Riverdale, IA

Urban Forestry Management Plan

SUMMER 2022

JEO CONSULTING GROUP

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Executive Summary

EXECUTIVE SUMMARY

Overview

This plan was developed to assist the City of Riverdale 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 7% of Riverdale'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 2022, 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 98 trees inventoried.

- Riverdale trees provide $10,020 of benefits annually, an average of $102 per tree
- There are over 23 species of trees
- The top three genera are: Oak 19%, Maple 17%, and Spruce 15%
- 6% of trees need some type of management
- 2 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 2 trees needing removal, 1 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*
- 1 of the 7 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 7 years to remove ash. We suggest that city officials request a budget increase to $1,600 annually and apply for grants to plant replacement trees

Introduction

INTRODUCTION

This plan was developed to assist Riverdale 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 Riverdale, 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 Riverdale's 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 Riverdale 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 Riverdale's urban forestry goals.

Assist Riverdale 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 2022, 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 98 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. Riverdale's trees reduce energy-related costs by approximately $2,647 annually (Appendix A, Table 1). These savings are both in electricity (12.5 MWh) and in natural gas (1,733.4 Therms).

Annual Stormwater Benefits

Riverdale's trees intercept about 136,070 gallons of rainfall or snow melt per year (Appendix A, Table 2). This interception provides $3,688 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 Riverdale, it is estimated that trees remove 154 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 $427 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduce the amount of carbon in the atmosphere, mitigating climate change. In Riverdale, trees sequester about 29,467 lbs of carbon per year with an associated value of $359 (Appendix A, Table 5). In addition, the trees store 505,477 lbs of carbon, with a yearly benefit of $3,791 (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. Riverdale receives $2,900 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, Riverdale's trees provide $10,020 of benefits annually. Benefits of individual trees vary based on size, species, health and location, but on average each of the 98 trees in Riverdale provide approximately $102 annually (Appendix A, Table 7).

ENERGY	STORMWATER	AIR QUALITY	CARBON	AESTHETICS	SUMMARY
• Reduce energy cost by **$2,647**	• Intercept 136,070 **gallons** • Provides **$3,688** benefit	• Remove 154 **lbs** of pollution • Net value of **$427**	• Sequester 29,467 **lbs** • Value of **$359** • Store 505,477 **lbs** • Value of **$3,791**	• **$2,900** in social benefits	• **$10,020** annual benefits • Each tree provides **$102** annually

FOREST STRUCTURE

Species Distribution

Riverdale has over 23 different tree species along city streets and parks (Appendix A, Figure 1).

The distribution of trees by genera is as follows:

Oak	19	19%	Buckthorn	3	3%
Maple	17	17%	Hackberry	3	3%
Spruce	15	15%	Pear	3	3%
Birch	14	14%	Ginkgo	1	1%
Ash	7	7%	Locust	1	1%
Apple	5	5%	Tulip Tree	1	1%
Coffee	4	4%	Walnut	1	1%
Basswood/Linden	3	3%	Yellowwood	1	1%

Age Class

Most of Riverdale's trees (22%) are between 0 and 3 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. Riverdale's size curve is on the smaller side, indicating a younger than average stand.

Condition: Wood and Foliage

Both wood condition and leaf condition are good indicators of the urban forest's overall health. The foliage condition results for Riverdale indicate that 94% of the trees are in good health, with only 3% of the foliage in poor health, dead, or dying (Appendix A, Figure 3 & Appendix B, Figure 3). Similarly, 89% of Riverdale's trees are in good health for wood condition (Appendix A, Figure 4 & Appendix B, Figure 3). Three percent of the tree population's wood condition is in poor health, dead, or dying. This 3% is an estimate of trees that need management follow up.

Management Needs

The following outlines the specific management needs of the street and park trees by number of trees and percent of canopy (Appendix B, Figure 3).

Action	Number of Trees	Percentage
Tree Removal	2	2%
Tree Staking	2	2%
Crown Raising	1	1%
Crown Cleaning	1	1%
Crown Reduction	0	0%

Canopy Cover

The total canopy with both private and public trees is 389 acres or 18% cover. The canopy cover included in the Riverdale inventory includes approximately 1 acres (Appendix A, Figure 4). The city's canopy goal is to increase canopy by 5% in 30 years. To achieve this goal it is estimated that 4 trees need to be planted annually on public and private lands.

Land Use and Location

The majority of Riverdale'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	15%
Park/Vacant/Other	85%
Industrial/Large Commercial	0%
Small Commercial	0%
Multifamily Residential	0%

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

Riverdale has 1 critical concern trees that need immediate removal. These trees can be seen on the Location of Trees with Recommended Maintenance Map (Appendix B, Figure 4). We recommend starting with the large-diameter, critical concern trees first. There are 1 trees over 24 inches in diameter at 4.5 ft that should be addressed immediately. Please refer to the Six-Year Maintenance Plan at the end of this section. After all of the critical concern trees are addressed, there should be follow up on the trees marked as needing maintenance. There are a total of 1 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 2 removals, 2 are ash trees. There are a total of 7 ash trees, and 1 of those have signs and symptoms that have been associated with EAB. In addition, there are 2 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 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 Six Year Maintenance Plan 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 Riverdale.

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 (17%) (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: crabapple, Japanese Lilac, serviceberry, oak (red, white), hackberry, linden, elm (disease resistant), cork, London plane, ironwood hornbeam 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. 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 will not include crabapple, Japanese Lilac, serviceberry, oak (red, white), hackberry, linden, elm (disease resistant), cork, London plane, ironwood hornbeam.

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.

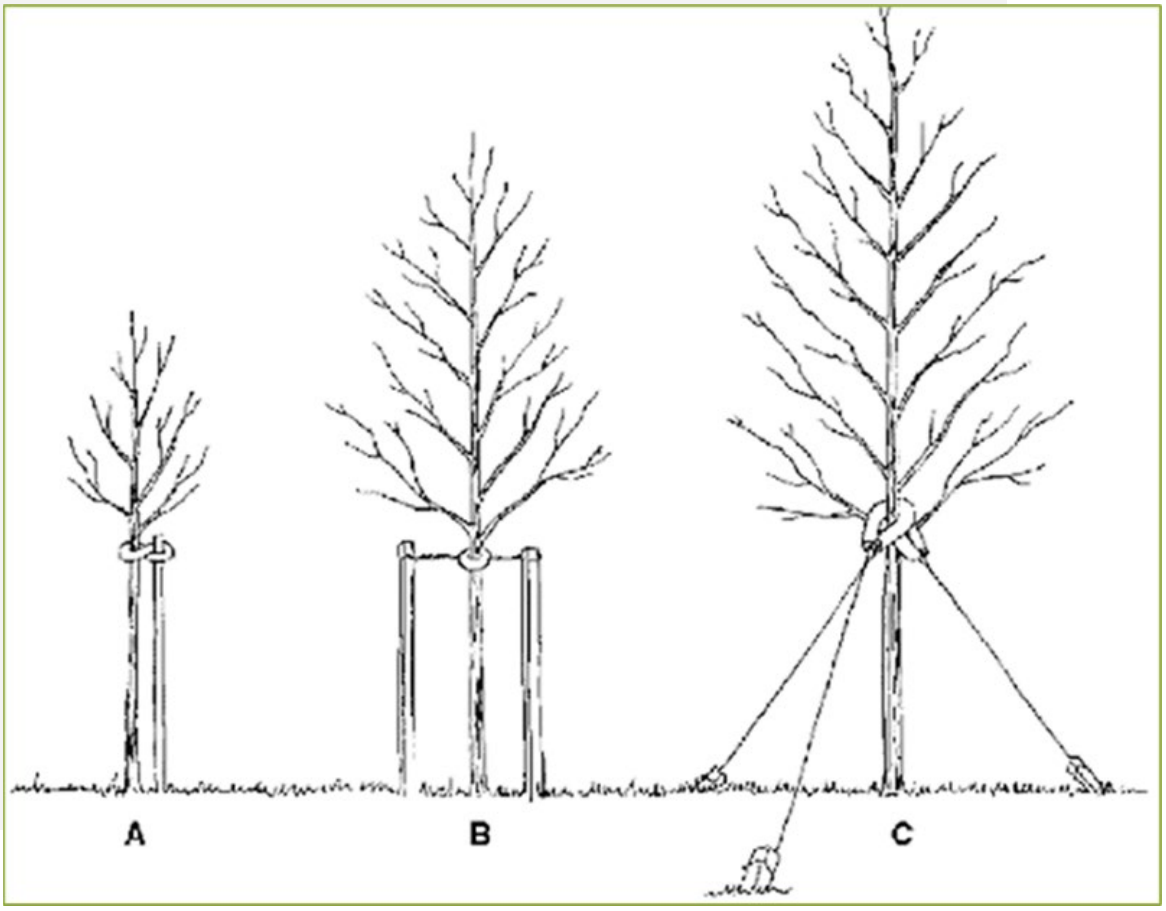
Monitoring

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 “A property owner may remove a tree that is on personal property as long as the property owner does the actual work. Otherwise, the property owner must hire a licensed tree surgeon to remove the tree.”

