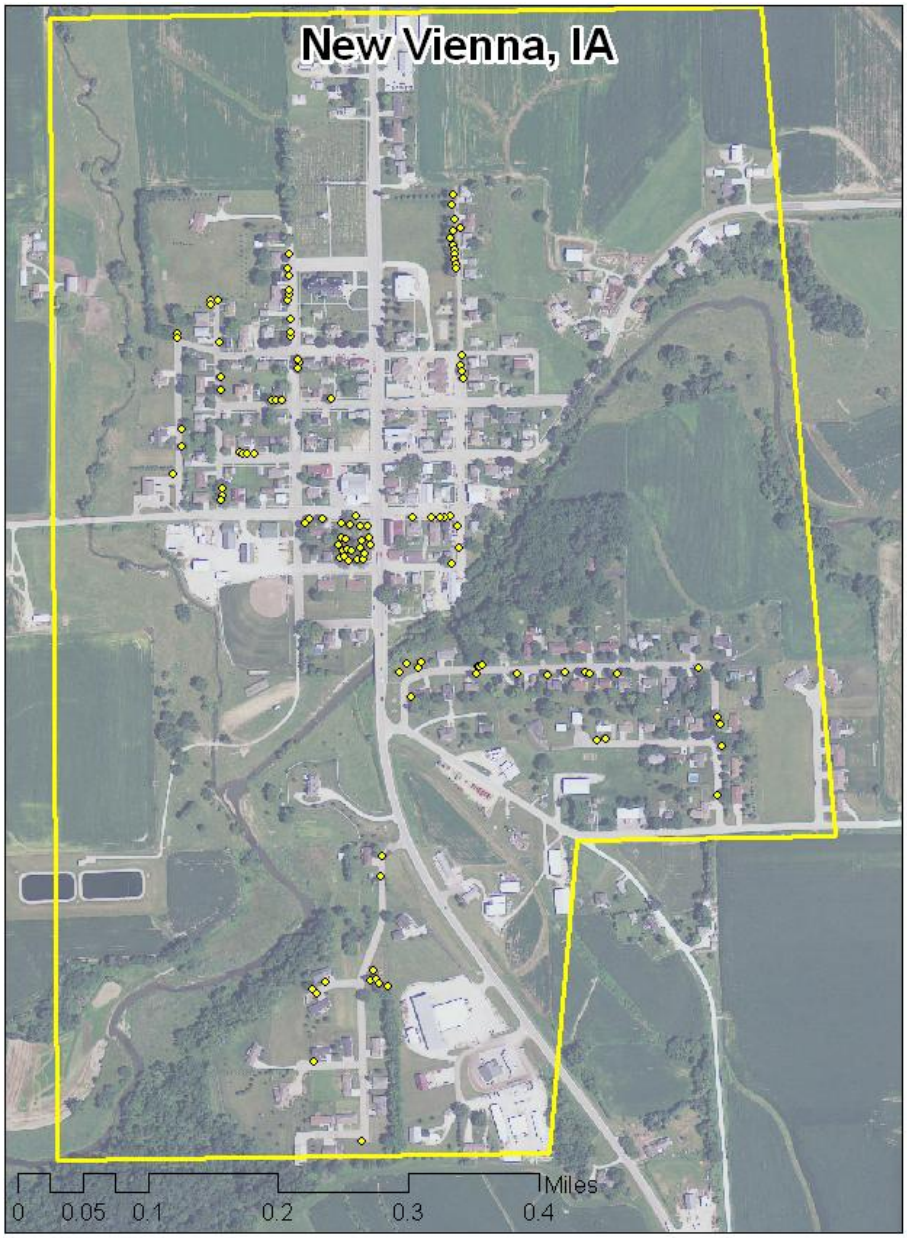
NEW VIENNA, IA



2011 Management Plan

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Executive Summary

Overview

This plan was developed to assist the City of New Vienna with managing its urban forest, including budgeting and future planning. Trees can provide a multitude of benefits to the community, and sound management allows communities to best take advantage of these benefits. Management is especially important considering the serious threats posed by forest pests such as the emerald ash borer (EAB). EAB is an invasive insect imported from Eastern Asia that kills all species of our native ash trees. There is a strong possibility that over 13% of New Vienna's city-owned ash trees could die once EAB becomes established in the community. With proper planning and management, the costs of removing dead and dying trees can be extended over several years mitigating public safety issues.

Inventory and Results

In the summer of 2010, a street tree inventory was conducted using an integrated Global Positioning System (GPS) data collector. This involved a complete inventory of street trees within the City's Right-of-Way and two small parks. Below are some key findings of the 116 trees inventoried.

- New Vienna street trees provide roughly $14,316 of annual benefits, an average of $123 per tree.
- The top three species groups are: Maples (31%), Ash (13%) and Lilac (11%).
- Approximately 27% of trees are in need of some type of management.
- For various reasons, 6 trees are recommended for removal.

Recommendations

The core recommendations are described in detail in the Recommendations Section. The Emerald Ash Borer Plan includes management recommendations, as well. Below are some key recommendations.

- Of the 6 trees recommended for removal, some were showing signs of severe stem decay, some were either dead or dying, and some were of undesirable species or were growing in a bad location.
- One of the 15 ash trees inventoried is in need of follow up checking because it displays some signs and symptoms (canopy dieback) associated with EAB.
- All trees should be pruned on a routine schedule- one third of the city every other year.
- Plant a diverse mix of trees that *does not include*: ash, soft maple, autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplars and tree-of-heaven.
- Check ash trees with a visual survey, yearly.

Introduction

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

Trees are an important component of New Vienna's infrastructure and are one of the greatest assets to the community. Through research, it has been shown that trees provide a community with numerous public benefits including: improved air quality, storm water runoff interception, energy conservation, lower traffic speeds, increased property values, reduced crime, improved mental health and creating a desirable place to live. It is essential that these benefits be maintained for the people of New Vienna and future generations through sound urban forestry management.

Good urban forestry management involves setting goals and developing management strategies to achieve these goals. An essential start to developing management strategies is to have a comprehensive public tree inventory. This inventory supplies information that can be used for maintenance, removal schedules, tree planting and budgeting. Basing actions on this information will help meet New Vienna's urban forestry goals.

Inventory

In the summer of 2010, a tree inventory was conducted that included just the city-owned street trees and park trees. The tree data was collected using a handheld Global Positioning System (GPS) receiver/data logger. This devise records Geographic Information System (GIS) coordinates with an accuracy of 3 meters. The data can then be used in Arc GIS as an active GIS data layer. Because the inventory is a digital document the data can be updated with new information and become a working document.

The programming used to collect tree information on the data collector was written to be compatible with a state-of-the-art software suite called i-Tree. This software was developed by the USDA Forest Service to quantify the structure of community trees and the environmental services that trees provide. This software is in the public domain and can be accessed for free.

To quantify the urban forest structure and its benefits, specific data is collected for each tree. This data includes: location, land use, tree species, diameter at 4.5 ft (DBH), recommended maintenance, priority of that maintenance, leaf health, and wood condition. Additionally, signs and symptoms of EAB were noted for all ash trees. The signs and symptoms noted were canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Inventory Results

The data collected by the data loggers was downloaded and analyzed by software developed by the USDA Forest service called *Street Tree Resource Analysis Tool for Urban forestry Management (STRATUM)*. This is software is also part of the i-Tree suite. The following are results from the i-Tree STRATUM analysis of New Vienna's inventory data.

Annual Benefits

Annual Energy Benefits

Trees conserve energy by shading buildings and blocking winds. New Vienna's trees reduce energy related costs by approximately $4,171 annually (Appendix A, Table 1). These savings are both in Electricity (19.9 MWh) and in Natural Gas (2,717 Therms).

Annual Storm water Benefits

New Vienna's trees intercept about 196,957 gallons of rainfall and snow melt per year (Appendix A, Table 2). This interception provides $5,338 of benefits to the city.

