Parkersburg, IA

Urban Forestry Management Plan

SUMMER 2021

JEO CONSULTING GROUP

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Parkersburg in managing its urban forest, including budgeting and future planning. Trees bring numerous benefits to a community, and sound management helps leaders take advantage of these benefits. Management is especially important now considering the serious threats posed by forest pests like 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 except mountain ash. There is a strong possibility that 14% of Parkersburg's city-owned trees will die once EAB becomes established in the community, unless local leaders begin preventative treatment. 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 2021, JEO conducted a tree inventory 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 633 trees inventoried.

- Parkersburg's trees provide $92,695 of benefits annually, an average of $146.44 per tree
- There are over 46 species of trees
- The top three genera are: Maple 29%, Oak 17%, and Ash 14%
- 32% of trees need some type of management
- 78 trees should be removed

Recommendations

We detail our core recommendations in the Recommendations Section. In the Emerald Ash Borer Plan, we include management recommendations. Below are some key recommendations.

- Out of the 78 trees needing removal, 24 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*
- 60 of the 90 ash trees should be carefully examined, as they have one or more symptoms that could be related to an EAB infestation.
- All trees should be pruned on a routine schedule: one third of the city every other year.
- Plant a diverse mix of trees that do not include: ash, maple, cottonwood, poplar, box elder, Chinese elm, evergreen, willow or black walnut.
- Check ash trees yearly with a visual survey.
- With the current budget it could take 16 years to remove ash. We suggest that city officials request a budget increase to $6,000 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

This plan was developed to assist Parkersburg with managing, budgeting, and future planning of their urban forest. Across the state, forestry budgets continue to decrease as a higher percentage of the budgets are devoted to 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, treatment, and replacement planting. With proper planning and management of the current canopy in Parkersburg, these costs can be spread out over the years and public safety issues from dead and dying ash trees can be mitigated.

Trees are an important part of Parkersburg infrastructure and one of the city's greatest assets. The benefits of trees are immense. Trees improve air quality, intercept stormwater runoff, conserve energy, lower traffic speeds, increase property values, reduce crime, improve mental health, and create a desirable place to live, to name just a few. Good urban forestry management will maintain these important benefits for the people of Parkersburg and future generations.

Urban forestry management sets goals and develops management strategies to achieve them. To develop management strategies, a comprehensive public tree inventory must be conducted. The inventory informs maintenance, removal schedules, tree planting, and budgeting. Aligning management actions with the tree inventory results will help meet Parkersburg's urban forestry goals.

Assist Parkersburg with Managing its Urban Forest

Inform on the Benefits of a Healthy Urban Forest

Establish Preventative Treatment for Emerald Ash Borer

Develop Efficient City Tree Management Techniques

Mitigate Public Safety Issues

Findings

INVENTORY

In 2021, JEO conducted a tree inventory that included 100% of the city-owned trees on both streets and parks. The team collected tree data 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 data collectors' programming 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, for all ash trees, the team notes signs and symptoms associated with EAB including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

INVENTORY RESULTS

JEO entered the data collected for the 633 city trees into the USDA Forest service program Street Tree Resource Analysis Tool for Urban forestry Management as part of the i-Tree suite. Following are results from the i-Tree STREETS analysis.

ANNUAL BENEFITS

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. Parkersburg's trees reduce energy-related costs by approximately $25,124 annually (Appendix A, Table 1). These savings are both in electricity (120.1 MWh) and in natural gas (16,336.9 Therms).

Annual Stormwater Benefits

Parkersburg's trees intercept about 1,280,671 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $34,706 in benefit 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 lessens emissions of volatile organic matter (ozone). In Parkersburg, it is estimated that trees remove 1,495.9 lbs of air pollution (ozone (O3), particulate matter less than 10 microns (PM10), carbon monoxide (CO), nitrogen dioxide (NO2), and sulfur dioxide (SO2)) per year with a net value of $4,183 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Parkersburg, trees sequester about 260,688 lbs of carbon per year with an associated value of $3,292 (Appendix A, Table 5). In addition, the trees store 4,534,975 lbs of carbon, with a yearly benefit of $34,012 (Appendix A, Table 4).

Annual Aesthetics Benefits

The social benefits of trees are hard to capture. The i-Tree 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. Parkersburg receives $25,390 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, Parkersburg's trees provide $92,695 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 633 trees in Parkersburg provide approximately $146.44 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$25,124**	• Intercept **1,280,671 gallons** • Provides **$34,706** benefit	• Remove **1,495.9 lbs** of pollution • Net value of **$4,183**	• Sequester **260,688 lbs** • Value of **$3,292** • Store **4,534,975 lbs** • Value of **$34,012**	• **$25,390** in social benefits	• **$92,695** annual benefits • Each tree provides **$146.44** annually

FOREST STRUCTURE

Species Distribution

Parkersburg has over 46 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Maple	183	29%
Oak	120	17%
Ash	90	14%
Apple (Crab)	54	8.5%
Cedar	46	7%
Spruce	23	3.5%
Basswood/Linden	21	3%
Hackberry	15	2%
Honeylocust	14	2%
Walnut	12	2%
Japanese tree lilac	11	1.5%
Buckeye	7	1%
Birch	7	<1%
Elm	5	<1%

Catalpa	4	<1%
Mulberry	4	<1%
Pine	2	<1%
Amur maple	2	<1%
Boxelder	1	<1%
Sycamore	1	<1%
Buckthorn	1	<1%
Cottonwood	1	<1%
Kentucky coffee	1	<1%
Aspen	1	<1%
Japanese maple	1	<1%
Eastern redbud	1	<1%
Callery pear	1	<1%
Other Deciduous	4	<1%

Age Class

Most of Parkersburg's trees (40%) are between 12 and 24 inches in diameter at 4.5 ft (Appendix A, Figure 2).

To prepare for natural mortality and to maintain canopy cover, most trees should be in the smallest size category (a downward slope), indicating youth. Parkersburg's size curve is on the medium side, indicating a middle-aged, average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Parkersburg indicate that 92% of the trees are in good or fair health, with only 8% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 88% of Parkersburg's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Twelve percent of the tree population's wood condition is in poor health, dead, or dying. This 12% 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).

Action	Number of Trees	Percentage
Crown Cleaning	127	20%
Crown Reduction	29	4.5%
Tree Removal	78	12%
Crown Raising	44	7%
Tree Staking	2	<1%

Canopy Cover

The total canopy with both private and public trees is 103 acres or 11% cover. The canopy cover included in the Parkersburg inventory includes approximately 13 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 20% in 30 years. To achieve this goal it is estimated that 22 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Parkersburg'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	Percentage
Single Family Residential	59%
Industrial/Large Commercial	0%
Park/Vacant/Other	36%
Small Commercial	4%
Multifamily Residential	<1%

Recommendations

RECOMMENDATIONS

Risk Management

Hazardous trees can be a significant threat to both people and property. Trees that are dead, dying, or have large issues such as trunk cracks longer than 18 inches should be removed. Broken branches and branches that interfere with motorists' vision of pedestrians, vehicles, traffic signs and signals should be removed.

HAZARDOUS TREES

Parkersburg has 78 trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 24 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the Proposed Schedule and Budget 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 202 trees with maintenance needs.

POOR TREE SPECIES

After removing the critical concern trees, ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 78 removals, 60 are ash trees. There are a total of 90 ash trees, and 60 of those have signs and symptoms that have been associated with EAB. *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 removes lower branches that are two inches in diameter or larger to provide clearance for pedestrians or vehicles. Crown reduction removes individual limbs from structures or utility wires. We recommend that all trees be pruned on a routine schedule every five to seven years. Please refer to the Proposed Schedule and Budget for further information.

Planting

Most of the planting over the next five years will replace the trees that are removed. We recommend planting 1.2 trees for every tree removed, 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 forest in Parkersburg.

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 (29%) (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. 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. We recommend 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.

EMERALD ASH BORER PLAN

Ash Tree Removal

Tree removal will be prioritized by first removing dead, dying, hazardous trees (Appendix B, Figure 4). Next will be all ash in poor condition that display EAB signs and symptoms (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 an effective tool for communities to spread removal costs out over several years while allowing trees to continue providing 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 normally disposed of if your county is not part of a quarantine.

Canopy Replacement

As budget permits, all removed trees will be replaced. All trees will meet the restrictions in city ordinance 151.02 (Appendix C). The new plantings will be a diverse mix and shall correspond with the approved species list within ordinance 151.02 (Appendix C).

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.

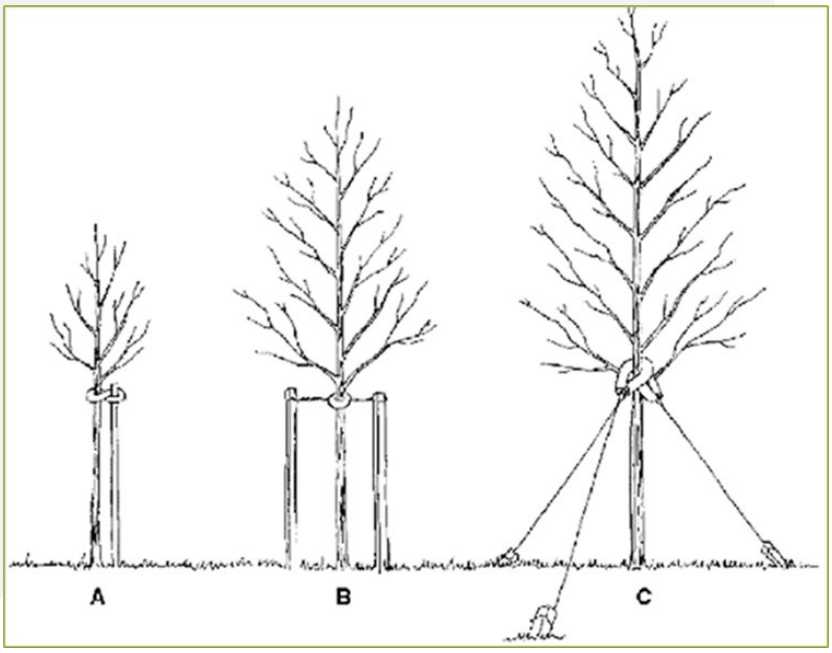
Monitoring

It is recommended that ash trees be checked with a visual survey every year for tree death and for EAB signs and symptoms including canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property upon arrival of EAB if preventative treatments are not being used. City Code 151.06 states “If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant, or person in charge of said property fails to comply within 14 days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.”