Schedule & Budget



PROPOSED WORK SCHEDULE & BUDGET

Budget Allowance of $800/Year – (Based off $2/Per Capita Tree Budget)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$700**

YEAR 2	Est. Cost
Prune 1/3 of city owned trees	$490
Plant 2 trees in open locations	$300
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$790**

YEAR 3	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Visual Survey of EAB Signs/Symptoms	n/a
Plant 1 tree in open locations	$150
TOTAL	**$850**

YEAR 4	Est. Cost
Prune 1/3 of city owned trees	$490
Plant 2 trees in open locations	$300
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$790**

YEAR 5	Est. Cost
Remove 1 tree recommended for removal	$700
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$700**

YEAR 6	Est. Cost
Prune 1/3 of city owned trees	$490
Visual Survey of EAB Signs/Symptoms	n/a
Plant 2 trees in open locations	$300
TOTAL	**$790**

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 $850 a year. If the budget were increased to $1,000 a year all ash could be removed in 5 years.*

PROPOSED WORK SCHEDULE WITH INCREASED BUDGET

Budget Allowance of $1,600/Year – (Budget Increase Suggested to Best Manage City Trees)

YEAR 1	Est. Cost
Remove 1 tree recommended for immediate removal	$700
Plant 6 trees in open locations	$900
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,600**

YEAR 2	Est. Cost
Remove 1 ash tree in poor condition	$700
Plant 2 trees in open locations	$300
Prune 1/3 of city owned trees	$490
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,490**

YEAR 3	Est. Cost
Remove 1 ash tree	$700
Plant 6 trees in open locations	$900
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,600**

YEAR 4	Est. Cost
Prune 1/3 of city owned trees	$490
Plant 7 trees in open locations	$1,050
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,540**

YEAR 5	Est. Cost
Remove 2 ash trees	$1,400
Plant 1 tree in open locations	$150
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,550**

YEAR 6	Est. Cost
Remove 1 ash tree	$700
Plant 2 trees in open locations	$300
Prune 1/3 of city owned trees	$490
Visual Survey of EAB Signs/Symptoms	n/a
TOTAL	**$1,490**

Purposed Budget Increase

EAB could potentially kill all ash trees in Riverdale within four years of its arrival. To remove all ash trees within six years, the budget would need to be increased to $850 a year. If the budget were increased to $1,600 per year all ash could be removed within 3 years. Additionally, we recommend that Riverdale 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 2 trees could be treated per year (every other year treatment). Four trees would be selected for treatment, and Riverdale would still need to find $2,100 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 Riverdale. We suggest considering an increased budget to plan for this.

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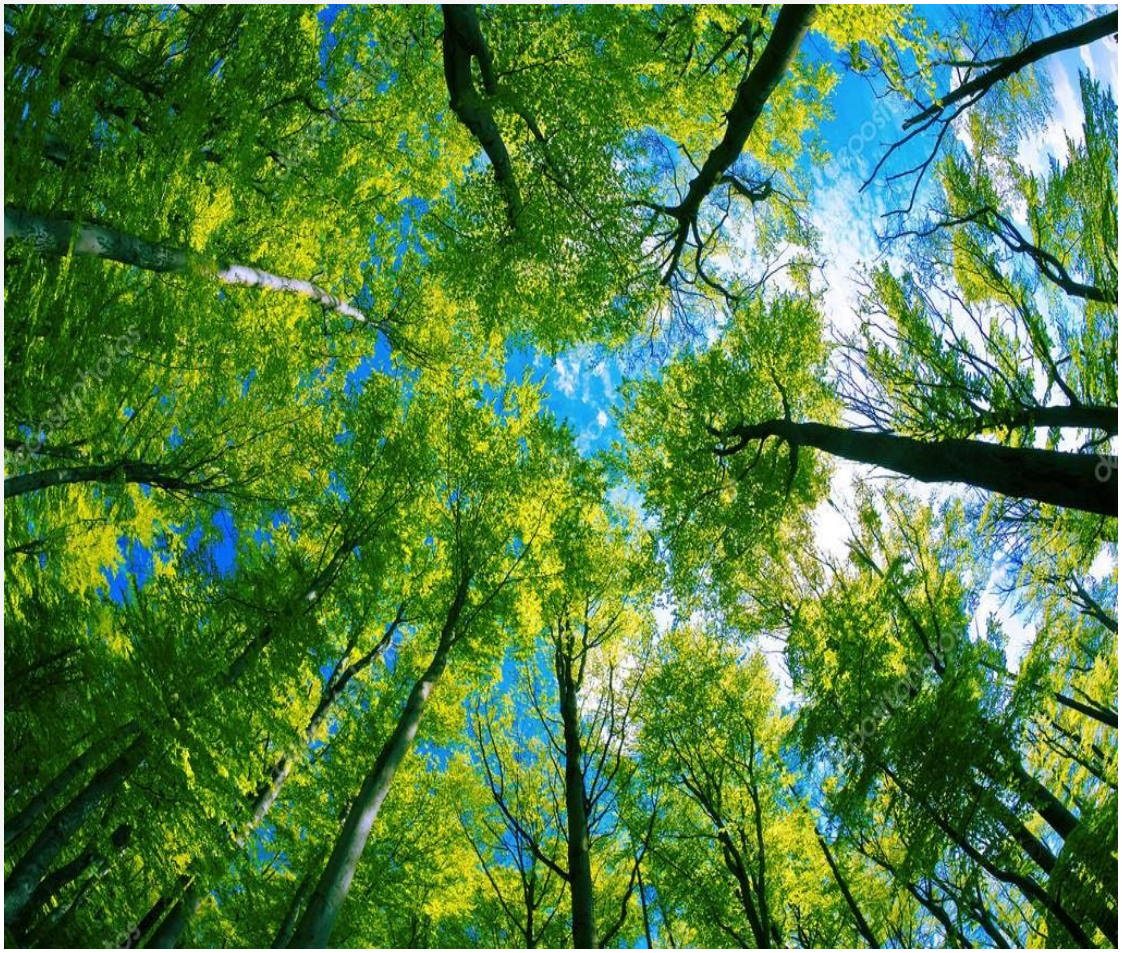
Appendices