Annual Air Quality Benefits

Air quality is a persistent public health issue in Iowa. The urban forest improves air quality by removing pollutants, lowering air temperature, and reducing energy consumption, which in turn reduces emissions from power plants that emit volatile organic matter (ozone). In New Vienna, it is estimated that trees remove 233 lbs. of air pollution (ozone (O_3), particulate matter less than 10 microns (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2)) per year with a net value of $637 (Appendix A, Table 3).

Annual Carbon Benefits

Carbon sequestration and storage reduces the amount of carbon in the atmosphere, mitigating climate change. Of the 116 trees inventoried, the amount of carbon stored amounts to approximately 527,993 total lbs of CO_2 (Appendix A, Table 4) . Those trees are sequestering about 36,611 lbs of carbon per year (Appendix A, Table 5). The benefits these trees provide from summer shading and from reductions in household wind infiltration in the winter result in approximately 33,332 fewer lbs of CO_2 being released into the atmosphere (Appendix A Table 5).

Annual Aesthetics Benefits

Social benefits of trees are hard to capture. The analysis does have a calculation for this area that includes: aesthetic value, property values, lowered rates of mental illness and crime, city livability and much more. New Vienna receives approximately $3,664 in annual social benefits from its street trees (Appendix A, Table 6).

Financial Summary of all Benefits

According to the USDA Forest Service i-Tree STRATUM analysis, New Vienna's trees provide $14,316 of benefits annually. Benefits of individual trees vary based on size, species, health and location. On average, each of the 116 trees in New Vienna's inventory provides approximately $123 annually (Appendix A, Table 7).

Forest Structure

Species Distribution

There were over 26 different tree species surveyed. These trees were distributed into 15 different genuses:

Genus	# of trees	% of total
Maple (*acer*)	36	31.0%
Ash (*fraxius*)	15	12.9%
Lilac (*Syringa*)	13	11.2%
Pine (*Pinus*)	9	7.8%
Apple (*malus*)	8	6.9%
Oak (*quercus*)	6	5.2%
Spruce (*picea*)	6	5.2%
Other broadleaf trees	5	4.3%
Linden (*tilia*)	4	3.4%
Hackberry *(Celtis)*	4	3.4%
Elm (*ulmus*)	4	3.4%
Arborvitae	2	1.7%
Walnut (*juglans*)	2	1.7%
Mountain Ash (*Sorbus*)	1	0.9%
Ohio Buckeye (*Aesculus*)	1	0.9%
	116	100.0%

The table below summarizes distribution of surveyed trees by their diameter in inches when measured at 4.5 above the ground. Trees between 12" to 18" in diameter were most abundant (24.1%). There were good numbers in the 3" to 12" range (34.4% total). This is a fairly flat size distribution which indicates there should be plenty of younger trees to replace older trees as they are removed. The exception to this is in the 0" to 3" diameter range which indicates there haven't been many trees planted in the past two or three years. See Appendix A, Figure 2 for a breakdown of size distributions by species.

Size Classes (inches of diameter at 4.5 feet)	# of trees	% of trees
0 - 3	7	6.0%
3 - 6	20	17.2%
6 - 12	20	17.2%
12 - 18	28	24.1%
18 - 24	20	17.2%
24 - 30	13	11.2%
30+	8	6.9%

Condition: Wood and Foliage

Leaf condition is a good indicator of the overall health of urban trees. The foliage condition results for New Vienna indicated that 74% of the trees were in good health, 24% in fair health, and 2% dead or dying. (Appendix A, Figure 3). The high proportion that was in fair health was likely is a result of the many leaf diseases, especially *anthracnose sp.,* associated with that summer's wet/warm weather. These climate conditions tend to be more conducive to the development of leaf diseases. The timing of the survey also effected the result as deciduous tree leaves start to "show their age" toward the end of summer. Leaf health is largely a function of climatic factors during the growing season. This year was not as cool or wet, so leaf diseases were not a much of an issue.

The condition of the wood in urban trees is another important indicator of tree health. The wood forms the structural support system for the leaves and branches. Extensive decay in the main stem makes a tree structurally unsafe which leads to a tree becoming a safety hazard. In New Vienna, 71% of the surveyed trees were in good health, 25% in fair health, and 4% in poor health for wood condition (Appendix A, Figure 4). The 4% in poor condition should be assessed more carefully. Many of these trees with poor wood condition are being recommended for removal. The 25% in fair health is to a large extent a reflection of having many older Norway maple trees which tend to have problems with decay or cracking in their main stem. The City already has too many maple trees, so please encourage far less planting of Norway maple.

Management Needs

Each surveyed tree was assessed for recommended maintenance needs. The following tables list the specific management needs and recommendations. Of the trees recommended for removal, none were judged to be of critical concern for public safety. However, three of the trees recommended for removal had poor wood condition and should be removed at some time in the near future. (See Appendix B, figure 4).

Priority Task	# of trees	% of trees
none	85	73.3%
stake/train	8	6.9%
clean	8	6.9%
raise	7	6.0%
remove	6	5.2%
reduce	2	1.7%
	116	100.0%

Maintenance Recommendation	# of trees	% of trees
mature tree (routine)	74	63.8%
young tree (routine)	37	31.9%
young tree (immediate)	3	2.6%
mature tree (immediate)	2	1.7%
None	0	0.0%
critical concern (public safety)	0	0.0%
	116	100.0%

Land Use and Location

The majority of New Vienna's surveyed trees are 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.

<u>Land Use</u>

Single family residential	63%
Park/vacant/other	36%
Small commercial	<1%

<u>Location</u>

Front yard	36%
Planting strip	18%
Back yard	9%
Other maintained locations	37%

Recommendations

Risk Management

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

Hazardous trees

These trees can be seen on the *Location of Trees with Recommended Maintenance* map (Appendix B, Figure 4). A total of 3 trees had serious enough issues that they should be addressed immediately. A total of 6 trees were recommended for removal for one reason or another. Of those, 2 trees were dead or dying, 2 had very poor wood condition and showed signs of severe decay, and 2 were of undesirable species or were growing in a bad location. Those trees with severe decay could easily break off or topple over in storms or under ice and snow loads.

Poor tree species

Ash trees in poor health should be assessed for removal (Appendix B, Figure 3 & Appendix B, Figure 4). Of the 6 trees recommended for removal, one tree was a white ash with severe stem decay and one was a green ash with severe canopy dieback. There were a total of 15 ash trees inventoried, and one of them had potential signs and symptoms that have been associated with EAB.

Pruning Cycle

Proper pruning can extend the life, improve the overall health, and reduce public safety issues. In the Management Needs section of the Findings there are four main maintenance issues to be addressed: routine pruning (stake/train), crown cleaning (clean), crown raising (raise), and crown reduction (reduce). Crown cleaning removes dead, diseased, and damaged limbs. Crown raising is the removal of lower branches to provide clearance for pedestrians or vehicles. Crown reduction is removing individual limbs from structures or utility wires. Staking and training is recommended for younger trees so they can develop good main stem architecture. It is recommended that all trees be pruned on a routine schedule every five to seven years.

Priority Task	# of trees	% of trees
none	85	73.3%
stake/train	8	6.9%
clean	8	6.9%
raise	7	6.0%
remove	6	5.2%
reduce	2	1.7%

Planting

Most of the planting over the next six years should be directed to replace the trees that are recommended for removal. It is recommended to plant two trees for every one tree removed since survival rates rarely reach 100%. It is not essential that the new trees be planted in the same location as the trees being removed. However, maintaining the same number of trees helps ensure continuation of the benefits of the existing forest in New Vienna.

Since most insects and diseases target a particular genus (e.g. ash) or species (e.g. green ash), it is important to always plant a diverse mix of species. Current diversity recommendations advise that any genus (e.g. maple, oak or ash) not make up more than 20% of the urban forest. Any single species (e.g. silver maple, sugar maple, white oak or bur oak) not make up more than 10% of the total urban forest. Presently, the forest is heavily planted with Maple (31%) and ash (13%) (Appendix A, Figure 1). Maples should not be planted until this percentage is 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: Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, and certain willows.