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $4,000/Year – (Based off $2/person calculation, no budget provided)

YEAR 1	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

YEAR 2	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

YEAR 3	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

YEAR 4	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

YEAR 5	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

YEAR 6	Est. Cost
Remove 3 trees recommended for immediate removal	$2,100
Plant 3 trees in open locations	$450
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$4,000**

Estimated costs based on average costs of $700/tree for removal, $150/tree for planting and maintenance, and $15/tree for pruning.

***To remove all ash trees within 6 years alone, the budget would need to be $10,500 a year. If the budget were increased to $6,000 a year all ash could be removed in 10.5 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $6,000/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

YEAR 2	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

YEAR 3	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

YEAR 4	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

YEAR 5	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

YEAR 6	Est. Cost
Remove 5 trees recommended for immediate removal	$3,500
Plant 6 trees in open locations	$900
Prune 1/6 of city owned trees	$1,500
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$5,900**

Proposed Budget Increase

EAB could potentially kill all ash trees in Parkersburg within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $10,500 a year. If the

budget were increased to $6,000 per year all ash could be removed within 10.5 years. Additionally, we recommend that Parkersburg 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 considered by many communities is treating 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 removal 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). Four trees would be selected for treatment, and Parkersburg would still need to find $60,200 for removal. Alternatively, if there are 8 treatable trees, it would cost approximately $2,400 a year for treatment and leave $57,400 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 Parkersburg. We suggest considering an increased budget to plan for this.

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Appendices

APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Parkersburg

Annual Energy Benefits of Public Trees

2/11/2022

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	20.7	1,569	2,791.8	2,736	4,305	(N/A)	12.5	17.1	54.49
Norway maple	15.7	1,192	2,261.7	2,216	3,408	(N/A)	10.9	13.6	49.40
Bur oak	20.2	1,534	2,772.8	2,717	4,252	(N/A)	8.8	16.9	75.92
Apple	2.3	175	376.2	369	544	(N/A)	8.5	2.2	10.07
Silver maple	14.6	1,111	1,906.6	1,868	2,979	(N/A)	8.1	11.9	58.42
Northern white cedar	5.1	388	633.6	621	1,009	(N/A)	7.1	4.0	22.43
Northern red oak	2.7	207	364.3	357	564	(N/A)	4.3	2.2	20.90
Red maple	2.8	215	402.3	394	609	(N/A)	3.9	2.4	24.35
Sugar maple	4.6	347	585.4	574	921	(N/A)	3.8	3.7	38.36
Swamp white oak	1.1	83	172.8	169	252	(N/A)	3.2	1.0	12.60
Pin oak	3.6	271	474.7	465	736	(N/A)	2.7	2.9	43.30
Northern hackberry	3.4	258	486.5	477	735	(N/A)	2.4	2.9	49.00
Honeylocust	3.2	242	414.4	406	648	(N/A)	2.2	2.6	46.28
Black walnut	2.8	214	362.7	355	570	(N/A)	1.9	2.3	47.47
Littleleaf linden	1.7	131	235.4	231	362	(N/A)	1.9	1.4	30.14
Japanese tree lilac	0.1	6	13.2	13	19	(N/A)	1.7	0.1	1.69
White ash	2.7	203	311.3	305	508	(N/A)	1.7	2.0	46.20
Blue spruce	1.0	75	134.7	132	207	(N/A)	1.4	0.8	22.99
Black maple	2.1	159	295.8	290	449	(N/A)	1.3	1.8	56.17
American basswood	0.9	67	129.7	127	194	(N/A)	1.3	0.8	24.21
Ohio buckeye	1.3	96	188.1	184	281	(N/A)	1.1	1.1	40.11
Spruce	1.2	88	152.4	149	238	(N/A)	1.1	0.9	33.97
Norway spruce	0.9	70	122.5	120	190	(N/A)	0.9	0.8	31.74
Maple	0.5	39	67.5	66	105	(N/A)	0.9	0.4	17.49
Broadleaf Deciduous Small	0.1	6	14.7	14	21	(N/A)	0.6	0.1	5.20
Catalpa	0.9	66	117.3	115	181	(N/A)	0.6	0.7	45.29
River birch	0.8	62	105.3	103	165	(N/A)	0.6	0.7	41.20
Mulberry	0.7	51	107.7	106	157	(N/A)	0.6	0.6	39.15
Chinese elm	0.3	22	41.2	40	62	(N/A)	0.5	0.2	20.64
Eastern white pine	0.3	24	39.2	38	62	(N/A)	0.3	0.2	31.15
Siberian elm	0.8	63	108.8	107	170	(N/A)	0.3	0.7	84.75
Amur maple	0.0	2	4.4	4	6	(N/A)	0.3	0.0	3.13
Birch	0.0	1	1.6	2	2	(N/A)	0.3	0.0	1.10
Basswood	0.0	2	3.7	4	6	(N/A)	0.2	0.0	5.82
Cottonwood	0.4	33	59.0	58	91	(N/A)	0.2	0.4	91.02
Eastern red cedar	0.0	1	2.5	2	4	(N/A)	0.2	0.0	3.62
Japanese maple	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
American sycamore	0.1	7	13.7	13	21	(N/A)	0.2	0.1	20.64
Boxelder	0.0	1	1.3	1	2	(N/A)	0.2	0.0	1.86
Paper birch	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Black spruce	0.1	10	15.2	15	25	(N/A)	0.2	0.1	24.51
Eastern redbud	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Quaking aspen	0.3	20	38.1	37	57	(N/A)	0.2	0.2	57.32
Buckthorn	0.0	2	3.8	4	5	(N/A)	0.2	0.0	5.40
Kentucky coffeetree	0.0	0	0.5	0	1	(N/A)	0.2	0.0	0.66
Pear	0.0	0	0.6	1	1	(N/A)	0.2	0.0	0.87
Total	120.1	9,114	16,336.9	16,010	25,124	(N/A)	100.0	100.0	39.69

Table 2: Annual Stormwater Benefits

Parkersburg

Annual Stormwater Benefits of Public Trees

2/11/2022

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	209,428	5,676	(N/A)	12.5	16.4	71.84
Norway maple	139,998	3,794	(N/A)	10.9	10.9	54.98
Bur oak	291,877	7,910	(N/A)	8.8	22.8	141.25
Apple	9,321	253	(N/A)	8.5	0.7	4.68
Silver maple	183,584	4,975	(N/A)	8.1	14.3	97.55
Northern white cedar	69,966	1,896	(N/A)	7.1	5.5	42.14
Northern red oak	21,033	570	(N/A)	4.3	1.6	21.11
Red maple	17,265	468	(N/A)	3.9	1.3	18.72
Sugar maple	39,776	1,078	(N/A)	3.8	3.1	44.91
Swamp white oak	6,511	176	(N/A)	3.2	0.5	8.82
Pin oak	30,182	818	(N/A)	2.7	2.4	48.11
Northern hackberry	26,385	715	(N/A)	2.4	2.1	47.67
Honeylocust	22,365	606	(N/A)	2.2	1.7	43.29
Black walnut	25,020	678	(N/A)	1.9	2.0	56.50
Littleleaf linden	13,533	367	(N/A)	1.9	1.1	30.56
Japanese tree lilac	204	6	(N/A)	1.7	0.0	0.50
White ash	19,315	523	(N/A)	1.7	1.5	47.59
Blue spruce	13,836	375	(N/A)	1.4	1.1	41.66
Black maple	20,694	561	(N/A)	1.3	1.6	70.10
American basswood	9,292	252	(N/A)	1.3	0.7	31.48
Ohio buckeye	10,182	276	(N/A)	1.1	0.8	39.42
Spruce	25,896	702	(N/A)	1.1	2.0	100.25
Norway spruce	20,553	557	(N/A)	0.9	1.6	92.83
Maple	2,778	75	(N/A)	0.9	0.2	12.55
Broadleaf Deciduous Small	287	8	(N/A)	0.6	0.0	1.94
Catalpa	11,525	312	(N/A)	0.6	0.9	78.08
River birch	4,813	130	(N/A)	0.6	0.4	32.61
Mulberry	3,787	103	(N/A)	0.6	0.3	25.65
Chinese elm	1,824	49	(N/A)	0.5	0.1	16.47
Eastern white pine	6,143	166	(N/A)	0.3	0.5	83.24
Siberian elm	10,710	290	(N/A)	0.3	0.8	145.12
Amur maple	76	2	(N/A)	0.3	0.0	1.03
Birch	24	1	(N/A)	0.3	0.0	0.33
Basswood	172	5	(N/A)	0.2	0.0	4.65
Cottonwood	7,239	196	(N/A)	0.2	0.6	196.17
Eastern red cedar	183	5	(N/A)	0.2	0.0	4.97
Japanese maple	7	0	(N/A)	0.2	0.0	0.20
American sycamore	608	16	(N/A)	0.2	0.0	16.47
Boxelder	25	1	(N/A)	0.2	0.0	0.67
Paper birch	18	0	(N/A)	0.2	0.0	0.48
Black spruce	1,544	42	(N/A)	0.2	0.1	41.85
Eastern redbud	7	0	(N/A)	0.2	0.0	0.20
Quaking aspen	2,591	70	(N/A)	0.2	0.2	70.21
Buckthorn	69	2	(N/A)	0.2	0.0	1.86
Kentucky coffeetree	18	0	(N/A)	0.2	0.0	0.48
Pear	7	0	(N/A)	0.2	0.0	0.20
Citywide total	1,280,671	34,706	(N/A)	100.0	100.0	54.83