APPENDIX A: i-TREE DATA

Table 1: Annual Energy Benefits

Riverdale

Annual Energy Benefits of Public Trees

2/8/2023

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	1.4	105	177.6	174	279	(N/A)	15.3	10.5	18.57
River birch	1.3	100	197.9	194	294	(N/A)	14.3	11.1	20.98
Bur oak	0.6	49	91.9	90	139	(N/A)	10.2	5.2	13.86
Silver maple	1.6	123	221.2	217	340	(N/A)	6.1	12.8	56.69
Northern red oak	1.0	79	149.4	146	226	(N/A)	6.1	8.5	37.63
Apple	0.3	19	36.7	36	55	(N/A)	5.1	2.1	11.04
Green ash	1.3	95	172.5	169	264	(N/A)	5.1	10.0	52.80
Kentucky coffeetree	0.1	8	15.1	15	23	(N/A)	4.1	0.9	5.65
Red maple	0.4	28	54.8	54	82	(N/A)	4.1	3.1	20.40
Buckthorn	0.3	22	48.3	47	70	(N/A)	3.1	2.6	23.25
Norway maple	0.2	19	39.9	39	58	(N/A)	3.1	2.2	19.31
Northern hackberry	0.0	1	2.4	2	3	(N/A)	3.1	0.1	1.14
American basswood	0.4	34	62.2	61	95	(N/A)	3.1	3.6	31.62
Callery pear	0.4	29	52.5	51	80	(N/A)	3.1	3.0	26.74
Oak	0.4	30	54.6	54	83	(N/A)	3.1	3.1	27.78
Black maple	0.1	9	17.2	17	26	(N/A)	2.0	1.0	12.80
White ash	0.7	52	82.9	81	133	(N/A)	2.0	5.0	66.69
Sugar maple	0.8	63	109.0	107	170	(N/A)	2.0	6.4	84.99
Tulip tree	0.1	7	13.7	13	21	(N/A)	1.0	0.8	20.64
Honeylocust	0.4	28	47.4	46	74	(N/A)	1.0	2.8	74.28
Black walnut	0.4	29	53.7	53	82	(N/A)	1.0	3.1	82.02
Yellowwood	0.2	18	29.5	29	47	(N/A)	1.0	1.8	46.78
Ginkgo	0.0	2	3.0	3	5	(N/A)	1.0	0.2	4.50
Total	12.5	948	1,733.4	1,699	2,647	(N/A)	100.0	100.0	27.01

Table 2: Annual Stormwater Benefits

Riverdale

Annual Stormwater Benefits of Public Trees

2/8/2023

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	17,143	465	(N/A)	15.3	12.6	30.97
River birch	9,126	247	(N/A)	14.3	6.7	17.67
Bur oak	6,830	185	(N/A)	10.2	5.0	18.51
Silver maple	23,789	645	(N/A)	6.1	17.5	107.45
Northern red oak	10,686	290	(N/A)	6.1	7.9	48.27
Apple	880	24	(N/A)	5.1	0.6	4.77
Green ash	12,550	340	(N/A)	5.1	9.2	68.02
Kentucky coffeetree	662	18	(N/A)	4.1	0.5	4.48
Red maple	2,013	55	(N/A)	4.1	1.5	13.64
Buckthorn	1,507	41	(N/A)	3.1	1.1	13.61
Norway maple	1,335	36	(N/A)	3.1	1.0	12.06
Northern hackberry	54	1	(N/A)	3.1	0.0	0.49
American basswood	7,773	211	(N/A)	3.1	5.7	70.22
Callery pear	2,158	58	(N/A)	3.1	1.6	19.49
Oak	5,526	150	(N/A)	3.1	4.1	49.92
Black maple	637	17	(N/A)	2.0	0.5	8.63
White ash	6,962	189	(N/A)	2.0	5.1	94.33
Sugar maple	14,166	384	(N/A)	2.0	10.4	191.94
Tulip tree	608	16	(N/A)	1.0	0.4	16.47
Honeylocust	4,685	127	(N/A)	1.0	3.4	126.96
Black walnut	5,491	149	(N/A)	1.0	4.0	148.79
Yellowwood	1,409	38	(N/A)	1.0	1.0	38.19
Ginkgo	82	2	(N/A)	1.0	0.1	2.22
Citywide total	136,070	3,688	(N/A)	100.0	100.0	37.63

Table 3: Annual Air Quality Benefits

Riverdale

Annual Air Quality Benefits of Public Trees

2/8/2023

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								
Spruce	1.8	0.4	1.6	0.2	12	6.5	0.9	0.9	6.2	41	-6.1	-23	12.4	30	(N/A)	15.3	1.98
River birch	1.4	0.2	0.8	0.1	8	6.4	0.9	0.9	6.0	40	-0.4	-1	16.3	46	(N/A)	14.3	3.30
Bur oak	0.8	0.1	0.4	0.0	4	3.1	0.4	0.4	2.9	19	0.0	0	8.2	23	(N/A)	10.2	2.33
Silver maple	4.5	0.8	2.2	0.2	24	7.7	1.1	1.1	7.4	48	-2.5	-9	22.4	63	(N/A)	6.1	10.48
Northern red oak	2.2	0.4	1.1	0.1	12	5.0	0.7	0.7	4.7	31	-3.2	-12	11.8	31	(N/A)	6.1	5.23
Apple	0.2	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	0.0	0	3.1	9	(N/A)	5.1	1.76
Green ash	1.4	0.2	0.7	0.1	7	6.0	0.9	0.8	5.7	37	0.0	0	15.7	45	(N/A)	5.1	8.94
Kentucky coffeetree	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.5	3	0.0	0	1.2	3	(N/A)	4.1	0.81
Red maple	0.2	0.0	0.1	0.0	1	1.8	0.3	0.2	1.7	11	-0.1	0	4.3	12	(N/A)	4.1	3.01
Buckthorn	0.5	0.1	0.2	0.0	3	1.5	0.2	0.2	1.3	9	0.0	0	4.0	12	(N/A)	3.1	3.87
Norway maple	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	8	0.0	0	2.9	8	(N/A)	3.1	2.72
Northern hackberry	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	0	0.0	0	0.2	0	(N/A)	3.1	0.14
American basswood	1.3	0.2	0.6	0.1	7	2.1	0.3	0.3	2.0	13	-1.1	-4	6.0	16	(N/A)	3.1	5.48
Callery pear	0.3	0.0	0.2	0.0	2	1.8	0.3	0.3	1.7	11	-0.1	0	4.5	13	(N/A)	3.1	4.20
Oak	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	3.1	5.29
Black maple	0.1	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	3	0.0	0	1.3	4	(N/A)	2.0	1.88
White ash	1.0	0.2	0.5	0.0	5	3.2	0.5	0.4	3.1	20	0.0	0	8.9	26	(N/A)	2.0	12.76
Sugar maple	2.2	0.4	1.0	0.1	12	3.9	0.6	0.5	3.8	25	-1.7	-6	10.9	30	(N/A)	2.0	15.01
Tulip tree	0.0	0.0	0.0	0.0	0	0.5	0.1	0.1	0.4	3	0.0	0	1.1	3	(N/A)	1.0	2.99
Honeylocust	0.9	0.2	0.4	0.0	5	1.7	0.3	0.2	1.7	11	-0.8	-3	4.7	13	(N/A)	1.0	12.87
Black walnut	0.8	0.1	0.4	0.0	4	1.9	0.3	0.3	1.8	12	0.0	0	5.5	16	(N/A)	1.0	15.71
Yellowwood	0.2	0.0	0.1	0.0	1	1.1	0.2	0.2	1.1	7	-0.1	0	2.8	8	(N/A)	1.0	7.92
Ginkgo	0.0	0.0	0.0	0.0	0	0.1	0.0	0.0	0.1	1	0.0	0	0.2	1	(N/A)	1.0	0.64
Citywide total	20.9	3.6	10.9	1.1	115	59.8	8.7	8.3	56.6	372	-16.1	-60	153.8	427	(N/A)	100.0	4.35