Continual Monitoring

Due to the threat of EAB, it is important to continuously check the health of ash trees. It is recommended that ash trees be checked with a visual survey every year for tree death and for the following signs and symptoms: canopy dieback, epicormic shoots, bark splitting, D-shaped borer exit holes, and wood pecker damage.

Emerald Ash Borer (EAB) Plan

Ash Tree Removal

Tree removal should be prioritized with dead, dying, hazardous trees to be removed first (Appendix B, Figure 4). Next will be all ash in poor condition and displaying signs and symptoms of EAB (Appendix B, Figure 2 & Appendix B, Figure 3). *City ownership of the tree recommended for removal should be verified prior to any removal*

EAB Quarantines

EAB is an extremely destructive plant pest and it is responsible for the death and decline of many millions ash trees throughout the Eastern United States and Canada. Ash in both forestlands and urban settings constitutes a very significant portion of the canopy cover. 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 its spread beyond its known locations 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 urban planning is determining how wood infested with EAB will be handled, keeping in mind that quarantines will restrict its movement. Consider who will cut and haul the dead and dying trees? Is there an accessible, secured site big enough to store and sort the hundreds of trees and the associated brush and chips? How will wood be disposed of or utilized? Do you have equipment capable of handling the amount and size of ash trees your tree inventory has identified? Once your county is under quarantine for EAB, contact USDA-APHIS-PPQ at 515-251-4083 or visit the website http://www.aphis.usda.gov/plant_health/plant_pest_info/emerald_ash_b/regulatory.shtml. Wood waste can be disposed of as you normally would if your county is not part of a quarantine.

Canopy Replacement

As your budget permits, all removed ash trees should be replaced. All trees should meet the restrictions in your city's ordinance (Appendix C). The new plantings should be a diverse mix and should *not* include maple, ash, Autumn olive, black locust, black walnut, boxelder, Chinese elm, Siberian elm, cottonwood, poplar, tree of heaven, or willow.

Postponed Work

While finances, staffing and equipment are focused on the management of ash, usual services may be delayed. Tree removal requests on genuses other than ash will be prioritized by hazardous or emergency situations only.

Private Ash Trees

It is strongly recommended that private property owners start removing ash trees on their property as trees are infested with Emerald Ash Borer. Trees that are on private property are part of New Vienna's urban forest. Private property owners should be given direction to the proper species to plant, spacing, and location. New Vienna has a city ordinance for trees.

Budget

Purposed Budget Increase

EAB could potentially kill all ash trees in New Vienna within a decade after its arrival. To remove all of these trees within 6 years, the City's urban forestry budget would need to be increased. Additionally, it is recommended that the City apply for grants to fund replacement tree planting. 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. It would not be imprudent to suggest communities in Iowa start questioning their City's elected officials and State Legislators on how government is going to help when this issue starts heating up in the future. Cities need to start planting today!

Current Budget

Total $8000 over 6 years ($1333/year)

FY 2012 Budget
- Removal: $1000
- Planting: $500
- Watering & Maintenance: $100

FY 2013 Budget
- Removal: $1000
- Planting: $500
- Routine trimming:
- Watering & Maintenance: $100

FY 2014 Budget
- Removal: $1000
- Planting: $500
- Watering & Maintenance: $100

FY 2015 Budget
- Removal: $500
- Planting: $500
- Routine trimming: $400
- Watering & Maintenance: $100

FY 2016 Budget
- Removal: $800

FY 2017 Budget
- Removal: $500
- Routine trimming: $400

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Appendix A: i-Tree Data

Table 1: Annual Energy Benefits

Annual Energy Benefits of Public Trees by Species

12/2/2010

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	6.4	486	895.0	877	1,363	(N/A)	23.5	32.7	50.49
Green ash	2.2	166	300.0	294	460	(N/A)	8.7	11.0	46.04
Apple	0.8	58	117.3	115	173	(N/A)	7.0	4.1	21.58
Eastern white pine	1.3	98	172.2	169	267	(N/A)	6.1	6.4	38.17
Japanese tree lilac	0.2	12	26.6	26	38	(N/A)	6.1	0.9	5.40
Lilac	0.1	9	19.6	19	28	(N/A)	5.2	0.7	4.65
Northern red oak	0.3	24	40.8	40	64	(N/A)	4.4	1.5	12.83
Silver maple	1.2	89	145.3	142	231	(N/A)	3.5	5.5	57.76
Broadleaf Deciduous	0.1	4	8.8	9	13	(N/A)	3.5	0.3	3.13
Northern hackberry	1.2	89	168.4	165	254	(N/A)	3.5	6.1	63.55
Norway spruce	0.6	48	83.7	82	130	(N/A)	3.5	3.1	32.40
Siberian elm	1.3	101	184.3	181	282	(N/A)	3.5	6.8	70.39
Maple	0.5	39	60.8	60	99	(N/A)	2.6	2.4	32.98
White ash	1.4	104	171.1	168	272	(N/A)	2.6	6.5	90.50
Littleleaf linden	0.2	18	37.4	37	55	(N/A)	2.6	1.3	18.25
Sugar maple	0.5	35	53.9	53	88	(N/A)	1.7	2.1	44.11
Black walnut	0.3	25	40.7	40	65	(N/A)	1.7	1.6	32.43
Scotch pine	0.0	1	1.3	1	2	(N/A)	1.7	0.0	0.93
Northern white cedar	0.1	9	19.0	19	27	(N/A)	1.7	0.7	13.58
Other street trees	1.2	94	170.7	167	261	(N/A)	7.0	6.3	32.66
Citywide total	19.9	1,508	2,717.0	2,663	4,171	(N/A)	100.0	100.0	36.27

Table 2: Annual Stormwater Benefits

Annual Stormwater Benefits of Public Trees by Species

12/2/2010

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	50,985	1,382	(N/A)	23.5	25.9	51.18
Green ash	21,522	583	(N/A)	8.7	10.9	58.33
Apple	2,724	74	(N/A)	7.0	1.4	9.23
Eastern white pine	32,230	874	(N/A)	6.1	16.4	124.79
Japanese tree lilac	481	13	(N/A)	6.1	0.2	1.86
Lilac	351	10	(N/A)	5.2	0.2	1.58
Northern red oak	1,715	46	(N/A)	4.4	0.9	9.29
Silver maple	12,278	333	(N/A)	3.5	6.2	83.19
Broadleaf Deciduous	152	4	(N/A)	3.5	0.1	1.03
Northern hackberry	8,720	236	(N/A)	3.5	4.4	59.09
Norway spruce	13,511	366	(N/A)	3.5	6.9	91.55
Siberian elm	13,575	368	(N/A)	3.5	6.9	91.97
Maple	3,219	87	(N/A)	2.6	1.6	29.08
White ash	18,480	501	(N/A)	2.6	9.4	166.95
Littleleaf linden	1,382	37	(N/A)	2.6	0.7	12.48
Sugar maple	2,734	74	(N/A)	1.7	1.4	37.05
Black walnut	2,073	56	(N/A)	1.7	1.1	28.09
Scotch pine	97	3	(N/A)	1.7	0.1	1.32
Northern white cedar	1,191	32	(N/A)	1.7	0.6	16.14
Other street trees	9,536	258	(N/A)	7.0	4.8	32.30
Citywide total	196,957	5,338	(N/A)	100.0	100.0	46.42