Table 3: Annual Air Quality Benefits

Parkersburg

Annual Air Quality Benefits of Public Trees

2/11/2022

Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2								
Green ash	24.5	3.9	12.0	1.1	131	98.4	14.3	13.7	93.7	614	0.0	0	261.7	745	(N/A)	12.5	9.43
Norway maple	27.7	4.8	13.7	1.2	150	76.1	11.0	10.5	71.3	472	-6.6	-25	209.7	597	(N/A)	10.9	8.65
Bur oak	43.0	6.9	19.4	1.9	226	96.6	14.1	13.4	91.6	601	0.0	0	286.9	827	(N/A)	8.8	14.77
Apple	2.3	0.4	1.2	0.1	12	11.5	1.6	1.6	10.5	71	0.0	0	29.1	83	(N/A)	8.5	1.53
Silver maple	29.1	4.9	14.6	1.3	158	68.8	10.1	9.6	66.2	431	-15.9	-60	188.8	529	(N/A)	8.1	10.38
Northern white cedar	7.7	1.5	6.6	0.9	52	23.8	3.5	3.4	23.2	150	-27.5	-103	43.1	98	(N/A)	7.1	2.18
Northern red oak	4.0	0.7	2.0	0.2	22	12.9	1.9	1.8	12.4	81	-5.6	-21	30.2	81	(N/A)	4.3	3.01
Red maple	2.8	0.5	1.5	0.1	15	13.6	2.0	1.9	12.8	84	-1.1	-4	34.0	96	(N/A)	3.9	3.82
Sugar maple	4.7	0.8	2.5	0.2	26	21.4	3.1	3.0	20.7	135	-3.8	-14	52.7	146	(N/A)	3.8	6.09
Swamp white oak	0.8	0.1	0.5	0.0	4	5.4	0.8	0.7	4.9	33	-0.2	-1	13.1	37	(N/A)	3.2	1.84
Pin oak	4.4	0.8	2.4	0.2	25	16.9	2.5	2.4	16.2	106	-8.7	-32	37.0	98	(N/A)	2.7	5.75
Northern hackberry	3.4	0.6	1.9	0.2	19	16.5	2.4	2.3	15.4	102	0.0	0	42.6	121	(N/A)	2.4	8.07
Honeylocust	3.8	0.6	1.9	0.2	21	15.0	2.2	2.1	14.4	94	-2.6	-10	37.7	105	(N/A)	2.2	7.49
Black walnut	2.7	0.4	1.4	0.1	14	13.3	1.9	1.9	12.8	83	0.0	0	34.4	98	(N/A)	1.9	8.13
Littleleaf linden	1.9	0.3	1.0	0.1	10	8.3	1.2	1.1	7.8	51	-1.0	-4	20.8	58	(N/A)	1.9	4.85
Japanese tree lilac	0.0	0.0	0.0	0.0	0	0.4	0.1	0.1	0.3	2	0.0	0	0.8	2	(N/A)	1.7	0.22
White ash	1.5	0.2	0.9	0.1	9	12.3	1.8	1.7	12.1	78	0.0	0	30.7	86	(N/A)	1.7	7.86
Blue spruce	1.8	0.4	1.5	0.2	12	4.7	0.7	0.7	4.5	29	-5.0	-19	9.4	23	(N/A)	1.4	2.51
Black maple	5.3	0.9	2.4	0.2	28	10.1	1.5	1.4	9.5	63	-1.7	-7	29.6	84	(N/A)	1.3	10.55
American basswood	1.2	0.2	0.6	0.1	7	4.3	0.6	0.6	4.0	26	-1.1	-4	10.5	29	(N/A)	1.3	3.65
Ohio buckeye	1.8	0.3	0.9	0.1	10	6.2	0.9	0.9	5.8	38	-0.4	-2	16.4	47	(N/A)	1.1	6.65
Spruce	3.1	0.6	2.5	0.4	20	5.5	0.8	0.8	5.3	34	-14.8	-55	4.2	-1	(N/A)	1.1	-0.08
Norway spruce	2.5	0.5	2.0	0.3	16	4.4	0.6	0.6	4.2	27	-12.2	-46	2.9	-2	(N/A)	0.9	-0.33
Maple	0.4	0.1	0.2	0.0	2	2.4	0.4	0.3	2.3	15	-0.2	-1	6.0	17	(N/A)	0.9	2.81
Broadleaf Deciduous Small	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)	0.6	0.72
Catalpa	2.1	0.3	0.9	0.1	11	4.1	0.6	0.6	4.0	26	0.0	0	12.7	37	(N/A)	0.6	9.19
River birch	0.7	0.1	0.4	0.0	4	3.8	0.6	0.5	3.7	24	-0.2	-1	9.7	27	(N/A)	0.6	6.81
Mulberry	1.3	0.2	0.6	0.1	7	3.3	0.5	0.5	3.0	21	0.0	0	9.6	28	(N/A)	0.6	6.90
Chinese elm	0.1	0.0	0.1	0.0	0	1.4	0.2	0.2	1.3	9	0.0	0	3.2	9	(N/A)	0.5	2.99
Eastern white pine	0.7	0.1	0.6	0.1	5	1.5	0.2	0.2	1.4	9	-3.4	-13	1.5	1	(N/A)	0.3	0.62
Siberian elm	2.2	0.4	1.0	0.1	12	3.9	0.6	0.5	3.8	24	0.0	0	12.5	36	(N/A)	0.3	18.04
Amur maple	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)	0.3	0.41
Birch	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)	0.3	0.14
Basswood	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)	0.2	0.87
Cottonwood	1.2	0.2	0.5	0.1	6	2.1	0.3	0.3	2.0	13	0.0	0	6.6	19	(N/A)	0.2	19.04

Parkersburg

Annual Air Quality Benefits of Public Trees

2/11/2022

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								
Eastern red cedar	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	-0.1	0	0.1	0	(N/A)	0.2	0.20
Japanese 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)	0.2	0.11
American sycamore	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)	0.2	2.99
Boxelder	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)	0.2	0.25
Paper birch	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	0.2	0.08
Black spruce	0.2	0.0	0.2	0.0	1	0.6	0.1	0.1	0.6	4	-0.6	-2	1.2	3	(N/A)	0.2	2.89
Eastern redbud	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)	0.2	0.11
Quaking aspen	0.3	0.0	0.1	0.0	1	1.3	0.2	0.2	1.2	8	0.0	0	3.3	9	(N/A)	0.2	9.34
Buckthorn	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)	0.2	0.71
Kentucky coffeetree	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)	0.2	0.08
Pear	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)	0.2	0.11
Citywide total	189.4	32.0	98.2	9.7	1,038	572.2	83.4	79.5	544.2	3,567	-112.7	-423	1,495.9	4,183	(N/A)	100.0	6.61

