21.5	3.1	3.0	20.1	133	-2.5	-9	63.6	182	(N/A)	1.1	12.15
Other street trees	23.3	3.9	12.7	1.3	129	90.2	13.1	12.5	85.2	561	-11.7	-44	230.4	646	(N/A)	10.6	4.55
Citywide total	498.7	85.0	253.1	23.6	2,717	1,420.4	206.8	197.1	1,348.0	8,848	-331.7	-1,244	3,701.0	10,321	(N/A)	100.0	7.74

Table 4: Annual Carbon Stored

Reinbeck

Stored CO2 Benefits of Public Trees by Species

3/14/2014

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,723,747	12,928	(N/A)	15.4	15.7	63.06
Green ash	2,022,478	15,169	(N/A)	13.6	18.4	83.80
Silver maple	2,013,556	15,102	(N/A)	13.0	18.3	87.29
Sugar maple	1,468,973	11,017	(N/A)	9.2	13.4	90.31
Northern	320,793	2,406	(N/A)	5.2	2.9	34.87
Apple	54,013	405	(N/A)	4.8	0.5	6.33
Northern red oak	444,779	3,336	(N/A)	4.7	4.1	53.80
Pin oak	1,082,685	8,120	(N/A)	4.4	9.9	140.00
Spruce	32,826	246	(N/A)	4.1	0.3	4.48
Honeylocust	241,957	1,815	(N/A)	3.7	2.2	37.03
Maple	43,610	327	(N/A)	2.9	0.4	8.39
Littleleaf linden	204,765	1,536	(N/A)	1.7	1.9	66.77
Eastern white pine	150,171	1,126	(N/A)	1.7	1.4	51.19
Black walnut	199,167	1,494	(N/A)	1.5	1.8	74.69
Willow	91,980	690	(N/A)	1.4	0.8	36.31
Red maple	66,961	502	(N/A)	1.2	0.6	31.39
River birch	179,711	1,348	(N/A)	1.1	1.6	89.86
Other street trees	289,498	4,787	(N/A)	10.6	5.8	33.71
Citywide total	10,980,407	82,353	(N/A)	100.0	100.0	61.73

Table 5: Annual Carbon Sequestered

Reinbeck

Annual CO_2 Benefits of Public Trees by Species

3/14/2014

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	66,372	498	-8,274	-40	-62	86,380	648	144,437	1,083	(N/A)	15.4	12.9	5.28
Green ash	108,822	816	-9,708	-35	-73	78,634	590	177,713	1,333	(N/A)	13.6	15.9	7.36
Silver maple	176,762	1,326	-9,665	-34	-73	84,729	635	251,793	1,888	(N/A)	13.0	22.5	10.92
Sugar maple	76,877	577	-7,051	-24	-53	57,984	435	127,786	958	(N/A)	9.2	11.4	7.86
Northern hackberry	23,655	177	-1,540	-13	-12	33,757	253	55,858	419	(N/A)	5.2	5.0	6.07
Apple	5,678	43	-259	-12	-2	5,779	43	11,185	84	(N/A)	4.8	1.0	1.31
Northern red oak	11,023	83	-2,135	-12	-16	18,670	140	27,546	207	(N/A)	4.7	2.5	3.33
Pin oak	95,349	715	-5,197	-11	-39	33,735	253	123,876	929	(N/A)	4.4	11.1	16.02
Spruce	2,320	17	-158	-11	-1	3,893	29	6,044	45	(N/A)	4.1	0.5	0.82
Honeylocust	23,299	175	-1,161	-10	-9	18,760	141	40,888	307	(N/A)	3.7	3.7	6.26
Maple	5,106	38	-209	-8	-2	5,840	44	10,730	80	(N/A)	2.9	1.0	2.06
Littleleaf linden	10,803	81	-983	-4	-7	8,313	62	18,129	136	(N/A)	1.7	1.6	5.91
Eastern white pine	5,355	40	-721	-4	-5	6,617	50	11,248	84	(N/A)	1.7	1.0	3.83
Black walnut	10,040	75	-956	-4	-7	6,971	52	16,051	120	(N/A)	1.5	1.4	6.02
Willow	2,986	22	-442	-4	-3	4,724	35	7,265	54	(N/A)	1.4	0.7	2.87
Red maple	7,209	54	-321	-3	-2	5,229	39	12,113	91	(N/A)	1.2	1.1	5.68
River birch	3,216	24	-863	-3	-6	7,429	56	9,780	73	(N/A)	1.1	0.9	4.89
Other street trees	37,963	285	-3,064	-28	-23	31,526	236	66,398	498	(N/A)	10.6	5.9	3.51
Citywide total	672,836	5,046	-52,706	-260	-397	498,970	3,742	1,118,839	8,391	(N/A)	100.0	100.0	6.29

Table 6: Annual Social and Aesthetic Benefits

Reinbeck

Annual Aesthetic/Other Benefits of Public Trees by Species

3/14/2014

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	6,292	(N/A)	15.4	9.6	30.69
Green ash	9,250	(N/A)	13.6	14.2	51.10
Silver maple	15,070	(N/A)	13.0	23.1	87.11
Sugar maple	7,963	(N/A)	9.2	12.2	65.27
Northern hackberry	3,432	(N/A)	5.2	5.3	49.74
Apple	318	(N/A)	4.8	0.5	4.98
Northern red oak	911	(N/A)	4.7	1.4	14.70
Pin oak	7,259	(N/A)	4.4	11.1	125.15
Spruce	731	(N/A)	4.1	1.1	13.28
Honeylocust	5,466	(N/A)	3.7	8.4	111.56
Maple	813	(N/A)	2.9	1.2	20.85
Littleleaf linden	1,126	(N/A)	1.7	1.7	48.97
Eastern white pine	625	(N/A)	1.7	1.0	28.42
Black walnut	878	(N/A)	1.5	1.3	43.92
Willow	303	(N/A)	1.4	0.5	15.93
Red maple	905	(N/A)	1.2	1.4	56.55
River birch	293	(N/A)	1.1	0.5	19.55
Other street trees	3,734	(N/A)	10.6	5.7	26.30
Citywide total	65,371	(N/A)	100.0	100.0	49.00