Table 4: Annual Carbon Stored

Riverdale

Stored CO2 Benefits of Public Trees

2/8/2023

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	12,894	97	(N/A)	15.3	2.6	6.45
River birch	24,161	181	(N/A)	14.3	4.8	12.94
Bur oak	24,501	184	(N/A)	10.2	4.8	18.38
Silver maple	117,585	882	(N/A)	6.1	23.3	146.98
Northern red oak	47,951	360	(N/A)	6.1	9.5	59.94
Apple	3,584	27	(N/A)	5.1	0.7	5.38
Green ash	44,710	335	(N/A)	5.1	8.8	67.06
Kentucky coffeetree	1,071	8	(N/A)	4.1	0.2	2.01
Red maple	3,520	26	(N/A)	4.1	0.7	6.60
Buckthorn	7,828	59	(N/A)	3.1	1.5	19.57
Norway maple	2,420	18	(N/A)	3.1	0.5	6.05
Northern hackberry	14	0	(N/A)	3.1	0.0	0.04
American basswood	53,492	401	(N/A)	3.1	10.6	133.73
Callery pear	4,943	37	(N/A)	3.1	1.0	12.36
Oak	25,967	195	(N/A)	3.1	5.1	64.92
Black maple	1,118	8	(N/A)	2.0	0.2	4.19
White ash	19,445	146	(N/A)	2.0	3.8	72.92
Sugar maple	67,349	505	(N/A)	2.0	13.3	252.56
Tulip tree	1,035	8	(N/A)	1.0	0.2	7.76
Honeylocust	12,245	92	(N/A)	1.0	2.4	91.84
Black walnut	25,943	195	(N/A)	1.0	5.1	194.57
Yellowwood	3,624	27	(N/A)	1.0	0.7	27.18
Ginkgo	77	1	(N/A)	1.0	0.0	0.58
Citywide total	505,477	3,791	(N/A)	100.0	100.0	38.68

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

Riverdale

Annual CO $_2$ Benefits of Public Trees

2/8/2023

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
Spruce	1,295	10	-62	-23	-1	2,309	17	3,520	26 (N/A)	15.3	7.4	1.76
River birch	2,582	19	-120	-15	-1	2,204	17	4,651	35 (N/A)	14.3	9.7	2.49
Bur oak	1,609	12	-118	-8	-1	1,073	8	2,556	19 (N/A)	10.2	5.3	1.92
Silver maple	7,825	59	-565	-20	-4	2,725	20	9,965	75 (N/A)	6.1	20.8	12.46
Northern red oak	916	7	-230	-14	-2	1,755	13	2,427	18 (N/A)	6.1	5.1	3.03
Apple	390	3	-17	-4	0	426	3	795	6 (N/A)	5.1	1.7	1.19
Green ash	3,028	23	-215	-13	-2	2,098	16	4,898	37 (N/A)	5.1	10.2	7.35
Kentucky coffeetree	217	2	-5	-2	0	172	1	382	3 (N/A)	4.1	0.8	0.72
Red maple	535	4	-17	-4	0	617	5	1,131	8 (N/A)	4.1	2.4	2.12
Buckthorn	152	1	-38	-5	0	496	4	605	5 (N/A)	3.1	1.3	1.51
Norway maple	544	4	-12	-3	0	416	3	945	7 (N/A)	3.1	2.0	2.36
Northern hackberry	10	0	0	-1	0	23	0	32	0 (N/A)	3.1	0.1	0.08
American basswood	2,581	19	-257	-6	-2	750	6	3,068	23 (N/A)	3.1	6.4	7.67
Callery pear	706	5	-24	-4	0	635	5	1,313	10 (N/A)	3.1	2.7	3.28
Oak	965	7	-125	-5	-1	659	5	1,494	11 (N/A)	3.1	3.1	3.74
Black maple	168	1	-5	-1	0	192	1	354	3 (N/A)	2.0	0.7	1.33
White ash	1,809	14	-93	-5	-1	1,153	9	2,863	21 (N/A)	2.0	6.0	10.74
Sugar maple	2,568	19	-323	-10	-3	1,395	10	3,629	27 (N/A)	2.0	7.6	13.61
Tulip tree	209	2	-5	-1	0	159	1	361	3 (N/A)	1.0	0.8	2.71
Honeylocust	0	0	-59	-3	0	615	5	553	4 (N/A)	1.0	1.2	4.15
Black walnut	960	7	-125	-4	-1	650	5	1,481	11 (N/A)	1.0	3.1	11.11
Yellowwood	386	3	-17	-2	0	395	3	762	6 (N/A)	1.0	1.6	5.71
Ginkgo	16	0	0	-1	0	35	0	51	0 (N/A)	1.0	0.1	0.38
Citywide total	29,467	221	-2,433	-154	-19	20,953	157	47,834	359 (N/A)	100.0	100.0	3.66

Table 6: Annual Social and Aesthetic Benefits

Riverdale

Annual Aesthetic/Other Benefits of Public Trees

2/8/2023

Species	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Spruce	364	(N/A)	15.3	12.6	24.27
River birch	287	(N/A)	14.3	9.9	20.48
Bur oak	175	(N/A)	10.2	6.0	17.48
Silver maple	589	(N/A)	6.1	20.3	98.19
Northern red oak	73	(N/A)	6.1	2.5	12.12
Apple	22	(N/A)	5.1	0.7	4.34
Green ash	263	(N/A)	5.1	9.1	52.66
Kentucky coffeetree	44	(N/A)	4.1	1.5	11.09
Red maple	97	(N/A)	4.1	3.3	24.20
Buckthorn	8	(N/A)	3.1	0.3	2.82
Norway maple	65	(N/A)	3.1	2.3	21.78
Northern hackberry	11	(N/A)	3.1	0.4	3.69
American basswood	157	(N/A)	3.1	5.4	52.26
Callery pear	78	(N/A)	3.1	2.7	26.09
Oak	77	(N/A)	3.1	2.7	25.71
Black maple	30	(N/A)	2.0	1.0	14.94
White ash	190	(N/A)	2.0	6.6	95.05
Sugar maple	233	(N/A)	2.0	8.0	116.31
Tulip tree	29	(N/A)	1.0	1.0	28.56
Honeylocust	0	(N/A)	1.0	0.0	0.00
Black walnut	67	(N/A)	1.0	2.3	66.60
Yellowwood	39	(N/A)	1.0	1.4	39.16
Ginkgo	3	(N/A)	1.0	0.1	2.76
Citywide total	2,900	(N/A)	100.0	100.0	29.59

Table 7: Summary of Benefits in Dollars

Riverdale

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

2/8/2023

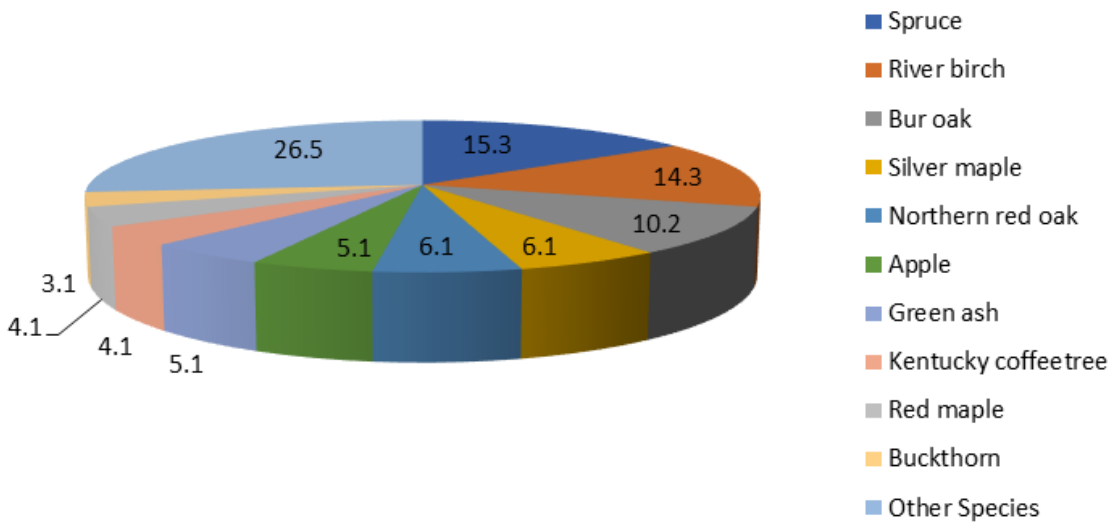
Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	2,647	(N/A)	27.01	(N/A)	6.98	(N/A)
CO2	359	(N/A)	3.66	(N/A)	0.95	(N/A)
Air Quality	427	(N/A)	4.35	(N/A)	1.13	(N/A)
Stormwater	3,688	(N/A)	37.63	(N/A)	9.73	(N/A)
Aesthetic/Other	2,900	(N/A)	29.59	(N/A)	7.65	(N/A)
Total Benefits	10,020	(N/A)	102.25	(N/A)	26.44	(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	10,020	(N/A)	102.25	(N/A)	26.44	(N/A)
Benefit-cost ratio	0.00	(N/A)				