Table 4: Annual Carbon Stored

Parkersburg

Stored CO2 Benefits of Public Trees

2/11/2022

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	803,156	6,024	(N/A)	12.5	17.7	76.25
Norway maple	454,343	3,408	(N/A)	10.9	10.0	49.39
Bur oak	1,429,724	10,723	(N/A)	8.8	31.5	191.48
Apple	40,019	300	(N/A)	8.5	0.9	5.56
Silver maple	656,151	4,921	(N/A)	8.1	14.5	96.49
Northern white cedar	61,712	463	(N/A)	7.1	1.4	10.29
Northern red oak	79,799	598	(N/A)	4.3	1.8	22.17
Red maple	34,796	261	(N/A)	3.9	0.8	10.44
Sugar maple	135,301	1,015	(N/A)	3.8	3.0	42.28
Swamp white oak	14,617	110	(N/A)	3.2	0.3	5.48
Pin oak	110,296	827	(N/A)	2.7	2.4	48.66
Northern hackberry	48,005	360	(N/A)	2.4	1.1	24.00
Honeylocust	47,599	357	(N/A)	2.2	1.0	25.50
Black walnut	88,732	665	(N/A)	1.9	2.0	55.46
Littleleaf linden	42,133	316	(N/A)	1.9	0.9	26.33
Japanese tree lilac	480	4	(N/A)	1.7	0.0	0.33
White ash	44,687	335	(N/A)	1.7	1.0	30.47
Blue spruce	12,191	91	(N/A)	1.4	0.3	10.16
Black maple	56,718	425	(N/A)	1.3	1.3	53.17
American basswood	47,791	358	(N/A)	1.3	1.1	44.80
Ohio buckeye	29,880	224	(N/A)	1.1	0.7	32.01
Spruce	37,817	284	(N/A)	1.1	0.8	40.52
Norway spruce	31,388	235	(N/A)	0.9	0.7	39.24
Maple	5,599	42	(N/A)	0.9	0.1	7.00
Broadleaf Deciduous	949	7	(N/A)	0.6	0.0	1.78
Catalpa	72,126	541	(N/A)	0.6	1.6	135.24
River birch	11,973	90	(N/A)	0.6	0.3	22.45
Mulberry	21,136	159	(N/A)	0.6	0.5	39.63
Chinese elm	3,104	23	(N/A)	0.5	0.1	7.76
Eastern white pine	8,661	65	(N/A)	0.3	0.2	32.48
Siberian elm	53,509	401	(N/A)	0.3	1.2	200.66
Amur maple	192	1	(N/A)	0.3	0.0	0.72
Birch	34	0	(N/A)	0.3	0.0	0.13
Basswood	185	1	(N/A)	0.2	0.0	1.39
Cottonwood	39,259	294	(N/A)	0.2	0.9	294.44
Eastern red cedar	43	0	(N/A)	0.2	0.0	0.32
Japanese maple	14	0	(N/A)	0.2	0.0	0.10
American sycamore	1,035	8	(N/A)	0.2	0.0	7.76
Boxelder	17	0	(N/A)	0.2	0.0	0.13
Paper birch	12	0	(N/A)	0.2	0.0	0.09
Black spruce	1,118	8	(N/A)	0.2	0.0	8.39
Eastern redbud	14	0	(N/A)	0.2	0.0	0.10
Quaking aspen	8,458	63	(N/A)	0.2	0.2	63.43
Buckthorn	178	1	(N/A)	0.2	0.0	1.33
Kentucky coffeetree	12	0	(N/A)	0.2	0.0	0.09
Pear	14	0	(N/A)	0.2	0.0	0.10
Citywide total	4,534,975	34,012	(N/A)	100.0	100.0	53.73

The value of stored carbon dioxide is calculated as the total amount of carbon dioxide sequestered annually over the life of each tree, summed for the population. This value should not be added to the Replacement Value or double-counting of the carbon dioxide storage benefit will occur.

Table 5: Annual Carbon Sequestered

Parkersburg

Annual CO $_2$ Benefits of Public Trees

2/11/2022

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total Standard ($) Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	47,466	356	-3,855	-210	-30	34,676	260	78,076	586 (N/A)	12.5	17.8	7.41
Norway maple	24,654	185	-2,185	-160	-18	26,340	198	48,648	365 (N/A)	10.9	11.1	5.29
Bur oak	46,970	352	-6,863	-226	-53	33,909	254	73,791	553 (N/A)	8.8	16.8	9.88
Apple	3,701	28	-193	-42	-2	3,871	29	7,338	55 (N/A)	8.5	1.7	1.02
Silver maple	53,974	405	-3,151	-153	-25	24,546	184	75,217	564 (N/A)	8.1	17.1	11.06
Northern white cedar	4,774	36	-296	-85	-3	8,585	64	12,977	97 (N/A)	7.1	3.0	2.16
Northern red oak	3,252	24	-383	-34	-3	4,583	34	7,418	56 (N/A)	4.3	1.7	2.06
Red maple	4,857	36	-167	-29	-1	4,742	36	9,402	71 (N/A)	3.9	2.1	2.82
Sugar maple	8,525	64	-652	-46	-5	7,667	58	15,494	116 (N/A)	3.8	3.5	4.84
Swamp white oak	2,349	18	-77	-14	-1	1,825	14	4,082	31 (N/A)	3.2	0.9	1.53
Pin oak	11,672	88	-530	-35	-4	5,984	45	17,092	128 (N/A)	2.7	3.9	7.54
Northern hackberry	3,663	27	-231	-31	-2	5,708	43	9,108	68 (N/A)	2.4	2.1	4.55
Honeylocust	7,020	53	-229	-25	-2	5,345	40	12,112	91 (N/A)	2.2	2.8	6.49
Black walnut	5,981	45	-426	-27	-3	4,733	35	10,261	77 (N/A)	1.9	2.3	6.41
Littleleaf linden	5,131	38	-202	-20	-2	2,895	22	7,804	59 (N/A)	1.9	1.8	4.88
Japanese tree lilac	154	1	-3	-3	0	125	1	273	2 (N/A)	1.7	0.1	0.19
White ash	5,510	41	-214	-21	-2	4,489	34	9,763	73 (N/A)	1.7	2.2	6.66
Blue spruce	829	6	-59	-18	-1	1,655	12	2,408	18 (N/A)	1.4	0.5	2.01
Black maple	4,782	36	-272	-20	-2	3,524	26	8,014	60 (N/A)	1.3	1.8	7.51
American basswood	2,826	21	-229	-12	-2	1,471	11	4,055	30 (N/A)	1.3	0.9	3.80
Ohio buckeye	2,339	18	-144	-13	-1	2,131	16	4,313	32 (N/A)	1.1	1.0	4.62
Spruce	746	6	-182	-25	-2	1,953	15	2,493	19 (N/A)	1.1	0.6	2.67
Norway spruce	168	1	-151	-20	-1	1,555	12	1,552	12 (N/A)	0.9	0.4	1.94
Maple	803	6	-27	-5	0	858	6	1,629	12 (N/A)	0.9	0.4	2.04
Broadleaf Deciduous Smal	140	1	-5	-2	0	141	1	274	2 (N/A)	0.6	0.1	0.51
Catalpa	1,484	11	-346	-11	-3	1,462	11	2,590	19 (N/A)	0.6	0.6	4.86
River birch	1,382	10	-57	-7	0	1,361	10	2,678	20 (N/A)	0.6	0.6	5.02
Mulberry	1,071	8	-101	-10	-1	1,128	8	2,088	16 (N/A)	0.6	0.5	3.91
Chinese elm	626	5	-15	-4	0	476	4	1,084	8 (N/A)	0.5	0.2	2.71
Eastern white pine	116	1	-42	-7	0	527	4	594	4 (N/A)	0.3	0.1	2.23
Siberian elm	1,623	12	-257	-9	-2	1,390	10	2,747	21 (N/A)	0.3	0.6	10.30
Amur maple	47	0	-1	-1	0	43	0	88	1 (N/A)	0.3	0.0	0.33

Annual CO ₂ Benefits of Public Trees

2/11/2022

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
Birch	11	0	0	0	0	14	0	25	0 (N/A)	0.3	0.0	0.09
Basswood	74	1	-1	-1	0	49	0	121	1 (N/A)	0.2	0.0	0.91
Cottonwood	912	7	-188	-5	-1	734	6	1,453	11 (N/A)	0.2	0.3	10.90
Eastern red cedar	13	0	0	-1	0	26	0	39	0 (N/A)	0.2	0.0	0.29
Japanese maple	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
American sycamore	209	2	-5	-1	0	159	1	361	3 (N/A)	0.2	0.1	2.71
Boxelder	16	0	0	0	0	13	0	28	0 (N/A)	0.2	0.0	0.21
Paper birch	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Black spruce	91	1	-5	-2	0	213	2	296	2 (N/A)	0.2	0.1	2.22
Eastern redbud	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Quaking aspen	660	5	-41	-3	0	441	3	1,058	8 (N/A)	0.2	0.2	7.93
Buckthorn	38	0	-1	-1	0	37	0	74	1 (N/A)	0.2	0.0	0.55
Kentucky coffeetree	3	0	0	0	0	4	0	7	0 (N/A)	0.2	0.0	0.05
Pear	9	0	0	0	0	6	0	14	0 (N/A)	0.2	0.0	0.10
Citywide total	260,688	1,955	-21,787	-1,339	-173	201,412	1,511	438,974	3,292 (N/A)	100.0	100.0	5.20

Table 6: Annual Social and Aesthetic Benefits

Parkersburg

Annual Aesthetic/Other Benefits of Public Trees

2/11/2022

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Green ash	4,123	(N/A)	12.5	16.2	52.19
Norway maple	2,357	(N/A)	10.9	9.3	34.15
Bur oak	3,317	(N/A)	8.8	13.1	59.24
Apple	205	(N/A)	8.5	0.8	3.79
Silver maple	4,470	(N/A)	8.1	17.6	87.64
Northern white cedar	1,315	(N/A)	7.1	5.2	29.22
Northern red oak	300	(N/A)	4.3	1.2	11.11
Red maple	777	(N/A)	3.9	3.1	31.09
Sugar maple	942	(N/A)	3.8	3.7	39.24
Swamp white oak	290	(N/A)	3.2	1.1	14.52
Pin oak	1,017	(N/A)	2.7	4.0	59.83
Northern hackberry	584	(N/A)	2.4	2.3	38.95
Honeylocust	1,521	(N/A)	2.2	6.0	108.62
Black walnut	564	(N/A)	1.9	2.2	46.97
Littleleaf linden	564	(N/A)	1.9	2.2	46.99
Japanese tree lilac	4	(N/A)	1.7	0.0	0.40
White ash	716	(N/A)	1.7	2.8	65.07
Blue spruce	199	(N/A)	1.4	0.8	22.09
Black maple	575	(N/A)	1.3	2.3	71.90
American basswood	202	(N/A)	1.3	0.8	25.20
Ohio buckeye	234	(N/A)	1.1	0.9	33.38
Spruce	153	(N/A)	1.1	0.6	21.82
Norway spruce	48	(N/A)	0.9	0.2	7.96
Maple	125	(N/A)	0.9	0.5	20.81
Broadleaf Deciduous Small	7	(N/A)	0.6	0.0	1.63
Catalpa	124	(N/A)	0.6	0.5	30.91
River birch	144	(N/A)	0.6	0.6	35.92
Mulberry	64	(N/A)	0.6	0.3	16.00
Chinese elm	86	(N/A)	0.5	0.3	28.56
Eastern white pine	32	(N/A)	0.3	0.1	16.16
Siberian elm	100	(N/A)	0.3	0.4	50.02
Amur maple	2	(N/A)	0.3	0.0	1.05
Birch	5	(N/A)	0.3	0.0	2.74
Basswood	15	(N/A)	0.2	0.1	14.73
Cottonwood	58	(N/A)	0.2	0.2	58.34
Eastern red cedar	13	(N/A)	0.2	0.1	13.37
Japanese maple	0	(N/A)	0.2	0.0	0.03
American sycamore	29	(N/A)	0.2	0.1	28.56
Boxelder	15	(N/A)	0.2	0.1	15.44
Paper birch	5	(N/A)	0.2	0.0	5.26
Black spruce	25	(N/A)	0.2	0.1	25.23
Eastern redbud	0	(N/A)	0.2	0.0	0.03
Quaking aspen	58	(N/A)	0.2	0.2	57.69
Buckthorn	2	(N/A)	0.2	0.0	2.06
Kentucky coffeetree	5	(N/A)	0.2	0.0	5.26
Pear	0	(N/A)	0.2	0.0	0.03
Citywide total	25,390	(N/A)	100.0	100.0	40.11