Table 3: Annual Air Quality Benefits

Annual Air Quality Benefits of Public Trees by Species

12/2/2010

Species	Deposition (lb) O_3	NO_2	PM_{10}	SO_2	Total Depos. ($)	Avoided (lb) NO_2	PM_{10}	VOC	SO_2	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)	Standard Error	% of Total Trees	Avg. $/tree
Norway maple	9.4	1.6	4.8	0.4	51	30.8	4.5	4.3	29.1	191	-2.3	-9	82.5	234	(N/A)	23.5	8.67
Green ash	2.4	0.4	1.2	0.1	13	10.5	1.5	1.5	9.9	65	0.0	0	27.4	78	(N/A)	8.7	7.79
Apple	0.6	0.1	0.3	0.0	4	3.7	0.5	0.5	3.4	23	0.0	0	9.3	27	(N/A)	7.0	3.32
Eastern white pine	4.0	0.8	3.1	0.5	26	6.1	0.9	0.9	5.9	38	-20.1	-75	2.1	-11	(N/A)	6.1	-1.58
Japanese tree lilac	0.0	0.0	0.0	0.0	0	0.8	0.1	0.1	0.7	5	0.0	0	1.8	5	(N/A)	6.1	0.71
Lilac	0.0	0.0	0.0	0.0	0	0.6	0.1	0.1	0.5	4	0.0	0	1.3	4	(N/A)	5.2	0.61
Northern red oak	0.2	0.0	0.1	0.0	1	1.5	0.2	0.2	1.4	9	-0.3	-1	3.5	9	(N/A)	4.3	1.89
Silver maple	1.7	0.3	0.9	0.1	9	5.4	0.8	0.8	5.3	34	-1.0	-4	14.3	40	(N/A)	3.5	9.97
Broadleaf Deciduous	0.0	0.0	0.0	0.0	0	0.3	0.0	0.0	0.2	2	0.0	0	0.6	2	(N/A)	3.5	0.41
Northern hackberry	1.1	0.2	0.6	0.0	6	5.7	0.8	0.8	5.3	35	0.0	0	14.5	41	(N/A)	3.5	10.30
Norway spruce	1.6	0.3	1.3	0.2	10	3.0	0.4	0.4	2.8	19	-7.0	-26	3.1	3	(N/A)	3.5	0.69
Siberian elm	2.1	0.4	1.0	0.1	11	6.4	0.9	0.9	6.0	40	0.0	0	17.8	51	(N/A)	3.5	12.76
Maple	0.6	0.1	0.3	0.0	3	2.4	0.4	0.3	2.3	15	-0.2	-1	6.3	18	(N/A)	2.6	5.88
White ash	3.8	0.6	1.7	0.2	20	6.4	0.9	0.9	6.2	40	0.0	0	20.6	60	(N/A)	2.6	19.92
Littleleaf linden	0.1	0.0	0.1	0.0	1	1.2	0.2	0.2	1.1	7	-0.1	0	2.7	8	(N/A)	2.6	2.55
Sugar maple	0.3	0.0	0.2	0.0	1	2.1	0.3	0.3	2.1	14	-0.2	-1	5.1	14	(N/A)	1.7	7.08
Black walnut	0.1	0.0	0.1	0.0	1	1.5	0.2	0.2	1.5	10	0.0	0	3.7	10	(N/A)	1.7	5.21
Scotch pine	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0	0	0.0	0	(N/A)	1.7	0.05
Northern white cedar	0.1	0.0	0.1	0.0	1	0.6	0.1	0.1	0.5	3	-0.3	-1	1.1	3	(N/A)	1.7	1.48
Other street trees	1.3	0.2	0.7	0.1	7	5.9	0.9	0.8	5.6	37	-0.5	-2	15.0	42	(N/A)	7.0	5.28
Citywide total	29.5	5.1	16.6	1.8	166	94.9	13.8	13.2	90.1	591	-32.1	-120	232.8	637	(N/A)	100.0	5.54

Table 4: Total Carbon Stored in City Owned Trees

Stored CO2 Benefits of Public Trees by Species

12/2/2010

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	154,805	1,161	(N/A)	23.5	29.3	43.00
Green ash	76,687	575	(N/A)	8.7	14.5	57.52
Apple	10,792	81	(N/A)	7.0	2.0	10.12
Eastern white pine	52,432	393	(N/A)	6.1	9.9	56.18
Japanese tree lilac	1,245	9	(N/A)	6.1	0.2	1.33
Lilac	903	7	(N/A)	5.2	0.2	1.13
Northern red oak	4,167	31	(N/A)	4.4	0.8	6.25
Silver maple	35,809	269	(N/A)	3.5	6.8	67.14
Broadleaf	383	3	(N/A)	3.5	0.1	0.72
Northern	14,106	106	(N/A)	3.5	2.7	26.45
Norway spruce	17,519	131	(N/A)	3.5	3.3	32.85
Siberian elm	50,960	382	(N/A)	3.5	9.7	95.55
Maple	7,265	54	(N/A)	2.6	1.4	18.16
White ash	57,489	431	(N/A)	2.6	10.9	143.72
Littleleaf linden	3,074	23	(N/A)	2.6	0.6	7.68
Sugar maple	7,248	54	(N/A)	1.7	1.4	27.18
Black walnut	4,706	35	(N/A)	1.7	0.9	17.65
Scotch pine	5	0	(N/A)	1.7	0.0	0.02
Northern white	513	4	(N/A)	1.7	0.1	1.93
Other street trees	12,649	209	(N/A)	7.0	5.3	26.14
Citywide total	527,993	3,960	(N/A)	100.0	100.0	34.43

Table 5: Carbon Sequestered Annually

Annual CO_2 Benefits of Public Trees by Species

12/2/2010

Species	Sequestered (lb)	Sequestered ($)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	10,742	81	-743	-5	-6	10,745	81	20,739	156	(N/A)	23.5	30.8	5.76
Green ash	5,178	39	-368	-2	-3	3,678	28	8,486	64	(N/A)	8.7	12.6	6.36
Apple	1,143	9	-52	-2	0	1,275	10	2,364	18	(N/A)	7.0	3.5	2.22
Eastern white pine	768	6	-252	-1	-2	2,177	16	2,692	20	(N/A)	6.1	4.0	2.88
Japanese tree lilac	266	2	-6	-1	0	260	2	519	4	(N/A)	6.1	0.8	0.56
Lilac	198	1	-4	-1	0	192	1	384	3	(N/A)	5.2	0.6	0.48
Northern red oak	452	3	-20	-1	0	534	4	965	7	(N/A)	4.4	1.4	1.45
Silver maple	3,504	26	-172	-1	-1	1,959	15	5,290	40	(N/A)	3.5	7.9	9.92
Broadleaf Deciduous	93	1	-2	-1	0	86	1	176	1	(N/A)	3.5	0.3	0.33
Northern hackberry	1,262	9	-68	-1	-1	1,970	15	3,164	24	(N/A)	3.5	4.7	5.93
Norway spruce	562	4	-84	-1	-1	1,050	8	1,527	11	(N/A)	3.5	2.3	2.86
Siberian elm	2,561	19	-245	-1	-2	2,231	17	4,547	34	(N/A)	3.5	6.8	8.52
Maple	969	7	-35	-1	0	868	7	1,802	14	(N/A)	2.6	2.7	4.51
White ash	4,553	34	-276	-1	-2	2,295	17	6,571	49	(N/A)	2.6	9.8	16.43
Littleleaf linden	670	5	-15	-1	0	401	3	1,055	8	(N/A)	2.6	1.6	2.64
Sugar maple	637	5	-35	0	0	783	6	1,385	10	(N/A)	1.7	2.1	5.19
Black walnut	654	5	-23	0	0	552	4	1,183	9	(N/A)	1.7	1.8	4.44
Scotch pine	7	0	0	0	0	12	0	19	0	(N/A)	1.7	0.0	0.07
Northern white cedar	105	1	-2	0	0	189	1	291	2	(N/A)	1.7	0.4	1.09
Other street trees	2,286	17	-134	-2	-1	2,076	16	4,226	32	(N/A)	7.0	6.3	3.96
Citywide total	36,611	275	-2,534	-22	-19	33,332	250	67,386	505	(N/A)	100.0	100.0	4.39