Table 7: Summary of Benefits in Dollars

Average Annual Benefits of Public Trees by Species

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	11,169	1,083	2,017	13,492	6,292	$34,053.14	(±0)	14.66
Green ash	9,775	1,333	1,721	13,680	9,250	$35,758.91	(±0)	15.39
Silver maple	10,327	1,888	1,811	16,774	15,070	$45,871.40	(±0)	19.75
Sugar maple	7,129	958	1,149	10,371	7,963	$27,570.71	(±0)	11.87
Northern hackberry	4,382	419	731	4,555	3,432	$13,519.98	(±0)	5.82
Apple	784	84	122	351	318	$1,658.29	(±0)	0.71
Northern red oak	2,325	207	331	2,781	911	$6,555.50	(±0)	2.82
Pin oak	4,181	929	536	6,249	7,259	$19,153.65	(±0)	8.25
Spruce	460	45	37	911	731	$2,184.65	(±0)	0.94
Honeylocust	2,307	307	377	2,766	5,466	$11,222.69	(±0)	4.83
Maple	730	80	118	569	813	$2,310.54	(±0)	0.99
Littleleaf linden	1,074	136	183	1,470	1,126	$3,990.15	(±0)	1.72
Eastern white pine	810	84	-24	2,574	625	$4,069.39	(±0)	1.75
Black walnut	890	120	156	1,310	878	$3,354.89	(±0)	1.44
Willow	610	54	110	727	303	$1,803.82	(±0)	0.78
Red maple	638	91	117	702	905	$2,452.07	(±0)	1.06
River birch	968	73	182	1,316	293	$2,833.45	(±0)	1.22
Other street trees	4,001	498	646	5,051	3,734	$13,929.68	(±0)	6.00
Citywide total	62,562	8,391	10,321	85,648	65,371	$232,292.94	(±0)	100.00