Table 7: Summary of Benefits in Dollars

Parkersburg

Total Annual Benefits, Net Benefits, and Costs for Public Trees

2/11/2022

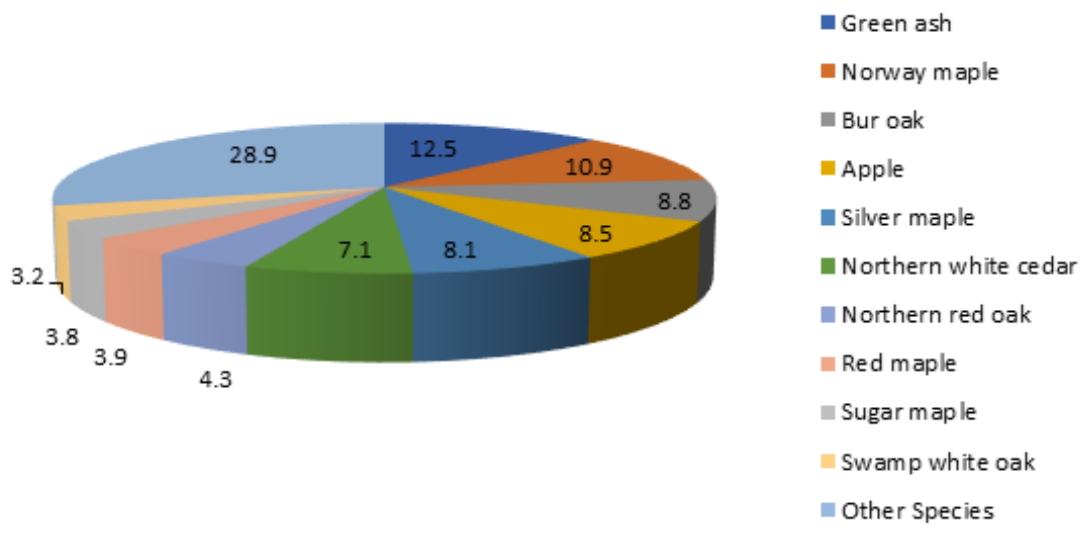
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	25,124	(N/A)	39.69	(N/A)	0.00	(N/A)
CO2	3,292	(N/A)	5.20	(N/A)	0.00	(N/A)
Air Quality	4,183	(N/A)	6.61	(N/A)	0.00	(N/A)
Stormwater	34,706	(N/A)	54.83	(N/A)	0.00	(N/A)
Aesthetic/Other	25,390	(N/A)	40.11	(N/A)	0.00	(N/A)
Total Benefits	92,695	(N/A)	146.44	(N/A)	0.00	(N/A)
Costs						
Planting	0		0.00		0.00	
Contract Pruning	0		0.00		0.00	
Pest Management	0		0.00		0.00	
Irrigation	0		0.00		0.00	
Removal	0		0.00		0.00	
Administration	0		0.00		0.00	
Inspection/Service	0		0.00		0.00	
Infrastructure Repairs	0		0.00		0.00	
Litter Clean-up	0		0.00		0.00	
Liability/Claims	0		0.00		0.00	
Other Costs	0		0.00		0.00	
Total Costs	0		0.00		0.00	
Net Benefits	92,695	(N/A)	146.44	(N/A)	0.00	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Parkersburg

Species Distribution of Public Trees

2/11/2022



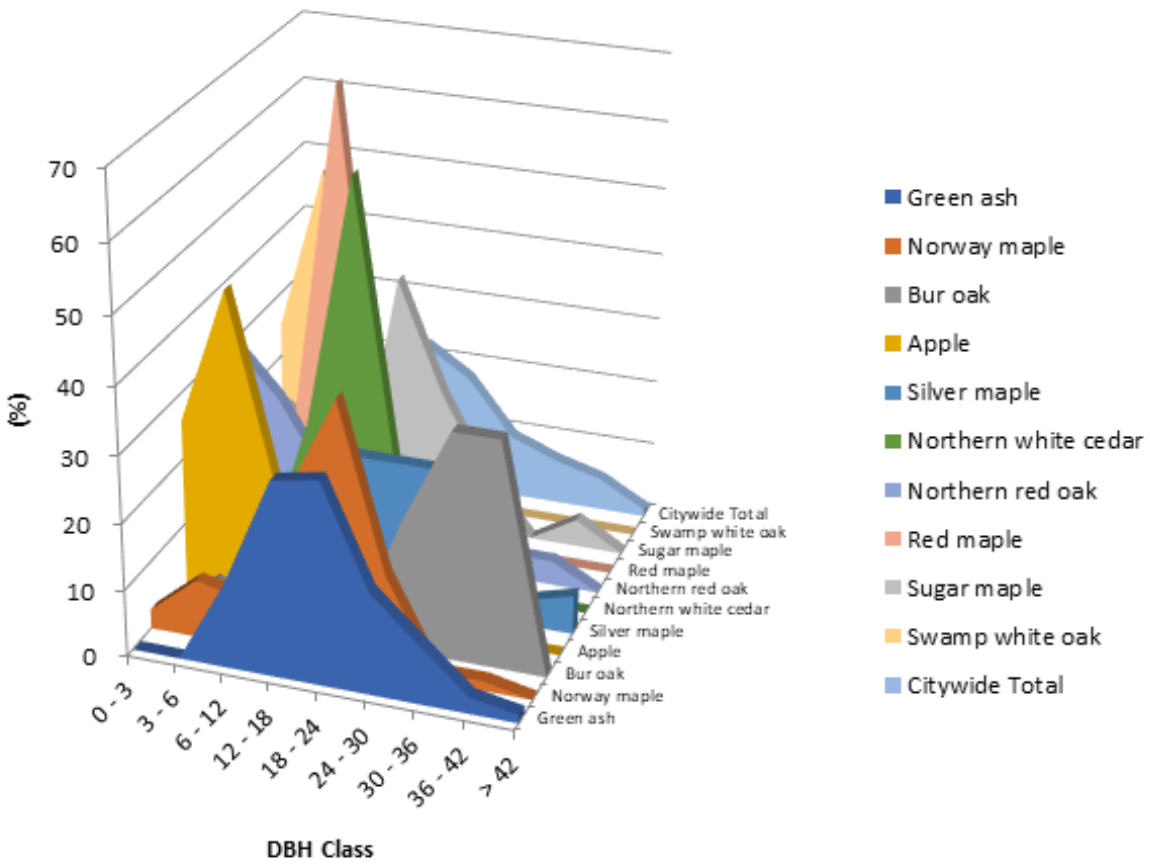
Species	Percent
Green ash	12.5
Norway maple	10.9
Bur oak	8.8
Apple	8.5
Silver maple	8.1
Northern white cedar	7.1
Northern red oak	4.3
Red maple	3.9
Sugar maple	3.8
Swamp white oak	3.2
Other Species	28.9
Total	100.0

Figure 2: Relative Age Class

Parkersburg

Relative Age Distribution of Top 10 Public Tree Species for All Zones (%)

2/11/2022



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Green ash	0.00	0.00	12.66	29.11	30.38	15.19	8.86	2.53	1.27
Norway maple	2.90	8.70	7.25	24.64	39.13	14.49	1.45	1.45	0.00
Bur oak	0.00	5.36	1.79	3.57	1.79	19.64	33.93	33.93	0.00
Apple	25.93	46.30	18.52	3.70	3.70	1.85	0.00	0.00	0.00
Silver maple	1.96	3.92	5.88	21.57	21.57	21.57	13.73	3.92	5.88
Northern white cedar	2.22	0.00	22.22	60.00	13.33	0.00	2.22	0.00	0.00
Northern red oak	29.63	22.22	11.11	22.22	3.70	3.70	3.70	3.70	0.00
Red maple	4.00	16.00	68.00	8.00	4.00	0.00	0.00	0.00	0.00
Sugar maple	16.67	12.50	0.00	37.50	20.83	8.33	0.00	4.17	0.00
Swamp white oak	25.00	50.00	20.00	0.00	5.00	0.00	0.00	0.00	0.00
Citywide Total	9.79	12.95	14.85	22.27	17.85	9.48	6.79	4.90	1.11