Figure 1: Species Distribution

Riverdale

Species Distribution of Public Trees

2/8/2023



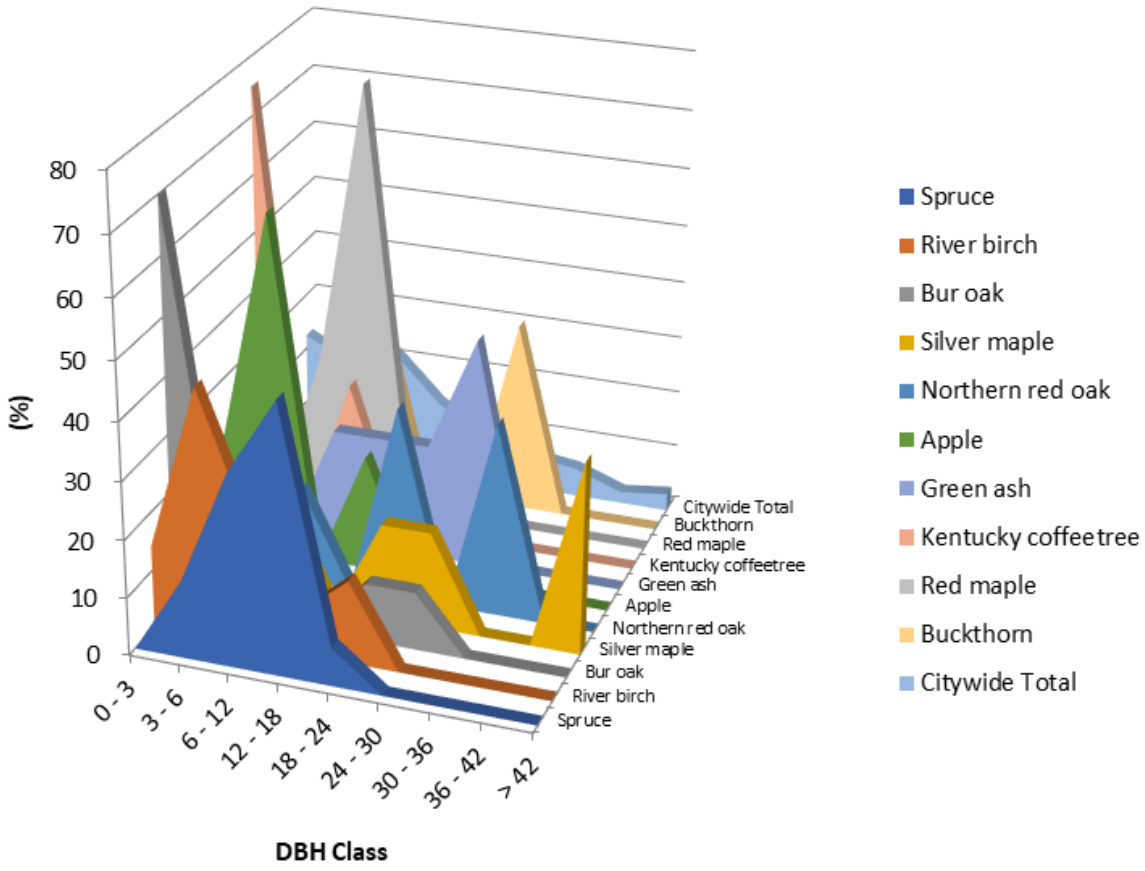
Species	Percent
Spruce	15.3
River birch	14.3
Bur oak	10.2
Silver maple	6.1
Northern red oak	6.1
Apple	5.1
Green ash	5.1
Kentucky coffeetree	4.1
Red maple	4.1
Buckthorn	3.1
Other Species	26.5
Total	100.0

Figure 2: Relative Age Class

Riverdale

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

2/8/2023



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	> 42
Spruce	0.00	13.33	33.33	46.67	6.67	0.00	0.00	0.00	0.00
River birch	14.29	42.86	21.43	7.14	14.29	0.00	0.00	0.00	0.00
Bur oak	70.00	10.00	0.00	0.00	10.00	10.00	0.00	0.00	0.00
Silver maple	0.00	16.67	16.67	0.00	16.67	16.67	0.00	0.00	33.33
Northern red oak	16.67	0.00	16.67	0.00	33.33	0.00	33.33	0.00	0.00
Apple	20.00	60.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00
Green ash	0.00	0.00	20.00	20.00	20.00	40.00	0.00	0.00	0.00
Kentucky coffeetree	75.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Red maple	0.00	25.00	75.00	0.00	0.00	0.00	0.00	0.00	0.00
Buckthorn	0.00	33.33	33.33	0.00	0.00	33.33	0.00	0.00	0.00
Citywide Total	22.45	18.37	21.43	13.27	8.16	6.12	5.10	2.04	3.06