Table 6: Annual Social and Aesthetic Benefits

Annual Aesthetic/Other Benefits of Public Trees by Species

12/2/2010

Species	Total ($)	Standar d Error	% of Total Trees	% of Total $	Avg. $/tree
Norway maple	1,042	(N/A)	23.5	28.4	38.59
Green ash	469	(N/A)	8.7	12.8	46.88
Apple	65	(N/A)	7.0	1.8	8.13
Eastern white pine	79	(N/A)	6.1	2.2	11.25
Japanese tree lilac	14	(N/A)	6.1	0.4	2.06
Lilac	10	(N/A)	5.2	0.3	1.72
Northern red oak	47	(N/A)	4.4	1.3	9.45
Silver maple	318	(N/A)	3.5	8.7	79.48
Broadleaf Deciduous	4	(N/A)	3.5	0.1	1.05
Northern hackberry	196	(N/A)	3.5	5.4	49.09
Norway spruce	141	(N/A)	3.5	3.9	35.31
Siberian elm	183	(N/A)	3.5	5.0	45.66
Maple	132	(N/A)	2.6	3.6	43.94
White ash	437	(N/A)	2.6	11.9	145.77
Littleleaf linden	94	(N/A)	2.6	2.6	31.20
Sugar maple	79	(N/A)	1.7	2.2	39.54
Black walnut	74	(N/A)	1.7	2.0	37.21
Scotch pine	12	(N/A)	1.7	0.3	5.76
Northern white cedar	31	(N/A)	1.7	0.8	15.42
Other street trees	237	(N/A)	7.0	6.5	29.61
Citywide total	3,664	(N/A)	100.0	100.0	31.86

Table 7: Summary of Benefits in Dollars

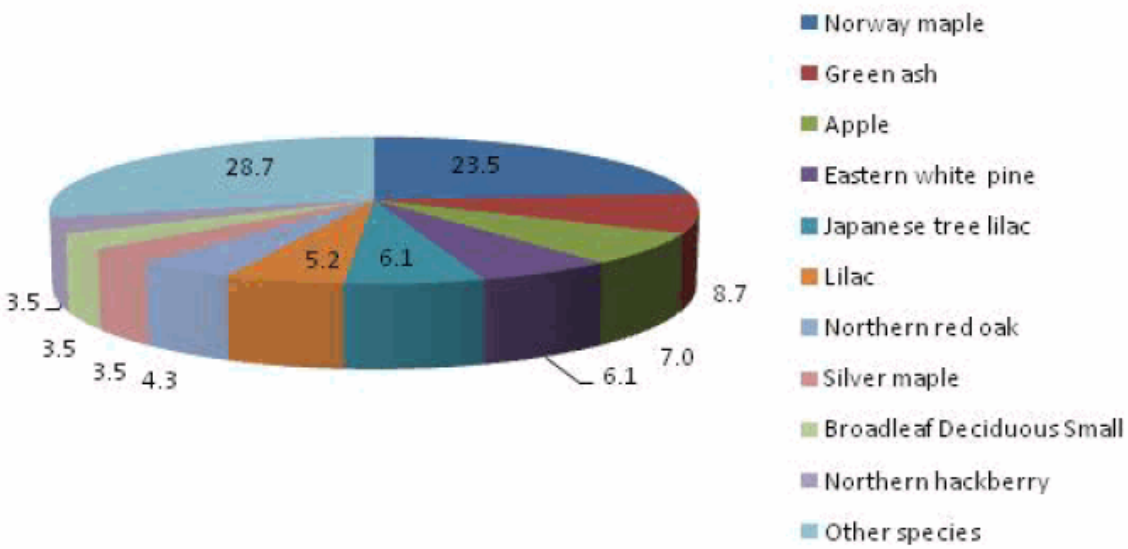
Total Annual Benefits of Public Trees by Species ($)

12/2/201

Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error	% of Total $
Norway maple	1,363	156	234	1,382	1,042	4,177	(±0)	29.2
Green ash	460	64	78	583	469	1,654	(±0)	11.6
Apple	173	18	27	74	65	356	(±0)	2.5
Eastern white pine	267	20	-11	874	79	1,229	(±0)	8.6
Japanese tree lilac	38	4	5	13	14	74	(±0)	0.5
Lilac	28	3	4	10	10	54	(±0)	0.4
Northern red oak	64	7	9	46	47	175	(±0)	1.2
Silver maple	231	40	40	333	318	961	(±0)	6.7
Broadleaf Deciduous	13	1	2	4	4	24	(±0)	0.2
Northern hackberry	254	24	41	236	196	752	(±0)	5.3
Norway spruce	130	11	3	366	141	651	(±0)	4.5
Siberian elm	282	34	51	368	183	917	(±0)	6.4
Maple	99	14	18	87	132	349	(±0)	2.4
White ash	272	49	60	501	437	1,319	(±0)	9.2
Littleleaf linden	55	8	8	37	94	201	(±0)	1.4
Sugar maple	88	10	14	74	79	266	(±0)	1.9
Black walnut	65	9	10	56	74	215	(±0)	1.5
Scotch pine	2	0	0	3	12	16	(±0)	0.1
Northern white cedar	27	2	3	32	31	95	(±0)	0.7
Other street trees	261	32	42	258	237	830	(±0)	5.8
Citywide Total	4,171	505	637	5,338	3,664	14,316	(±0)	100.0

Species Distribution of Public Trees (%)

12/2/2010

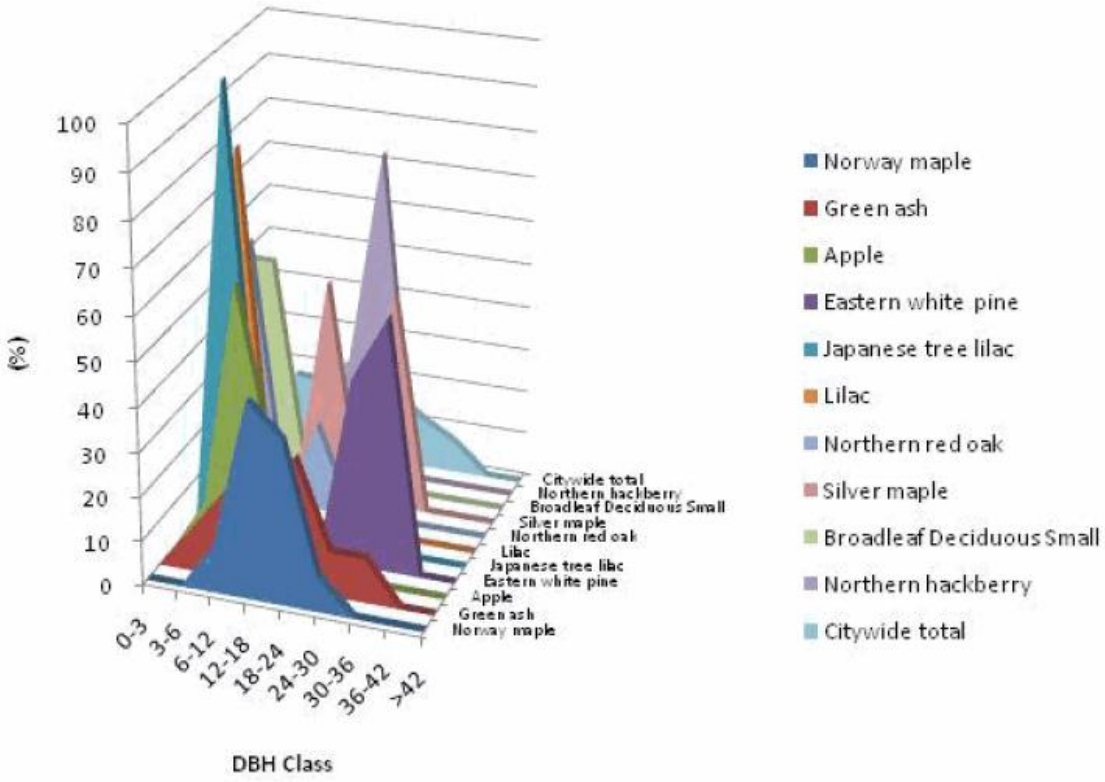


Species	Percent
Norway maple	23.5
Green ash	8.7
Apple	7.0
Eastern white pine	6.1
Japanese tree lilac	6.1
Lilac	5.2
Northern red oak	4.3
Silver maple	3.5
Broadleaf Deciduous	3.5
Northern hackberry	3.5
Other species	28.7
Total	100.0