Figure 3: Foliage Condition

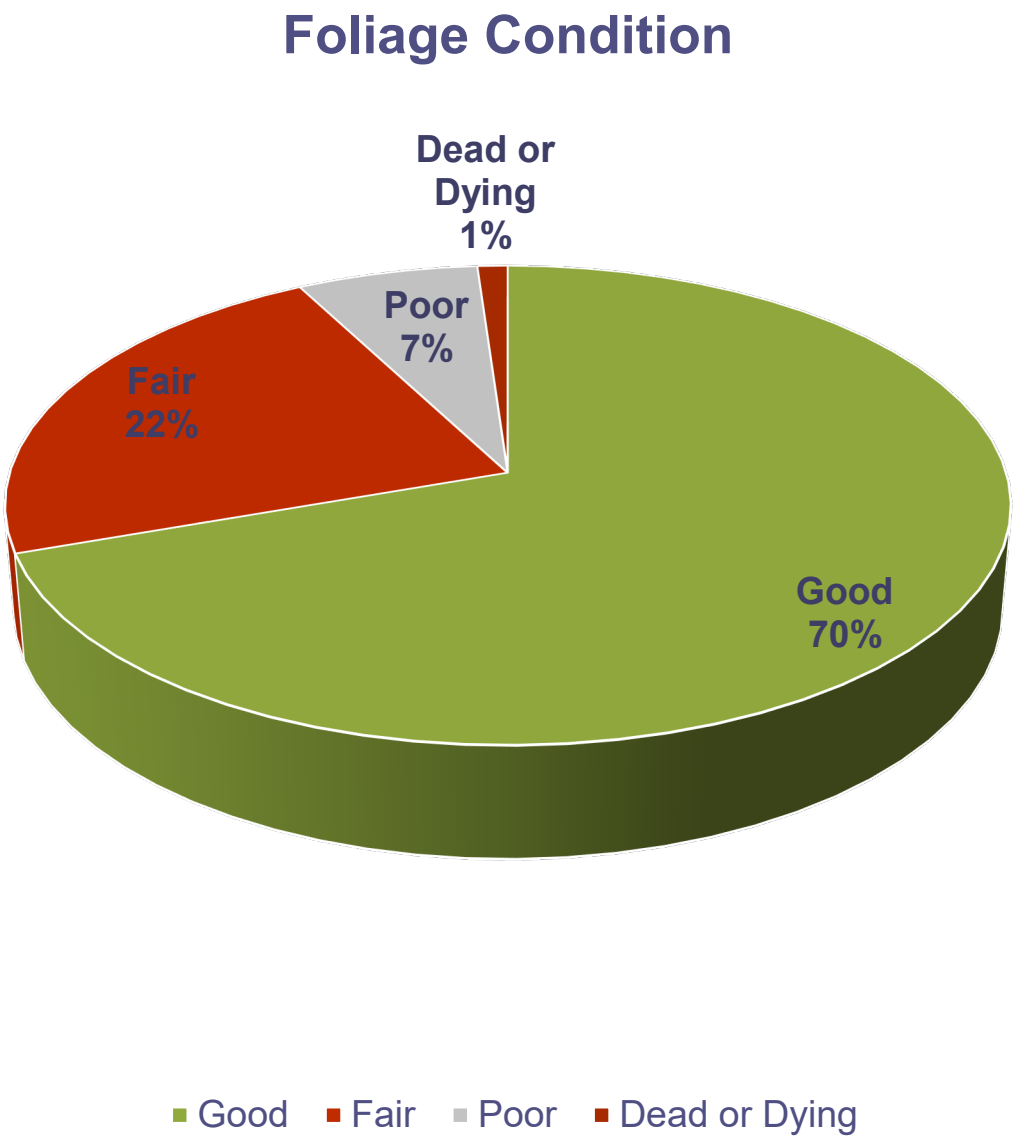


Figure 4: Wood Condition

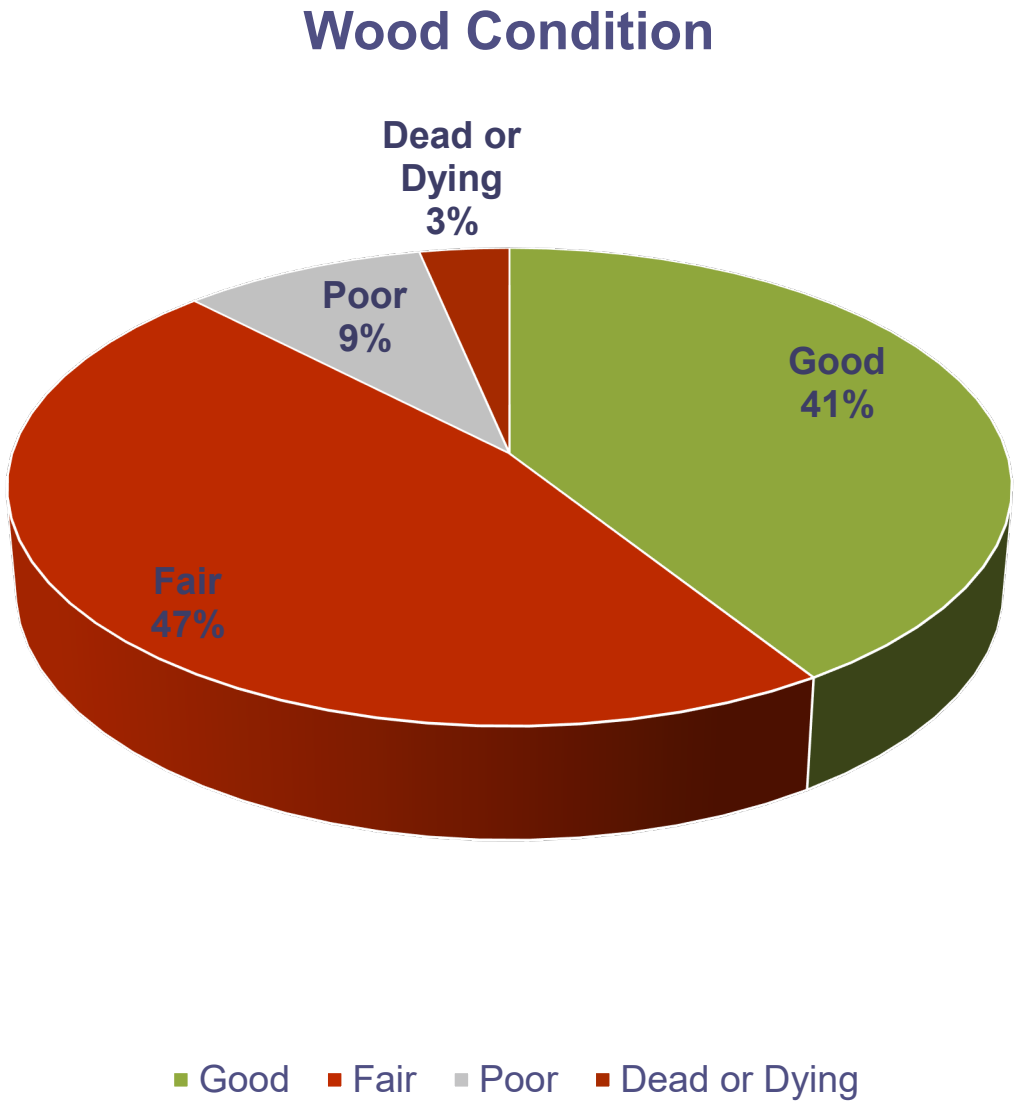
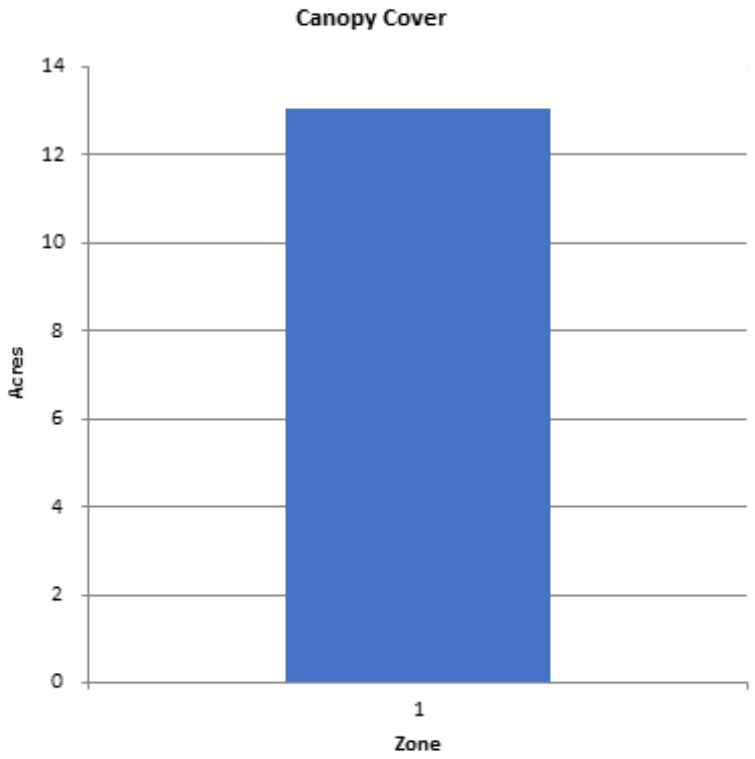