Figure 3: Foliage Condition

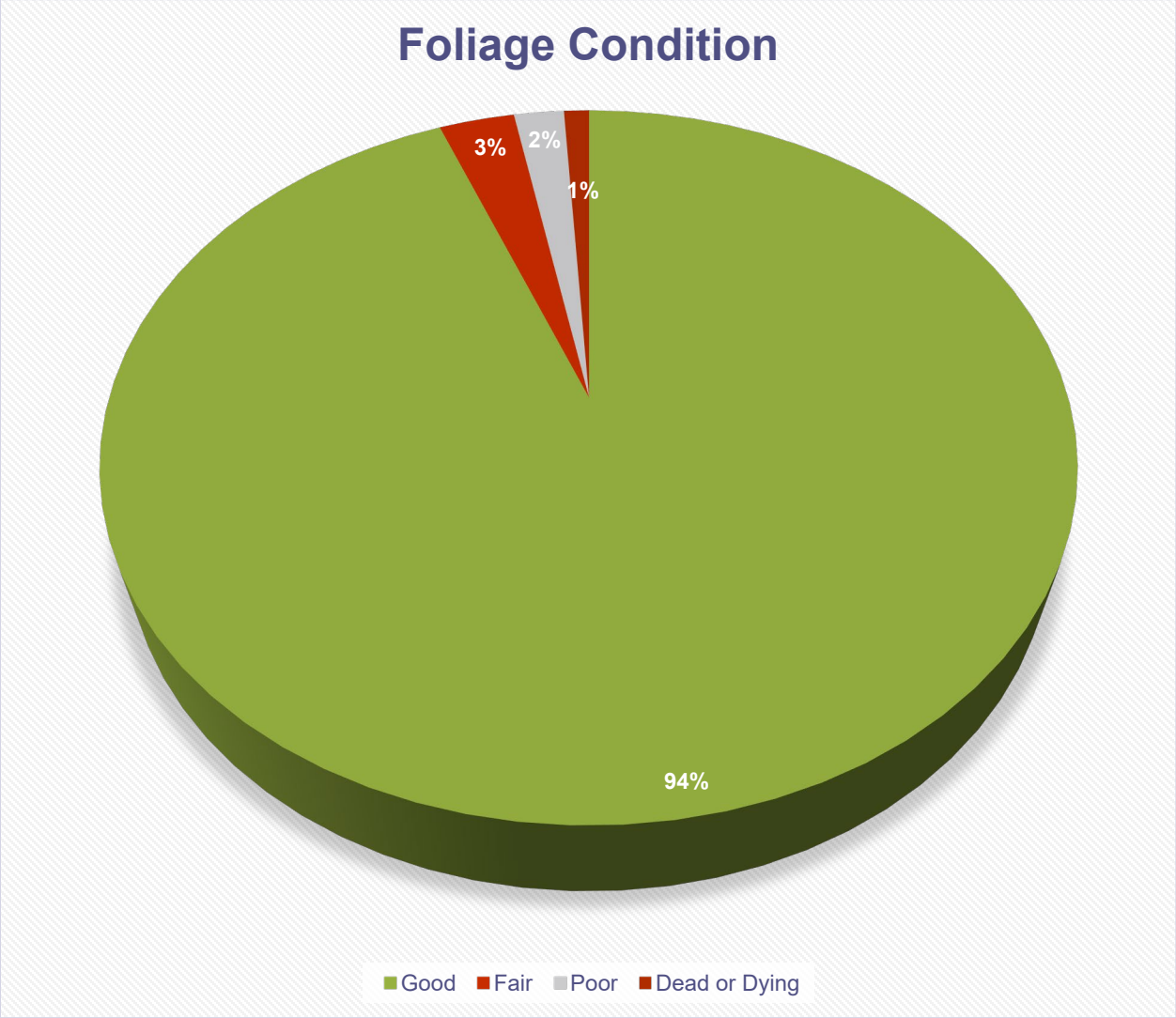


Figure 4: Wood Condition

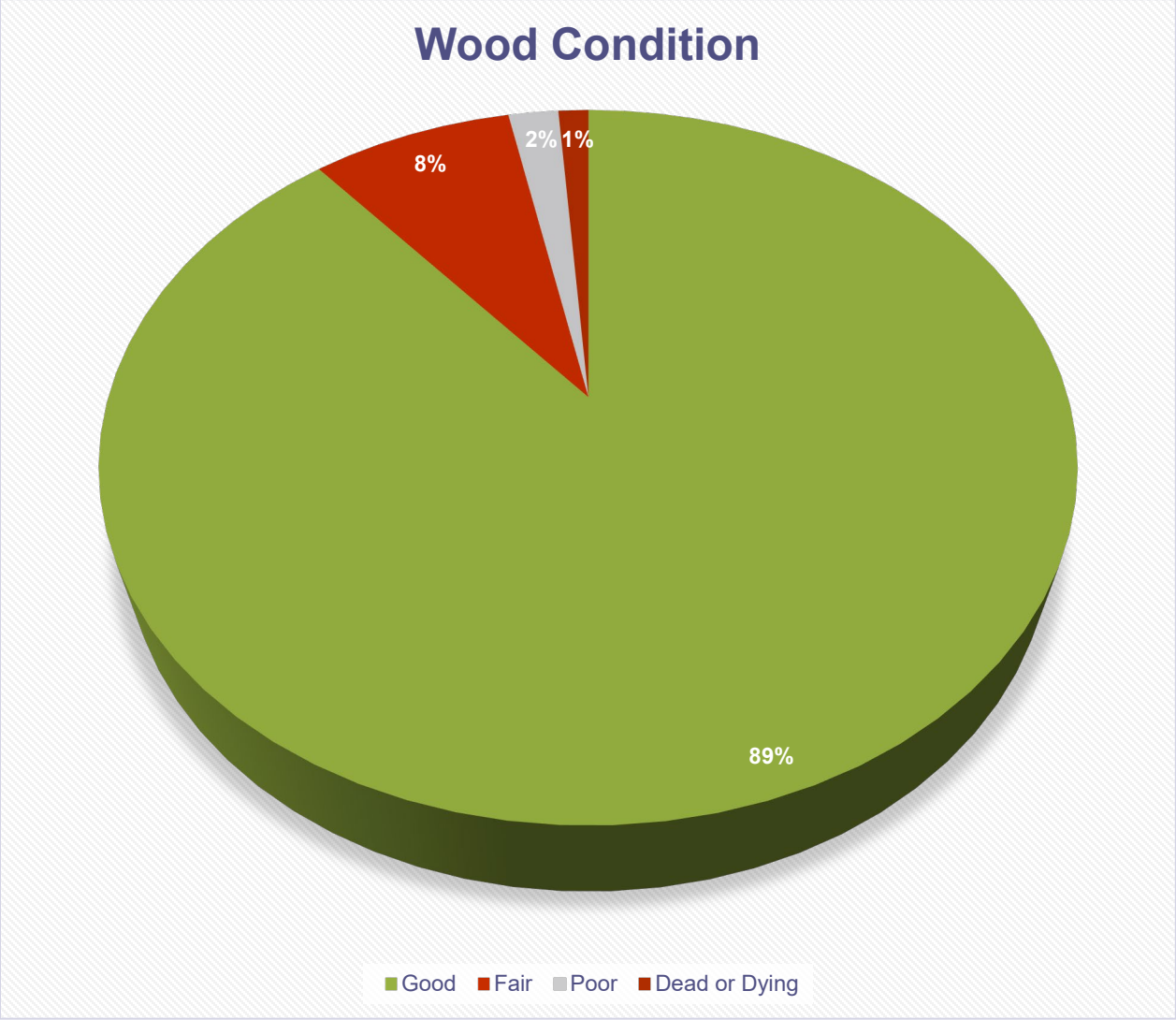
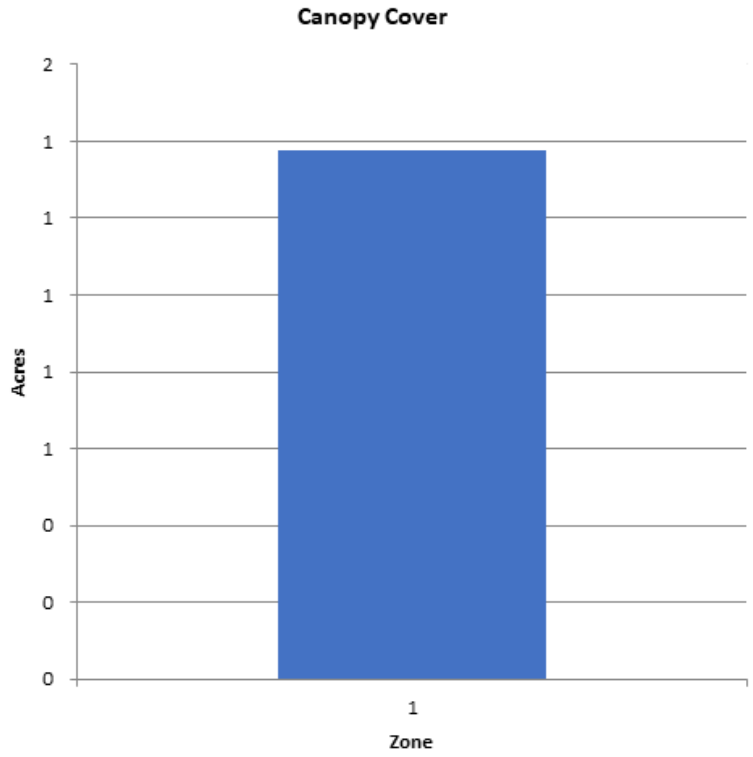


Figure 5: Canopy Cover in Acres

Riverdale

Canopy Cover of Public Trees (Acres)