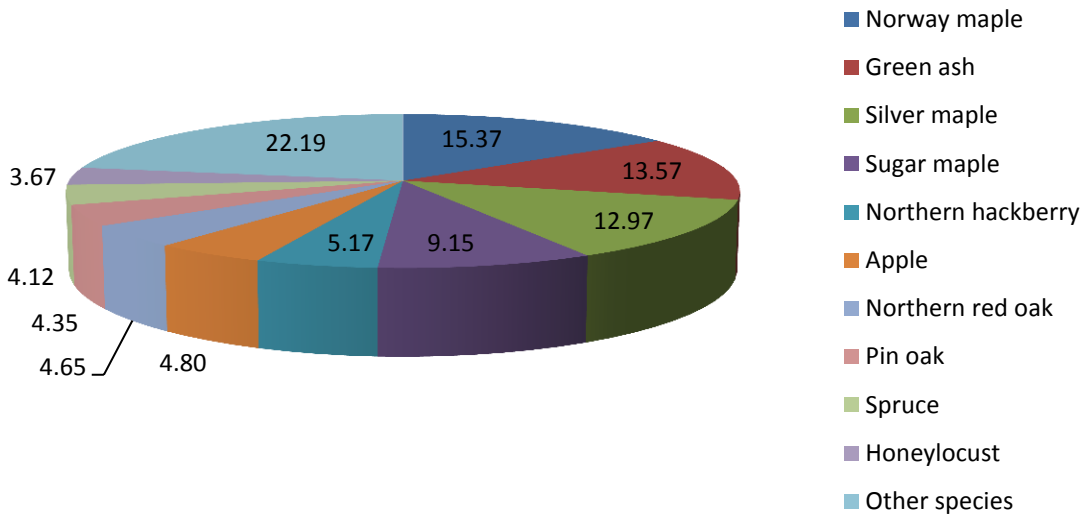

Figure 1: Species Distribution

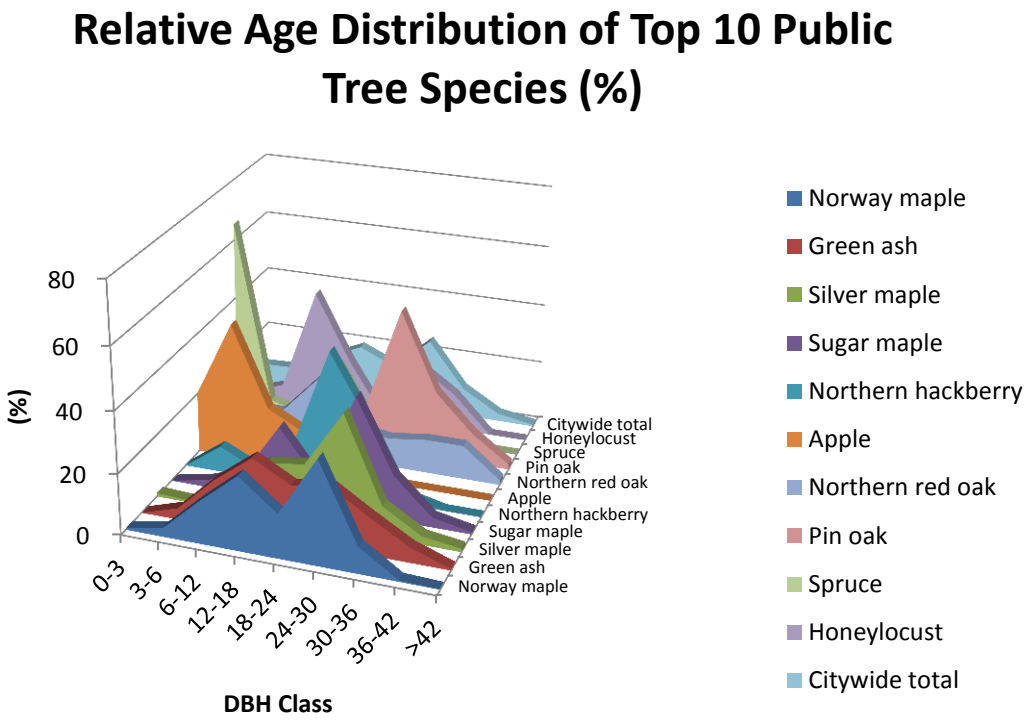

Figure 2: Relative Age Class

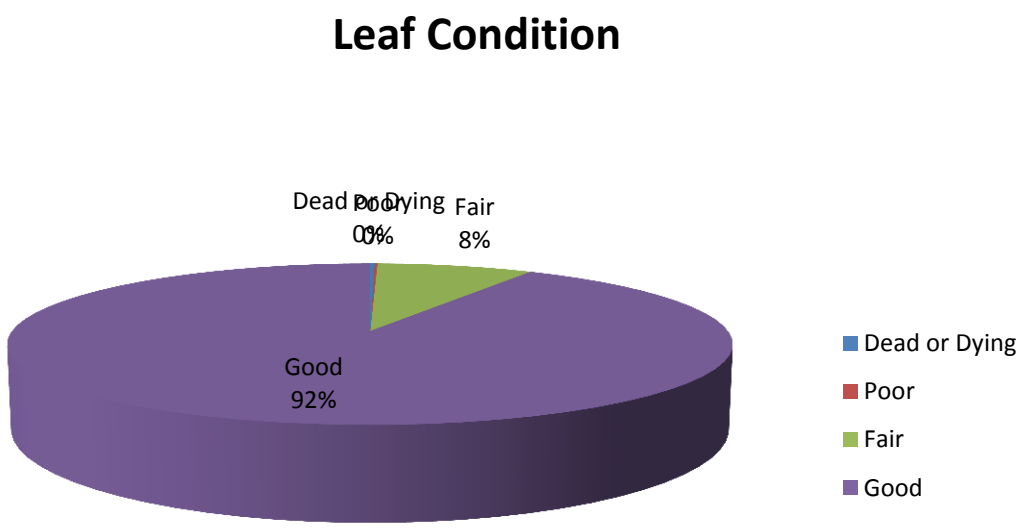

Figure 3: Foliage Condition

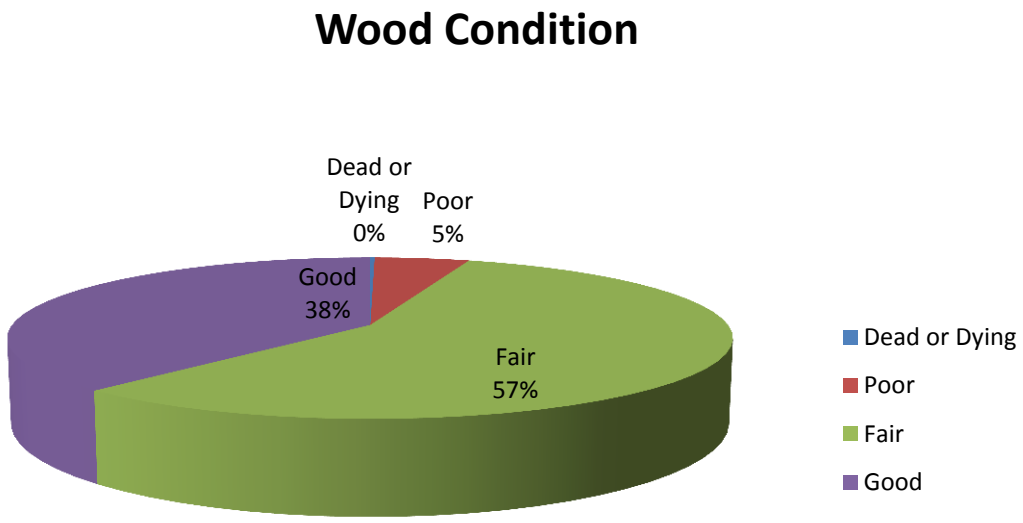

Figure 4: Wood Condition

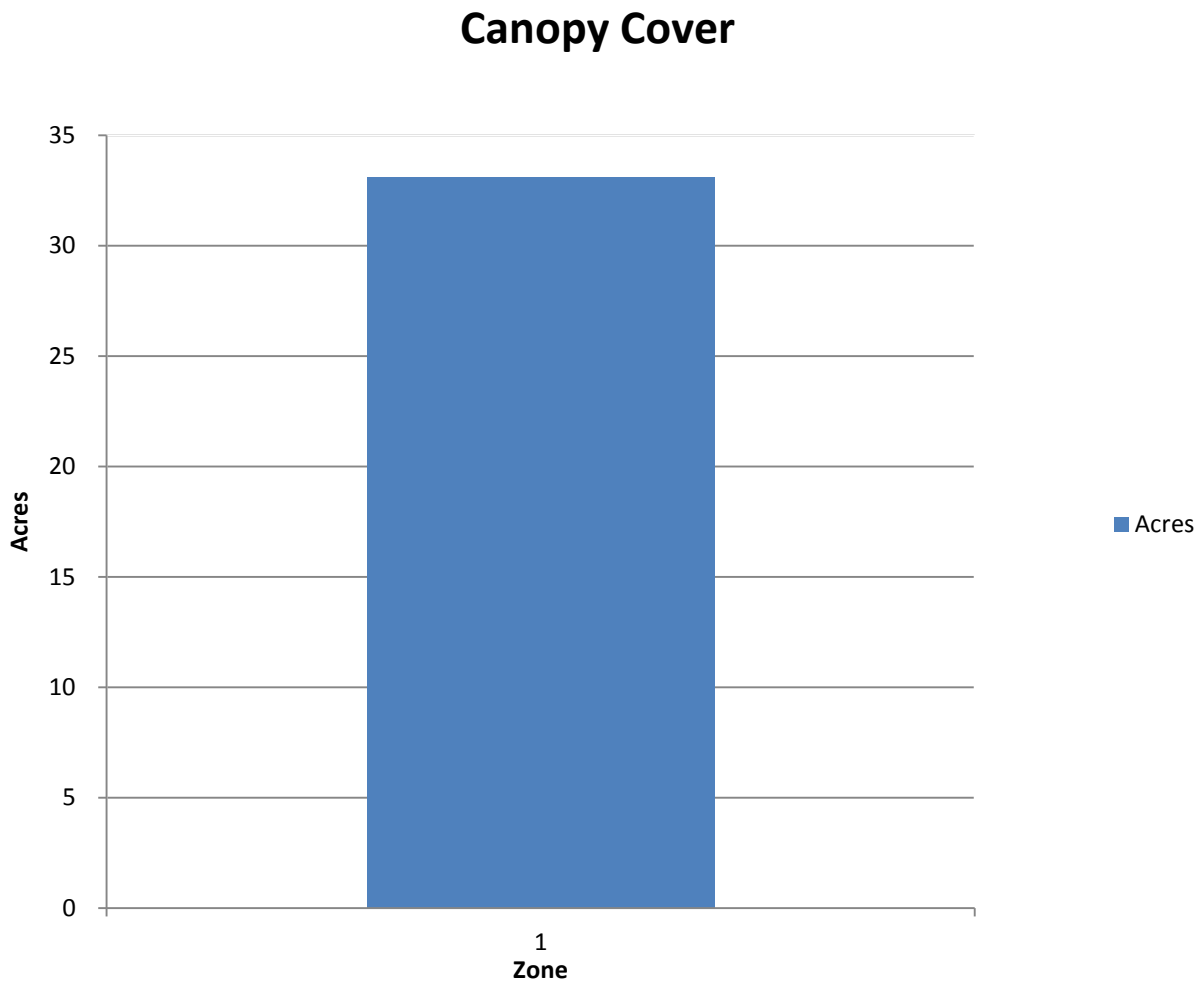

Figure 5: Canopy Cover in Acres

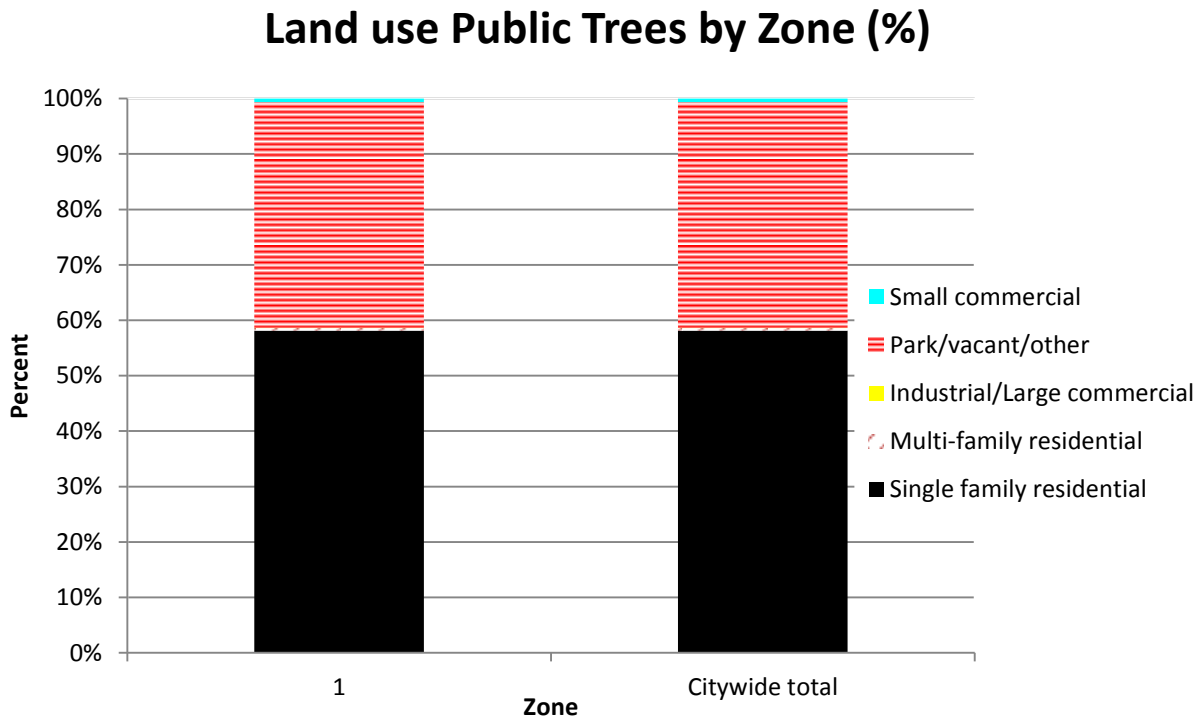