Figure 5: Canopy Cover in Acres

Parkersburg

Canopy Cover of Public Trees (Acres)

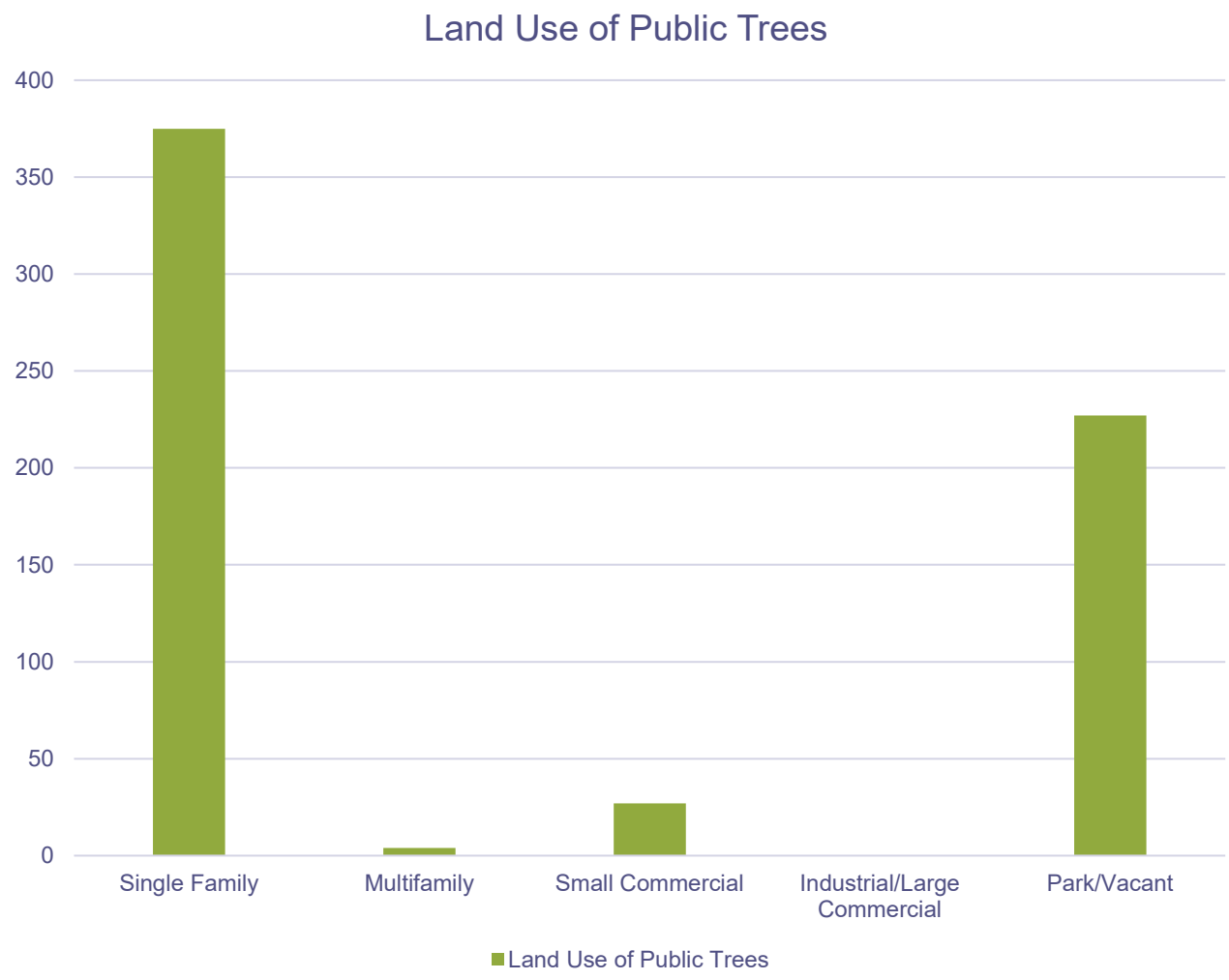
2/11/2022



Zone	Acres	% of Total Canopy Cover
1	13	100.0
Citywide total	13	100.0

	Total Land Area	Total Street and Sidewalk Area	Total Canopy Cover	Canopy Cover as % of Total Land Area	Canopy Cover as % of Total Streets and Sidewalks
Citywide Total	0	0	13	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

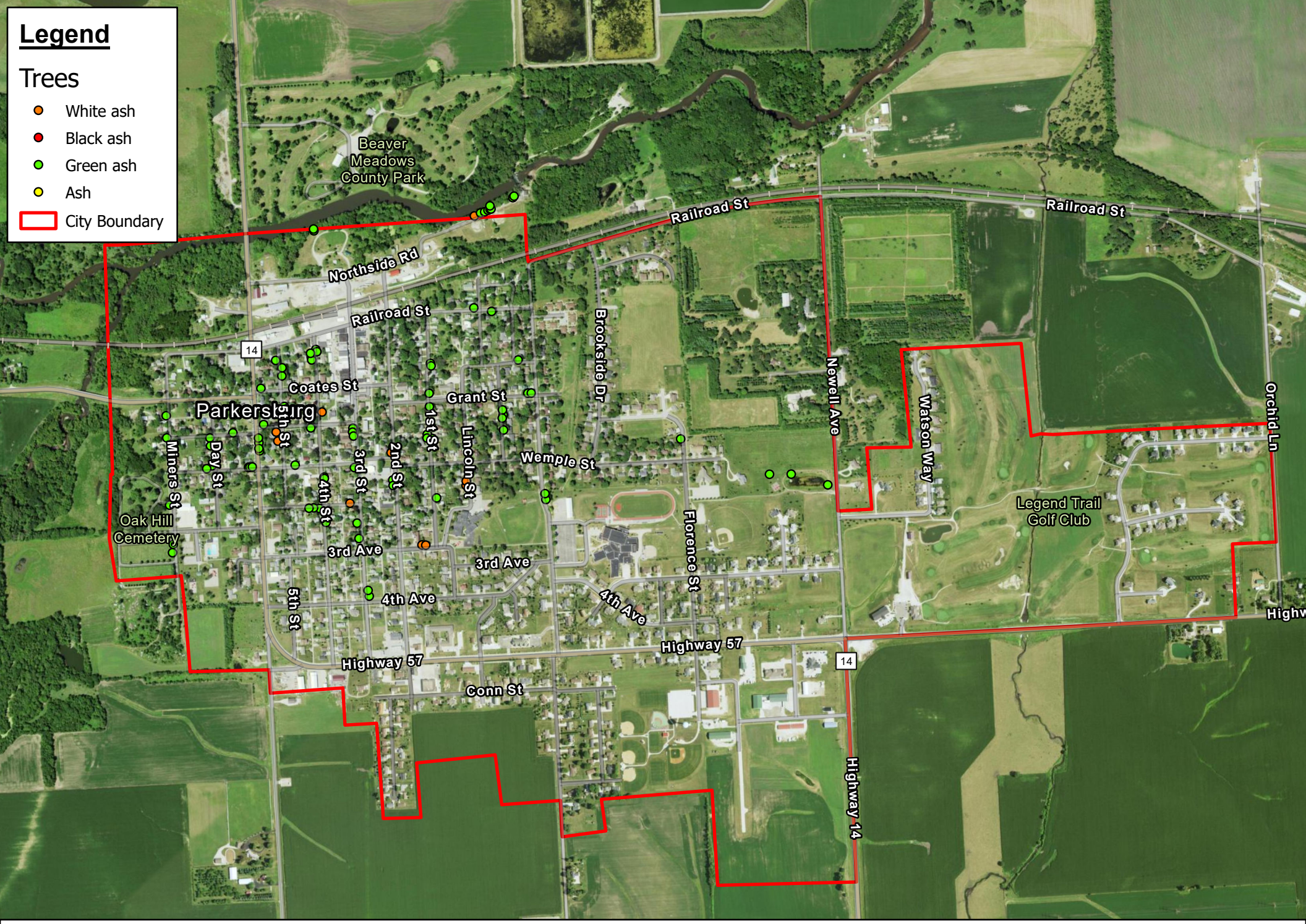
Figure 1: Location of Ash Trees

Figure 2: Location of EAB Symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