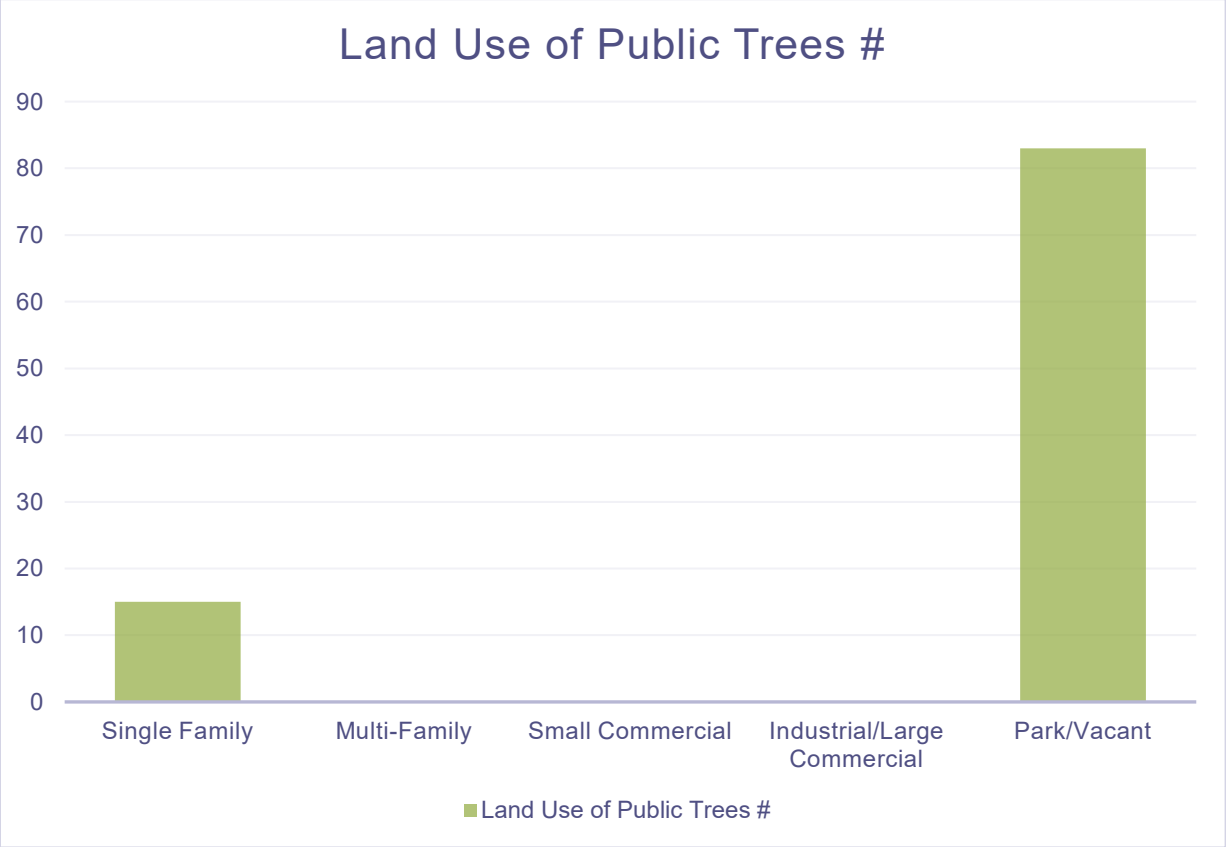
2/8/2023



Zone	Acres	% of Total Canopy Cover
1	1	100.0
Citywide total	1	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	1	0.00	0.00

Figure 6: Land Use of City/Park Trees



APPENDIX B: ArcGIS MAPPING

Figure 1: Location of Ash Trees

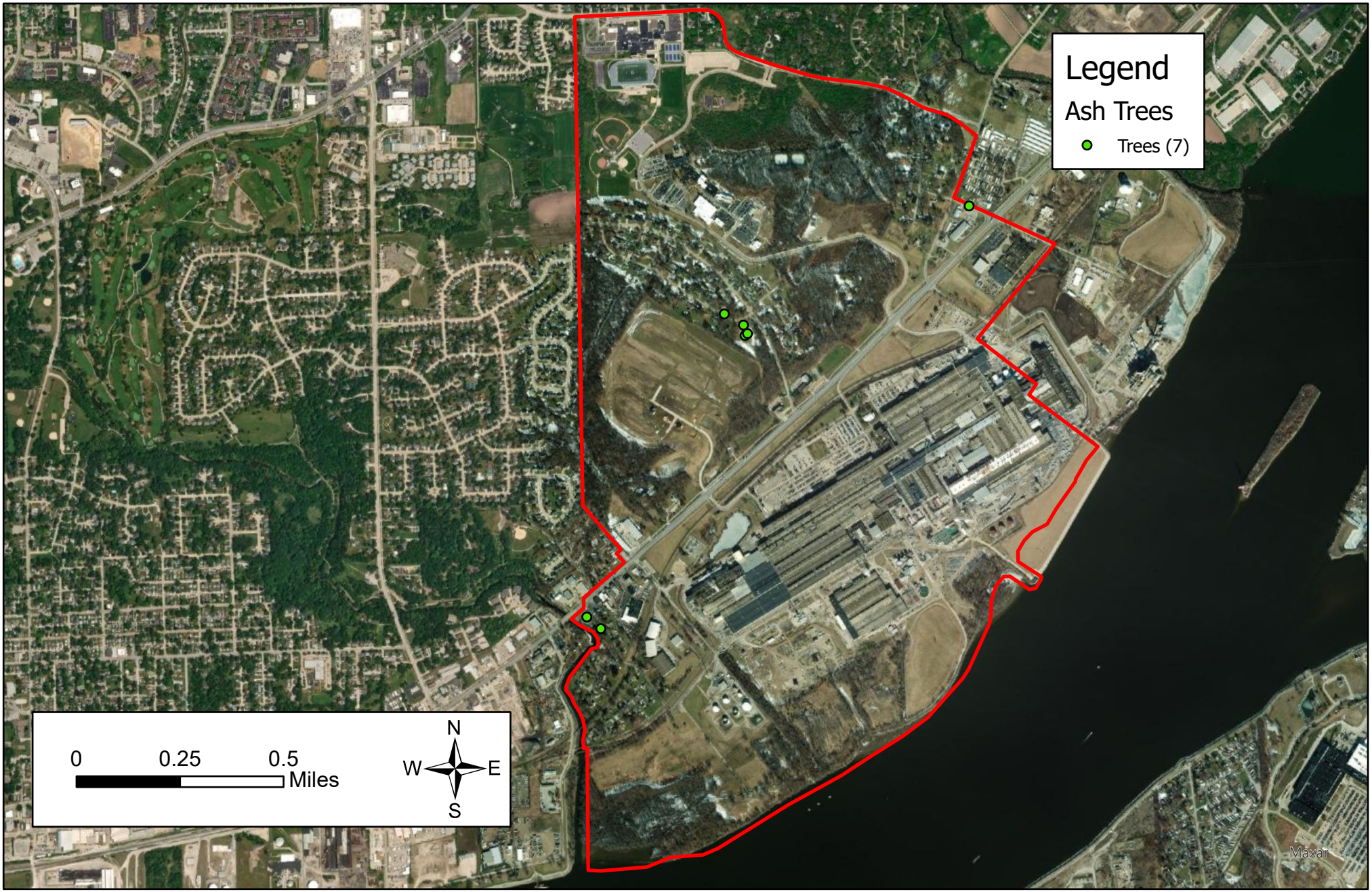
Figure 2: Location of EAB Symptoms

Figure 3: Location of Poor Condition Trees

Figure 4: Location of Trees with Recommended Maintenance

Figure 5: Maintenance Tasks

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



Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 1 - Ash Tree Location
Riverdale, Iowa

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Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 2 - EAB Symptoms
Riverdale, Iowa

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Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 3 - Poor Condition Trees
Riverdale, Iowa