Figure 6: Land Use of city/park trees

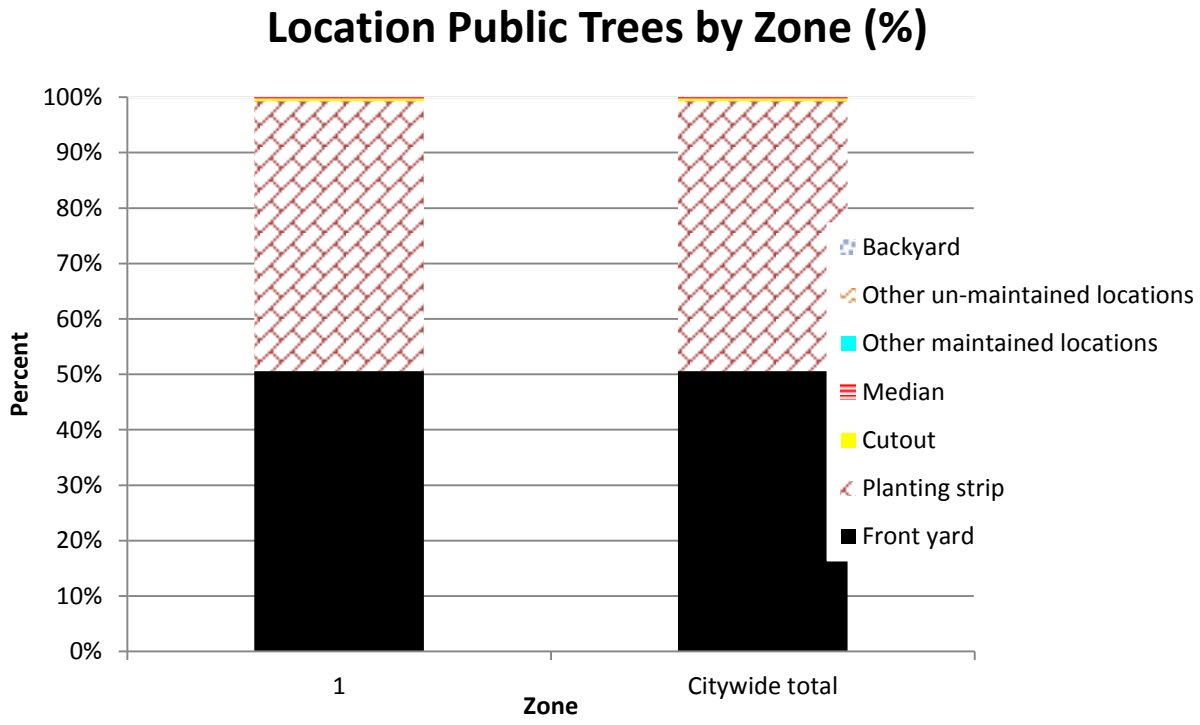

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

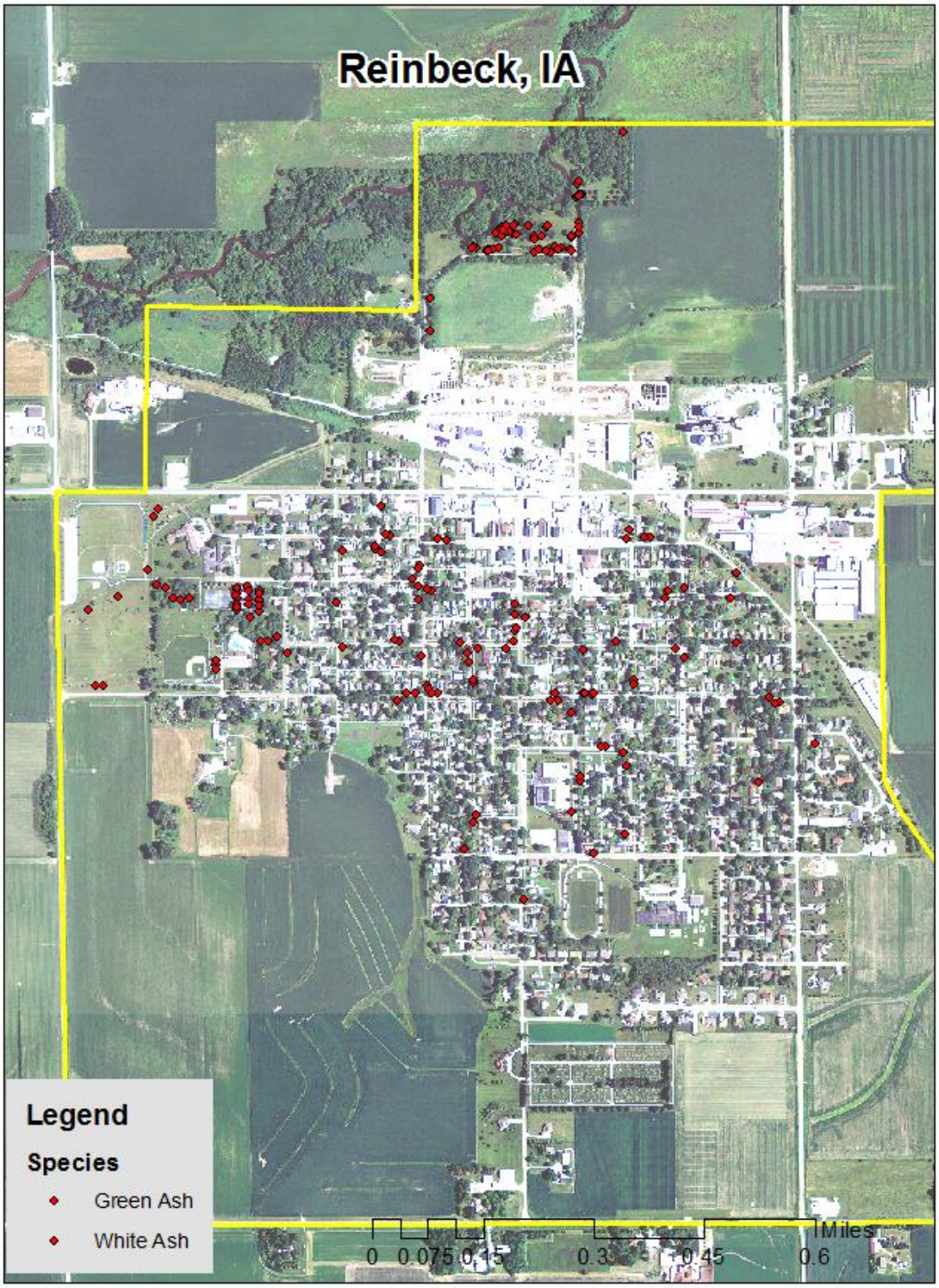

Figure 1: Location of Ash Trees

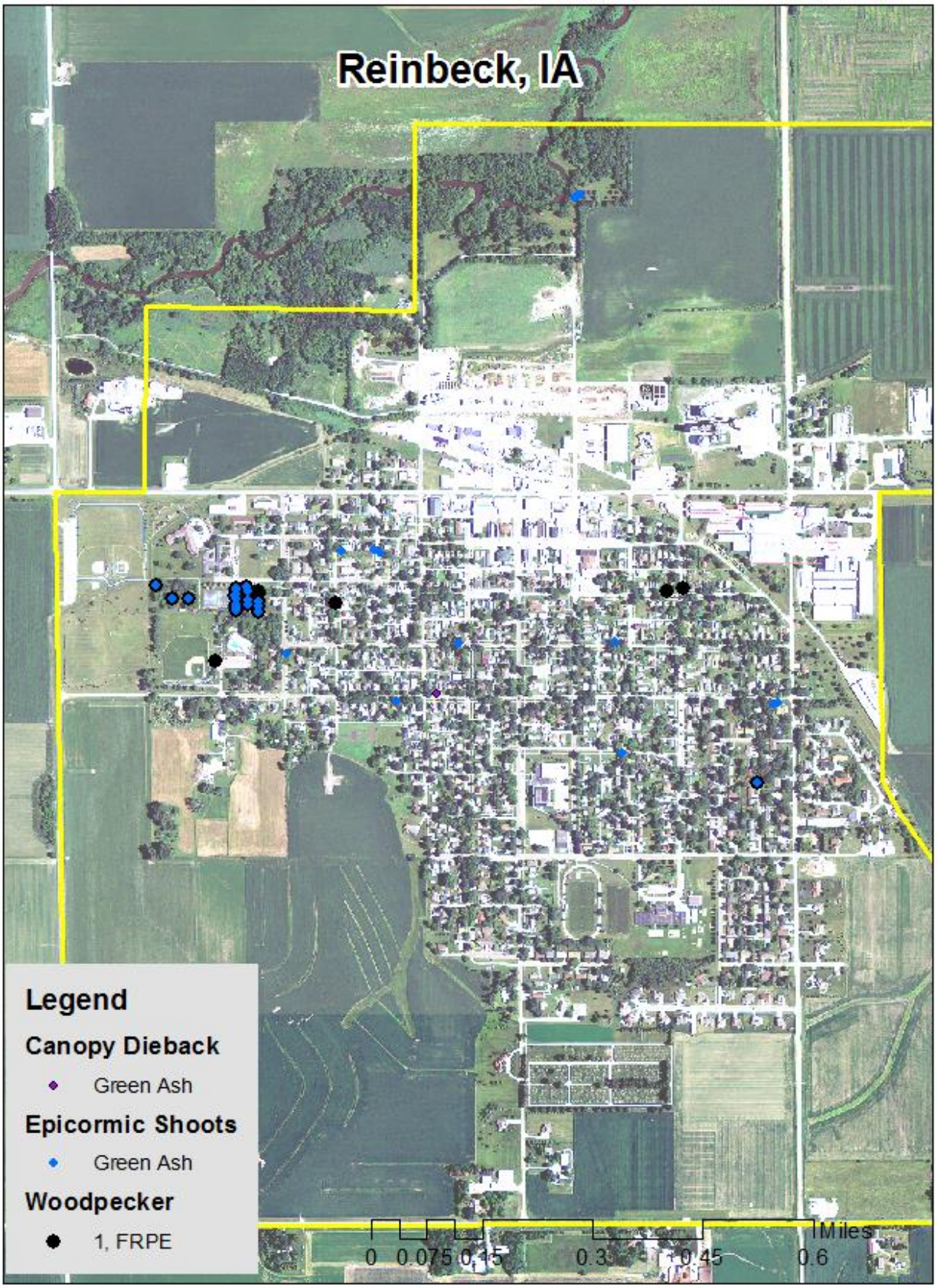

Figure 2: Location of EAB symptoms

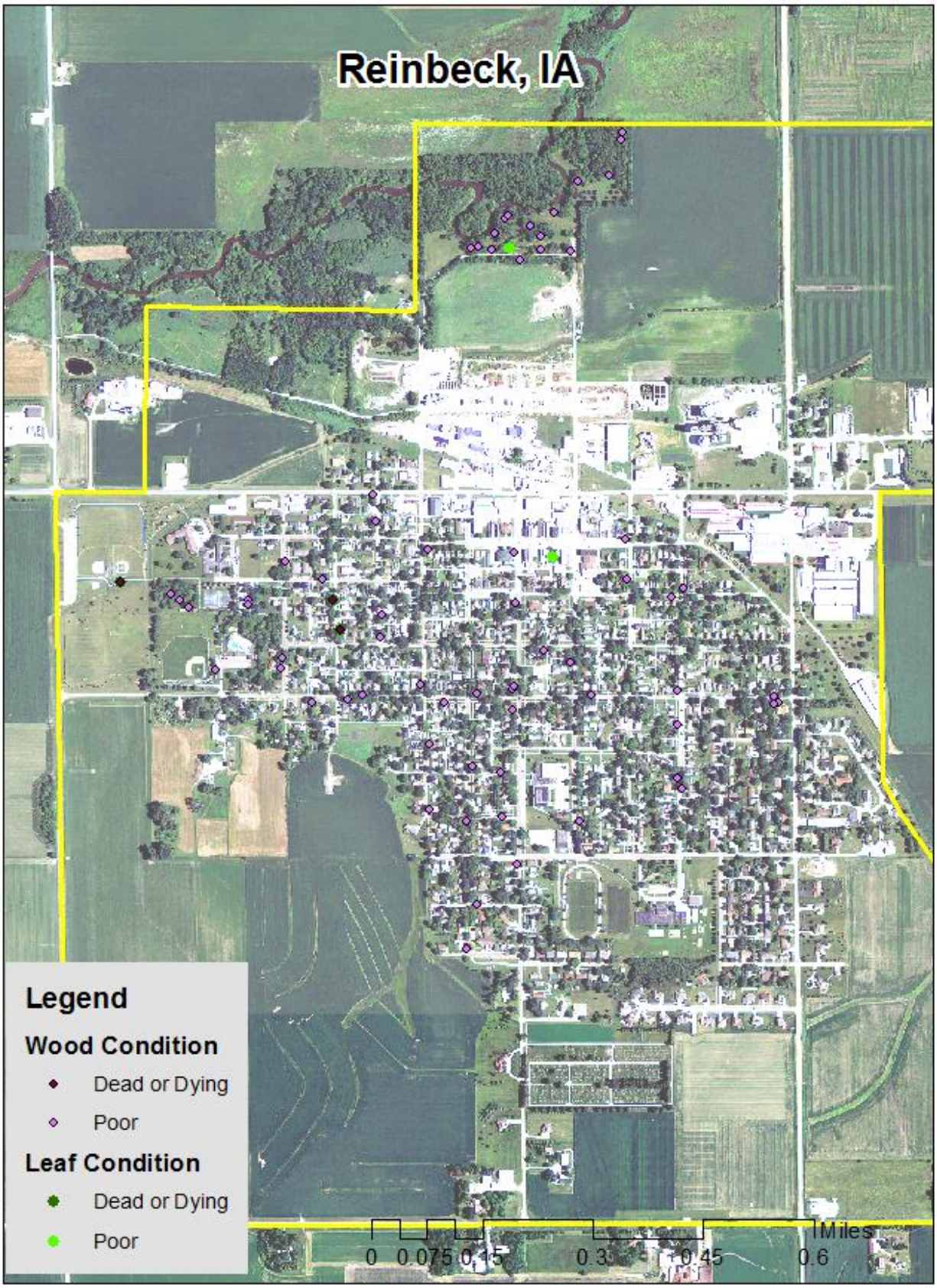

Figure 3: Location of Poor Condition Trees