Figure 1: Species Distribution

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

12/2/2010



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	0.0	0.0	11.1	44.4	37.0	7.4	0.0	0.0	0.0
Green ash	0.0	10.0	20.0	20.0	30.0	10.0	10.0	0.0	0.0
Apple	0.0	12.5	62.5	25.0	0.0	0.0	0.0	0.0	0.0
Eastern white pine	0.0	0.0	0.0	0.0	0.0	42.9	57.1	0.0	0.0
Japanese tree lilac	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lilac	16.7	83.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern red oak	20.0	60.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0
Silver maple	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0	0.0
Broadleaf Deciduous	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern hackberry	0.0	0.0	0.0	25.0	75.0	0.0	0.0	0.0	0.0
Citywide total	6.1	17.4	16.5	24.3	17.4	11.3	7.0	0.0	0.0

Figure 2: Relative Age Class

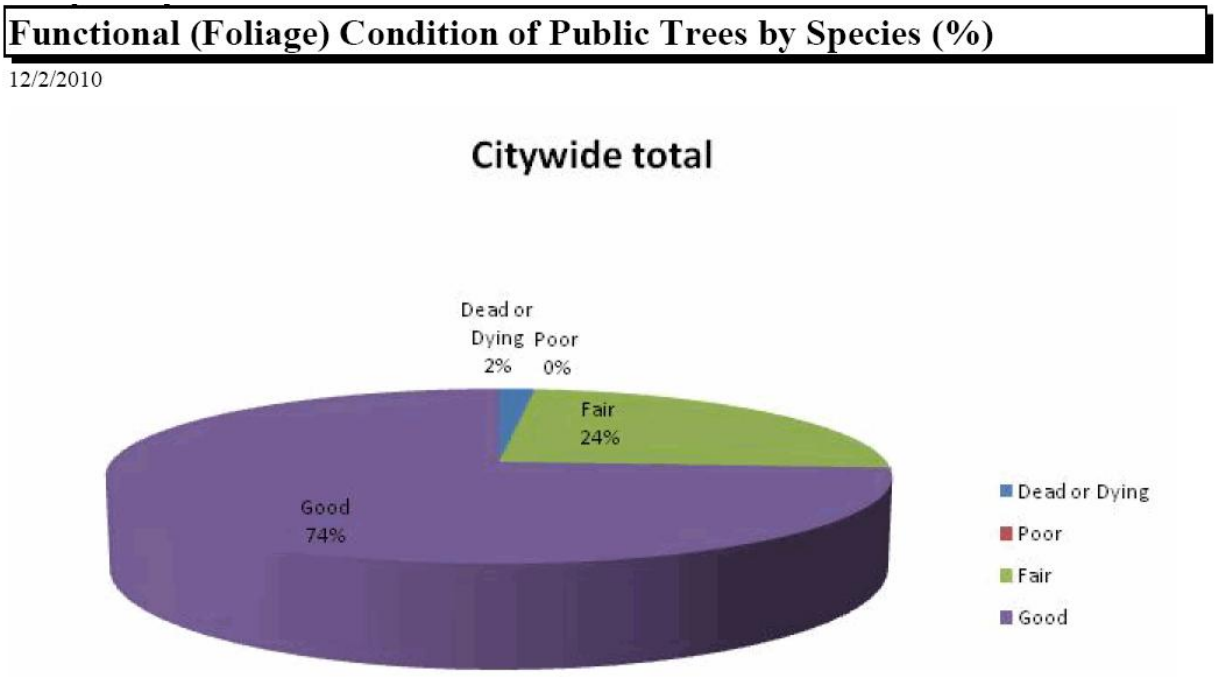


Figure 3: Foliage Condition

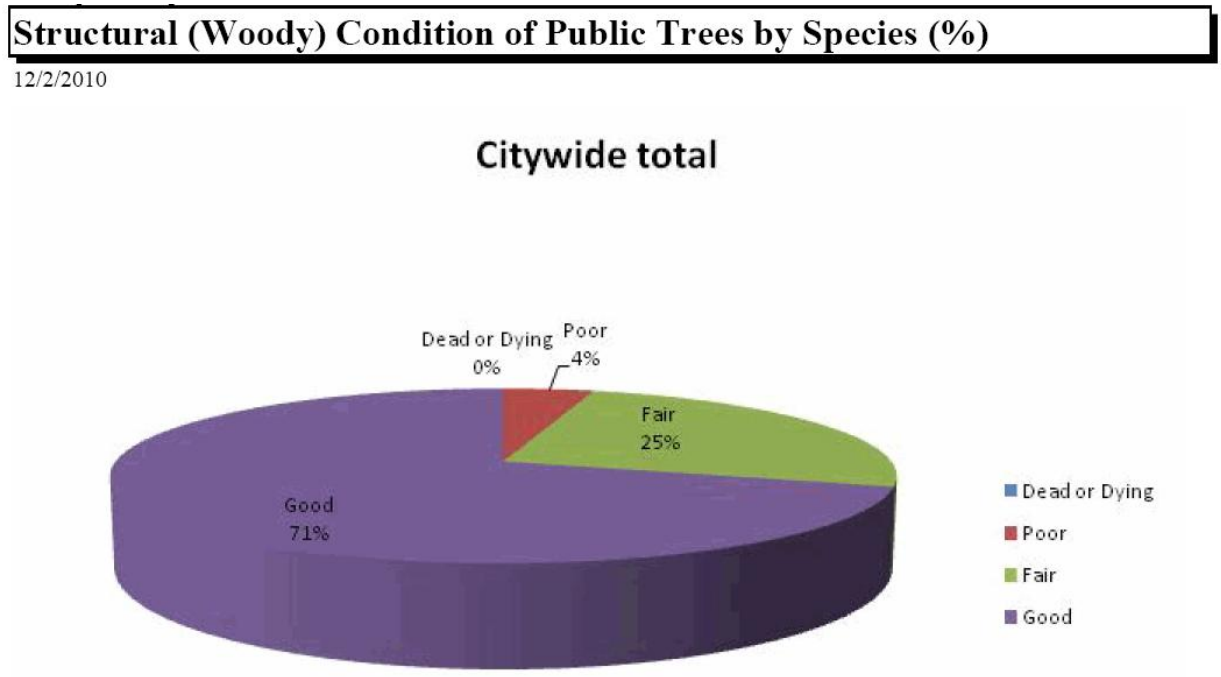
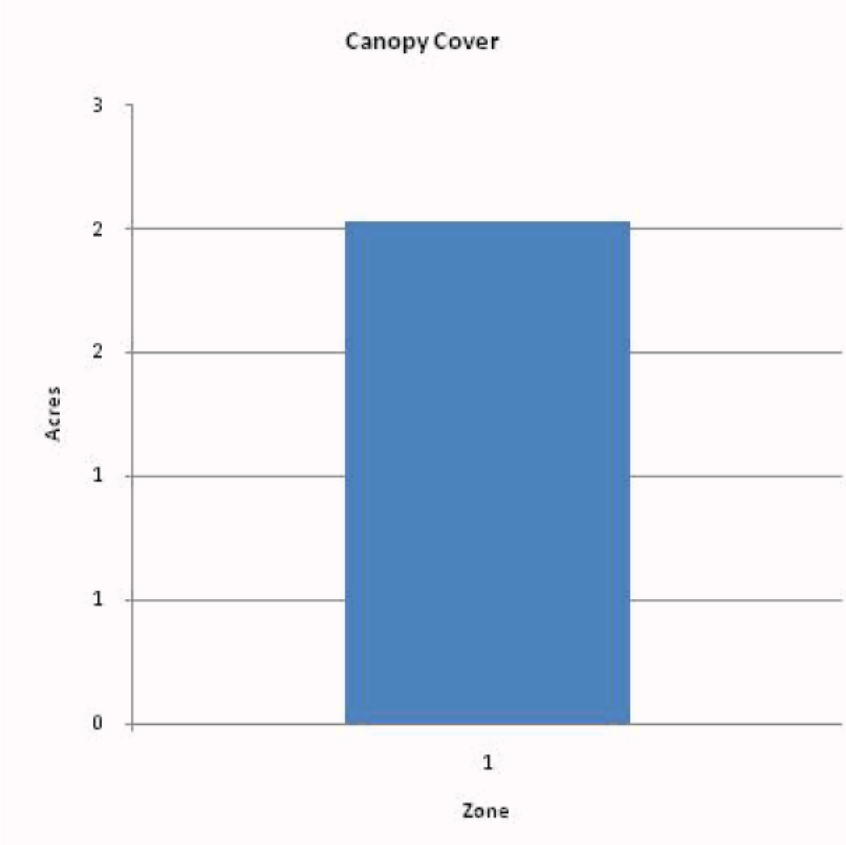