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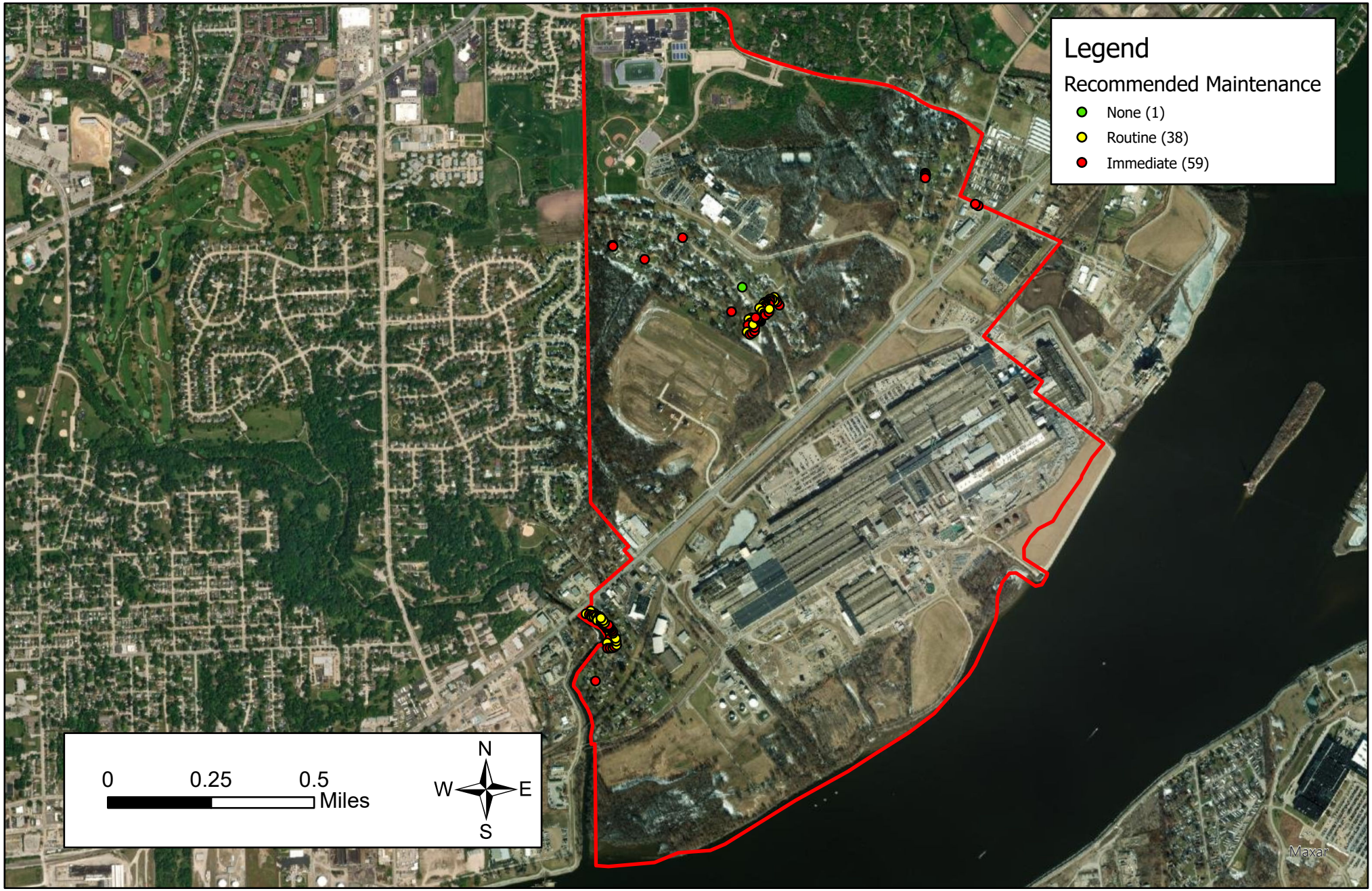

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 4 - Recommended Maintenance
Riverdale, Iowa

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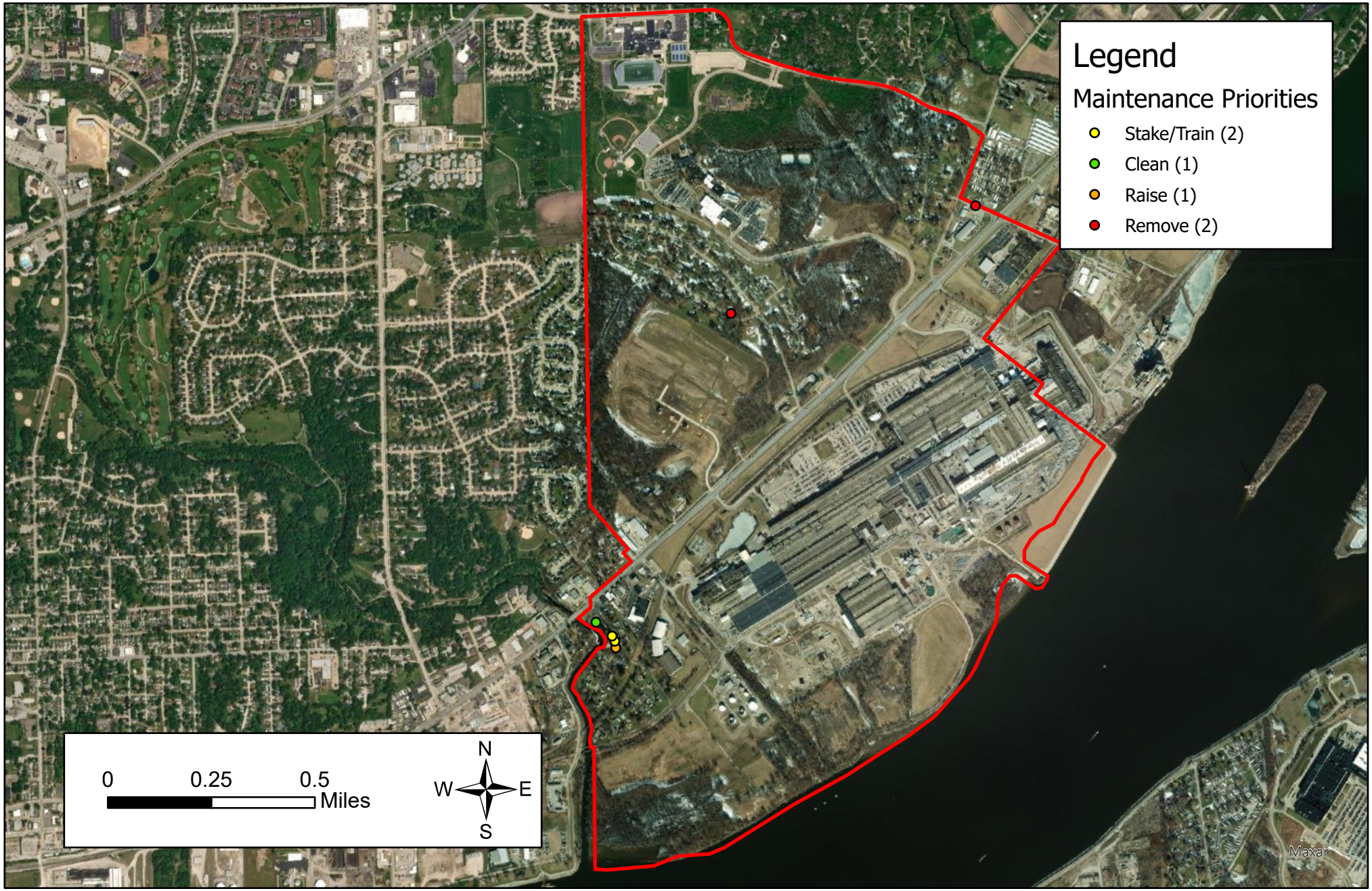

Created By: D. Genereux
Date: 1/26/2023
Software: ArcGIS Pro 3.0.3
File: 2022 IDNR Tree Inventory.aprx

2022 IDNR Tree Inventory

Figure 5 - Maintenance Priorities
Riverdale, Iowa

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APPENDIX C: RIVERDALE TREE ORDINANCES

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

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

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

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

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

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

2. Private Property. If it is determined with reasonable certainty that any such condition exists on private property and that danger to other trees or to adjoining property or passing motorists or pedestrians is imminent, the Council shall notify by certified mail the owner, occupant or person in charge of such property to correct such condition by treatment or removal within fourteen (14) days of said notification. If such owner, occupant or person in charge of said property fails to comply within fourteen (14) days of receipt of notice, the Council may cause the condition to be corrected and the cost assessed against the property.

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