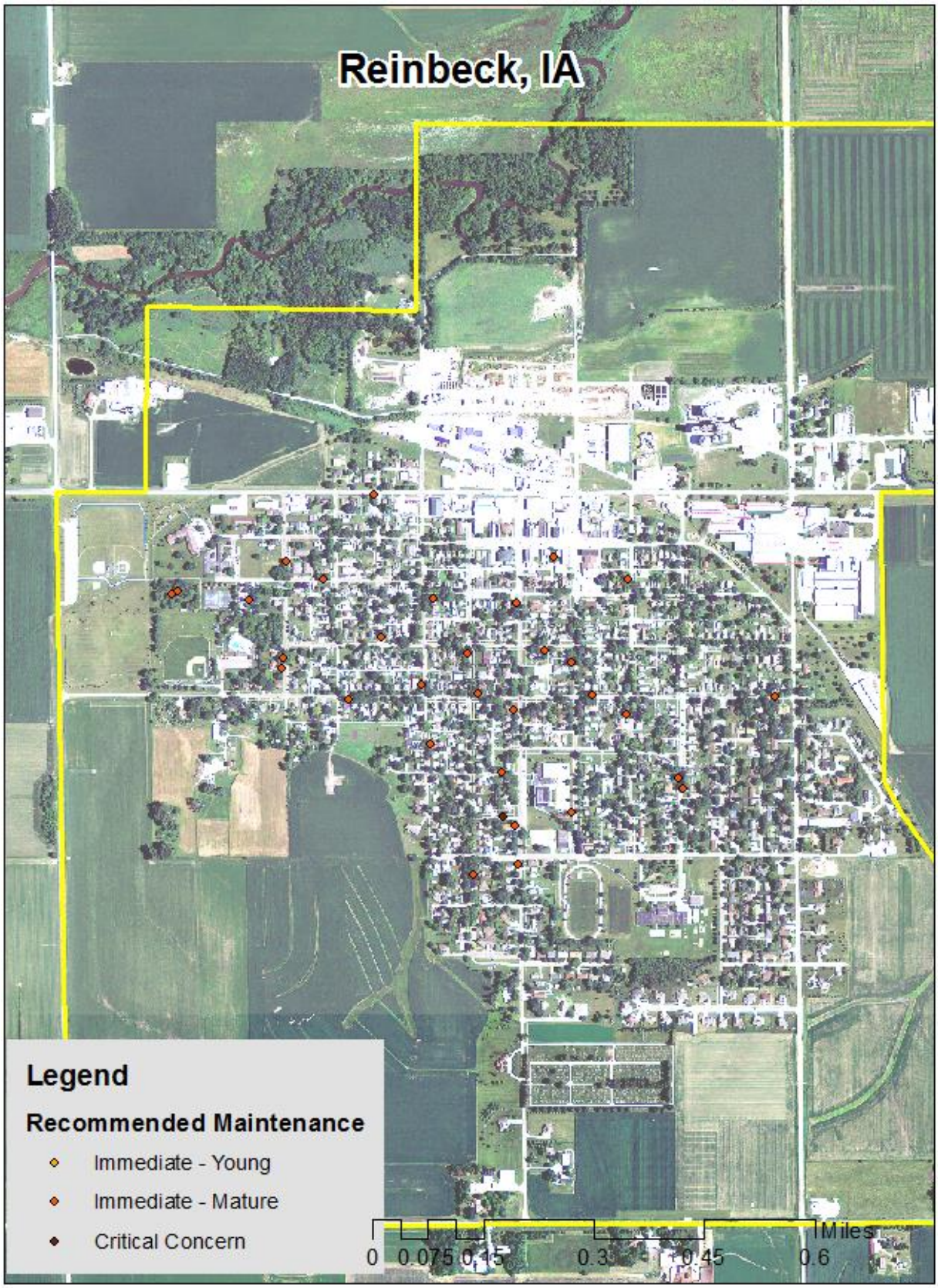

Figure 4: Location of Trees with Recommended Maintenance

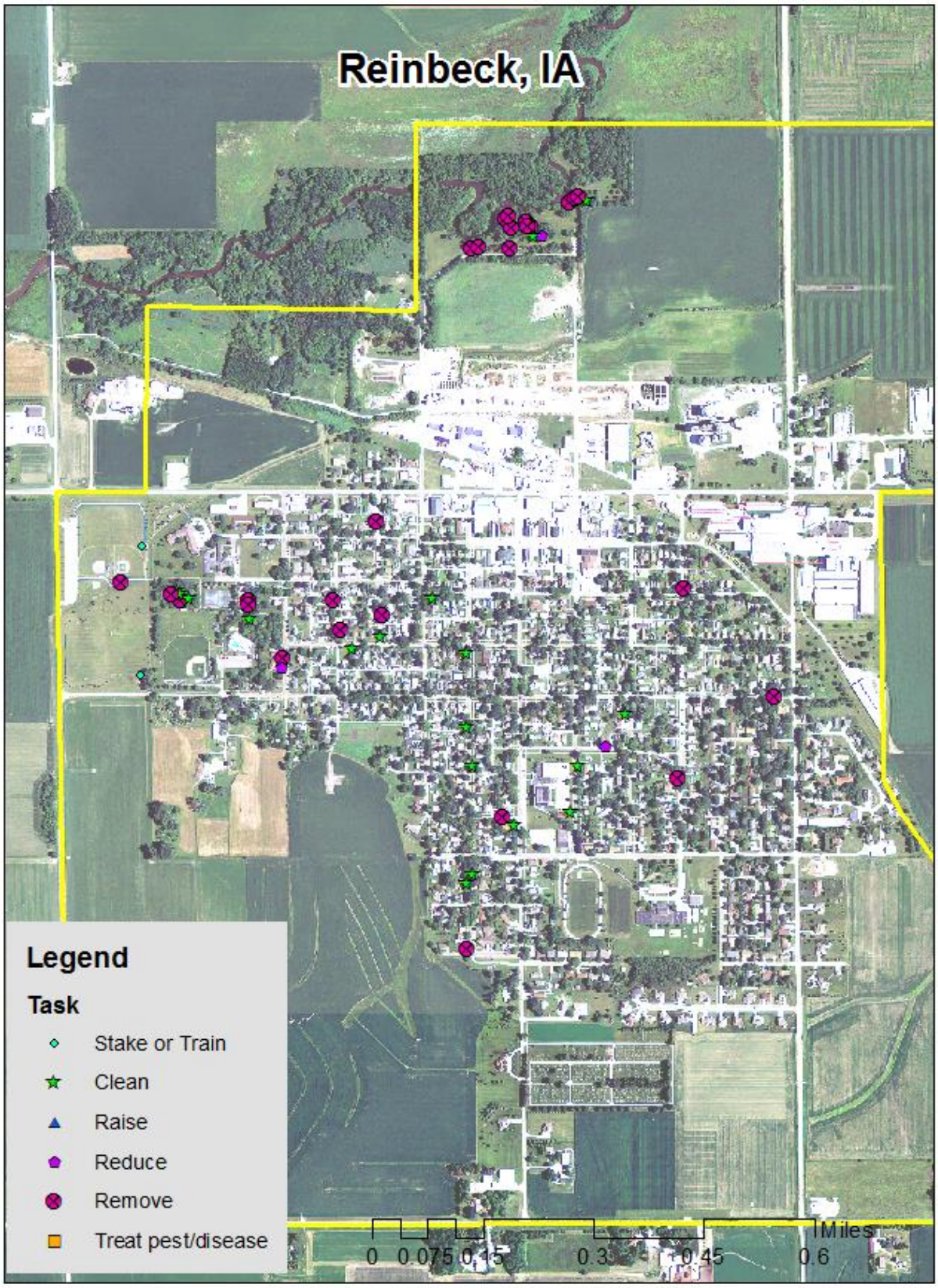

Figure 5: Maintenance Tasks ***City ownership of the trees recommended for removal should be verified prior to any removal****

Appendix C: Reinbeck Tree Ordinances

CHAPTER 151
TREES

151.1 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.

151.2 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 that 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.

151.3 DUTY TO TRIM TREES. The owner or agent of the abutting property shall keep the trees on, or overhanging the street, trimmed so that all branches will be at least twelve (12) feet above the surface of the street and eight (8) feet above the sidewalks. If the abutting property owner fails to trim the trees, the City may serve notice on the abutting property owner requiring that such action be taken within five (5) days. If such action is not taken within that time, the City may perform the required action and assess the costs against the abutting property for collection in the same manner as a property tax.

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

151.4 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.

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

151.6 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 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

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

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