Figure 4: Wood Condition

Canopy Cover of Public Trees (Acres)

12/2/2010



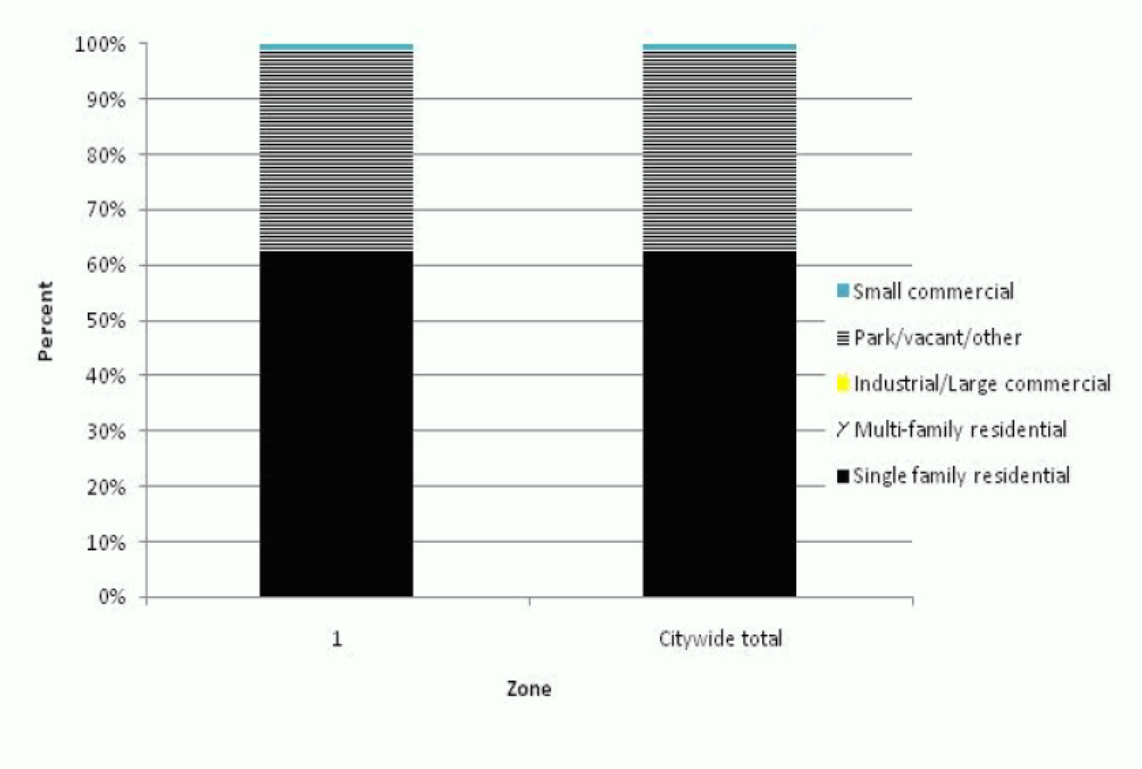
Zone	Acres	% of Total Canopy Cover
1	2	100.0
Citywide total	2	100.0

	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	0	0	2		

Figure 5: Canopy Cover in Acres

Land Use of Public Trees by Zone (%)

12/2/2010

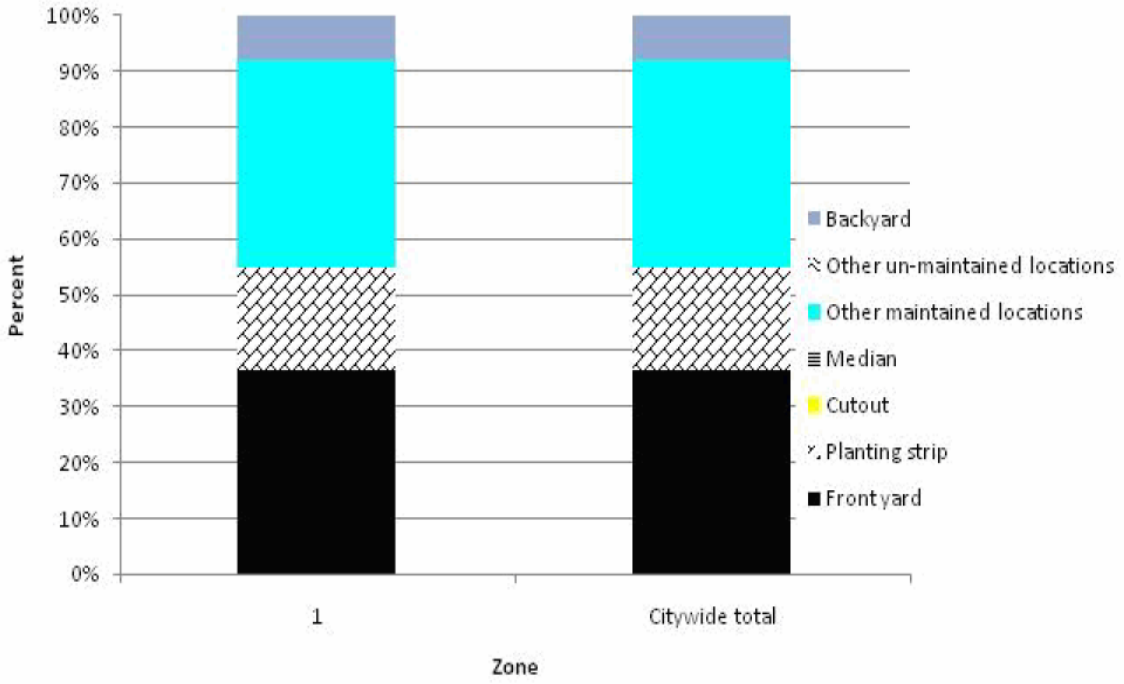


Zone	Single family residential	Multi-family residential	Industrial/ Large commercial	Park/vacant/ other	Small commercial
1	62.6	0.0	0.0	36.5	0.9
Citywide total	62.6	0.0	0.0	36.5	0.9

Figure 6: Land Use of city/park trees

Location of Public Trees by Zone (%)

12/2/2010



Zone	Front yard	Planting strip	Cutout	Median	Other maintained locations	Other un-maintained locations	Backyard
1	36.5	18.3	0.0	0.0	37.4	0.0	7.8
Citywide total	36.5	18.3	0.0	0.0	37.4	0.0	7.8