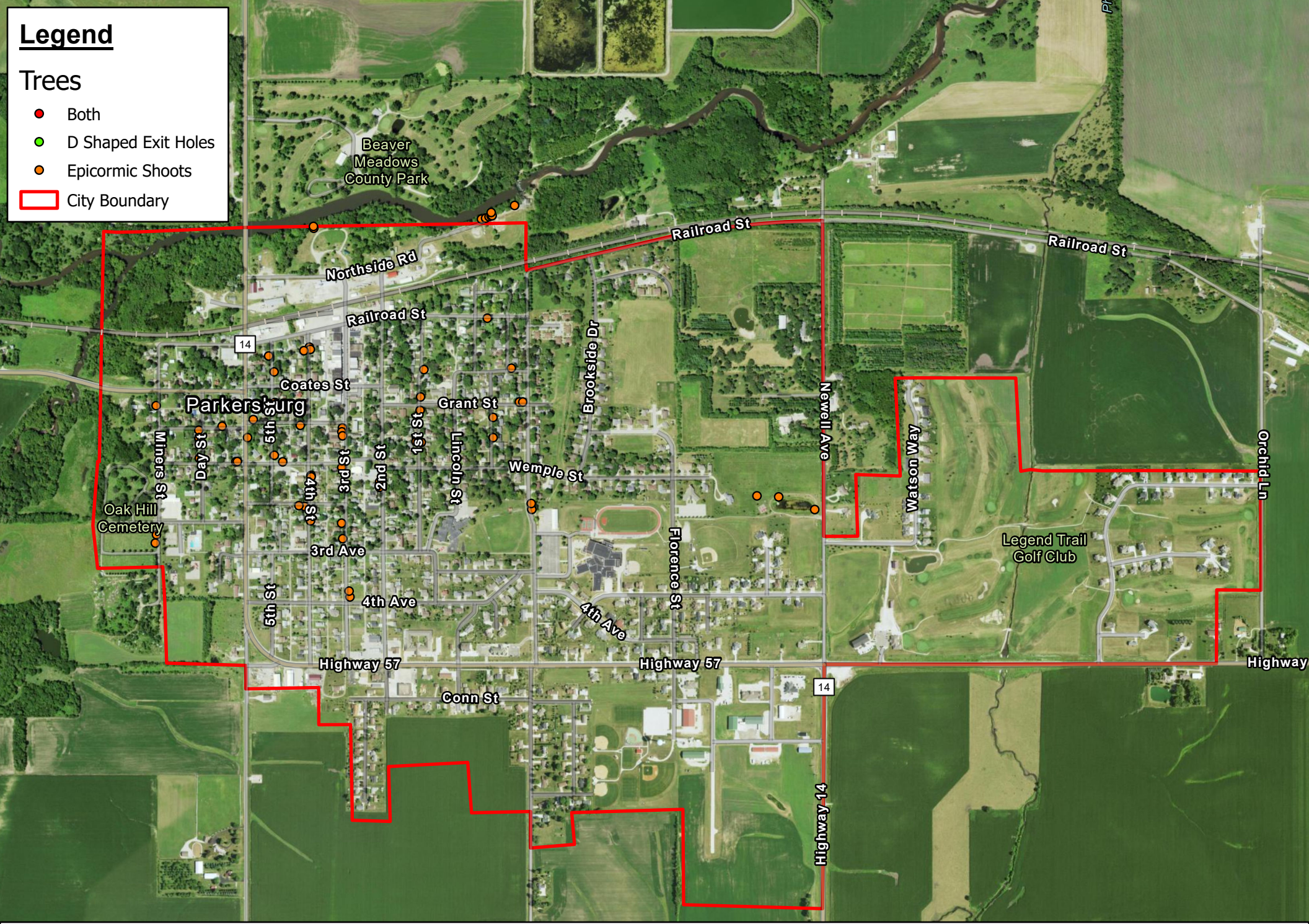
City ownership of the trees recommended for removal should be verified prior to any removal



Ash Tree Location

0 500 1,000 2,000 Feet

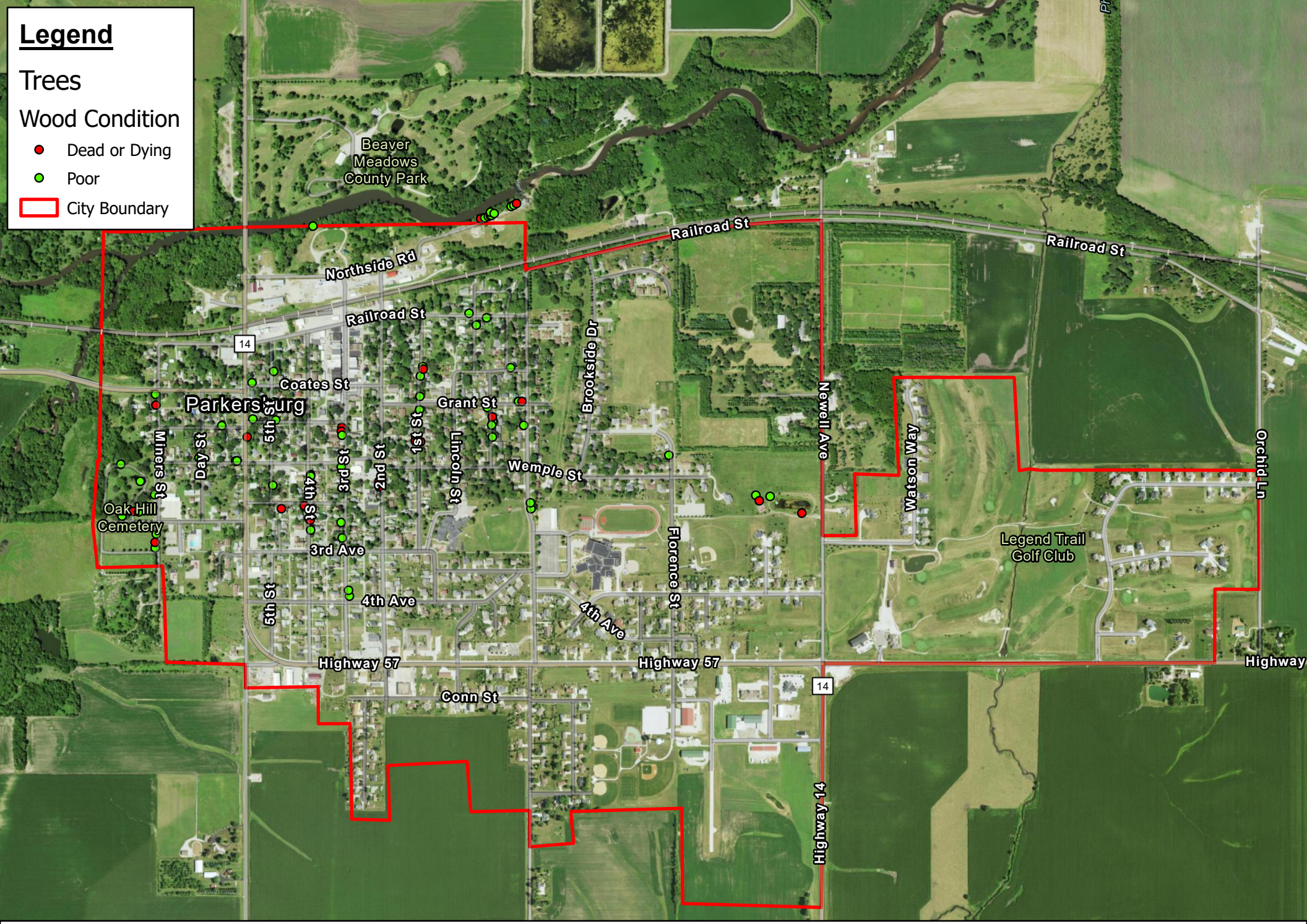
N



EAB Signs/Symptoms

0 500 1,000 2,000 Feet

N



Poor Condition Trees

Priority Task

0 500 1,000 2,000 Feet

N

APPENDIX C: PARKERSBURG 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 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.

4. Approved Trees.

A. The following is a list of approved trees for planting in parking areas with overhead utility lines (trees with a mature height of less than 25 feet):

American Hophornbeam or Ironwood (Ostrya)
American Hornbeam or Musclewood (Carpinus)
Amur Maackia
Amur Maple (single-stem tree form)
Cornelian Cherry Dogwood
Eastern Redbud
Flowering Crabapple (fruitless, vase-shaped varieties such as Van Eseltine)
Flowering Pear – Chanticleer and Redspire
Golden Rain Tree
Hawthorne (thornless)
Japanese Tree Lilac
Katsura Tree
Korean Mountain Ash (not an "ash tree" so not jeopardized by the emerald ash borer)
Ohio Buckeye
Pagoda Dogwood (also known as Alternate Leaf Dogwood)
Paper Bark Maple
Serviceberry
Siberian Crabapple
Star Magnolia

Tatarian Maple
Three Flower Maple

B. The following is a list of approved trees for planting in parking areas with no overhead utility lines (trees with a mature height greater than 25 feet):

American Linden (Boulevard and Redmond recommended)
Black Maple
Bur Oak
Ginkgo (fruitless male selections Lakeview and Princeton Sentry)
Hackberry
Honey Locust (seed pods are infrequent on Skyline)
Norway Maple
Red Oak
Swamp White Oak
Sugar Maple
White Oak

C. The following is a list of approved shade and evergreen trees for private property planting:

All trees approved for planting in the parking area
American Linden or Basswood
American Sycamore
Amur Corkscrew
Arborvitae (White Cedar)
Aspen
Black Hills Spruce
Bosnian Pine
Bur Oak
Caucasian or Nordmann Fir
Chestnut Oak
Concolor Fir
Cottonwood (male)
Crimson Spire Oak
Douglas Fir
English Oak
Gingko
Kentucky Coffee Tree
Korean Pine
Larch
Limber Pine
London Plane Tree
Mulberry (male)
New cultivars of Elm
Northern Catalpa
Norway Spruce
Pecan
Pin Oak
Ponderosa Pine
Red Cedar
Red Maple
Regal Prince Oak
River Birch
Siberian Spruce
State Street Maple
Sugar Maple
Swamp White Oak
Thornless Honeylocust
Turkish Filbert
Walnut
White Oak
White Pine

White Poplar
White or Black Hills Spruce

If a tree species is not on the approved list, written City approval is required prior to planting.

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

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

151.04 TRIMMING TREES TO BE SUPERVISED. Except as allowed in Section 151.03, it is unlawful for any person to trim or cut any tree in a street or public place unless the work is done under the supervision of the City.

151.05 DISEASE CONTROL. Any dead, diseased, or damaged tree or shrub that 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 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 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.