Figure 7: Location of city/park trees

Appendix B: ArcGIS Mapping

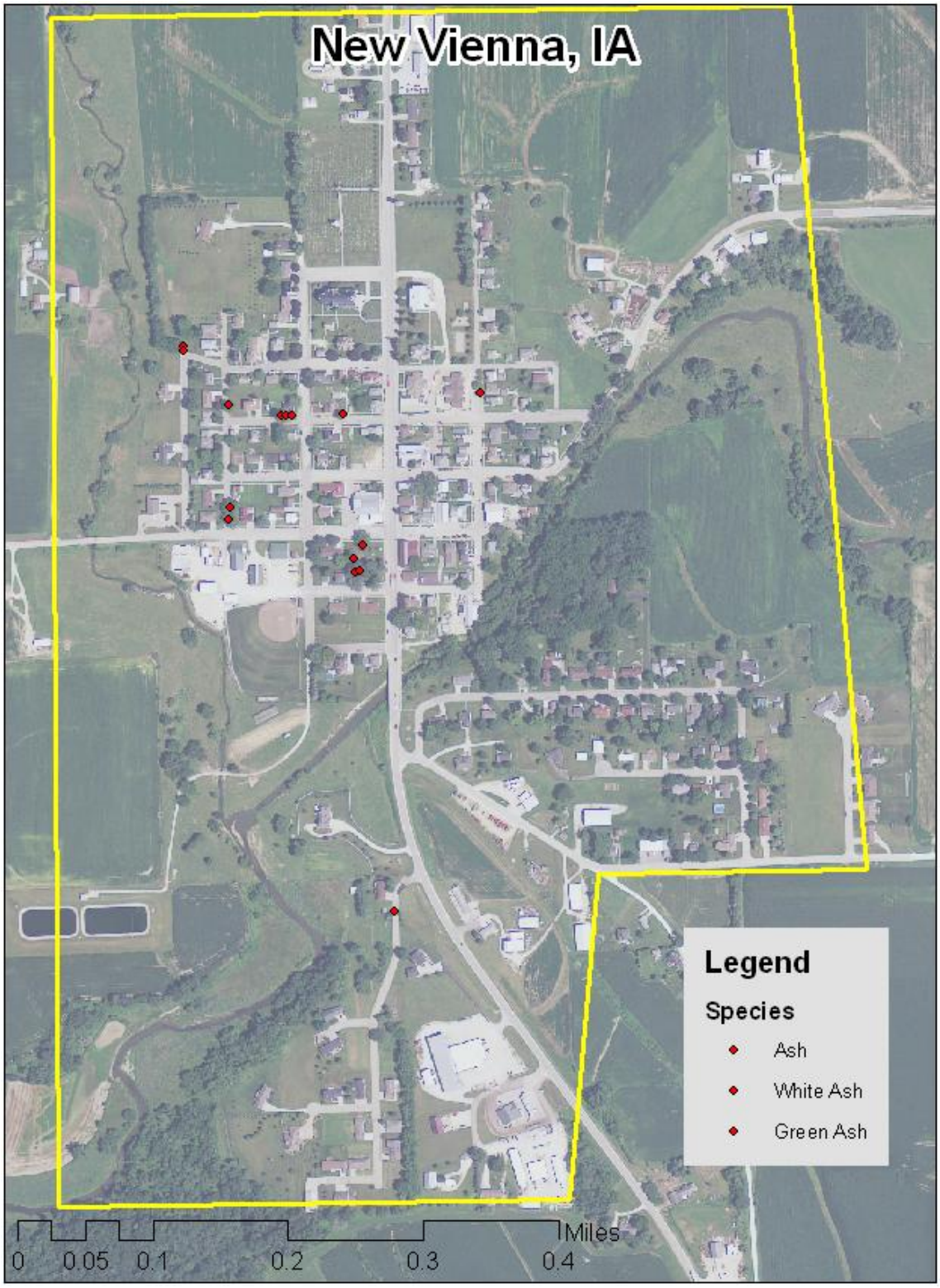


Figure 1: Location of Ash Trees

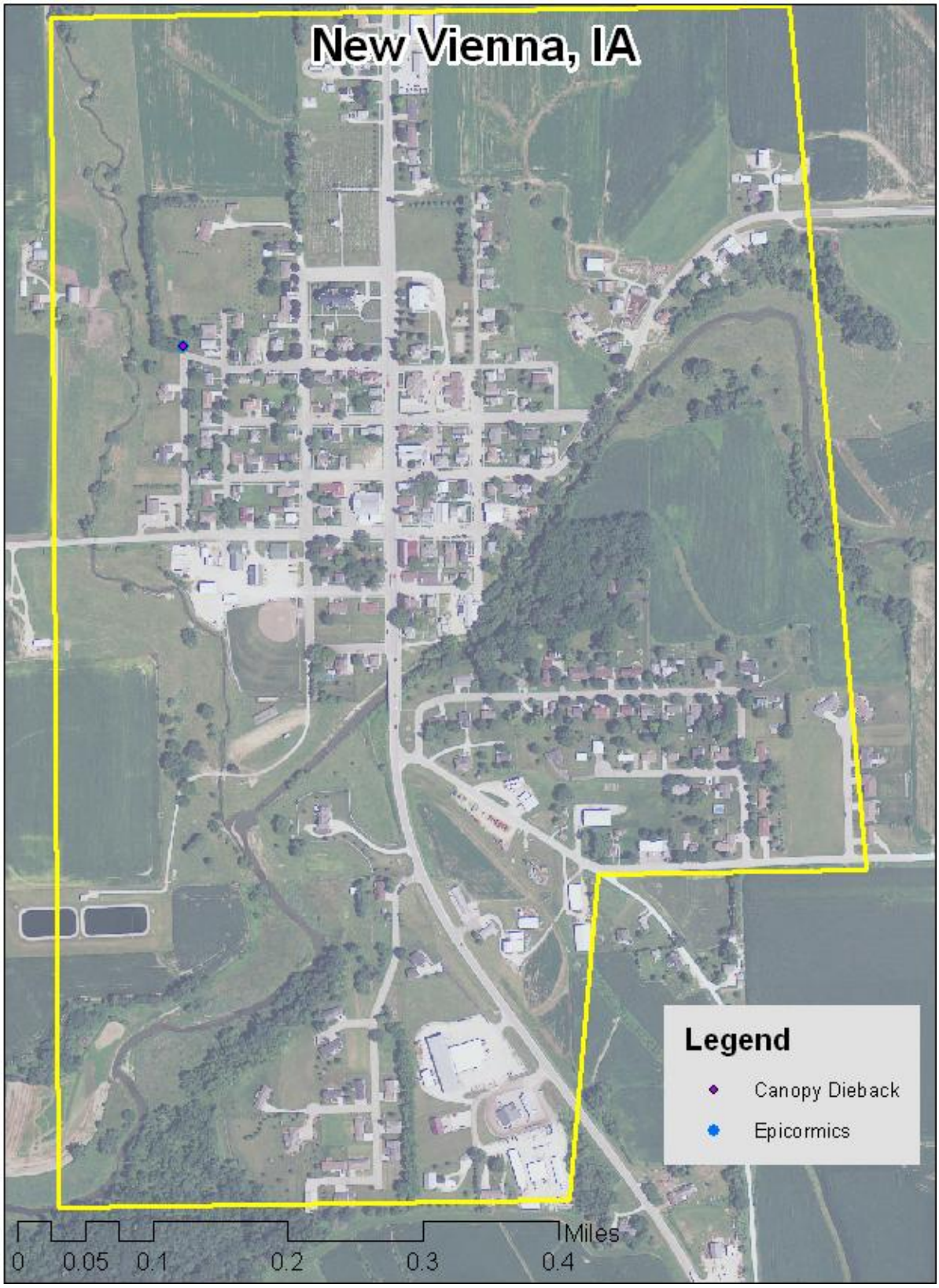


Figure 2: Location of EAB symptoms

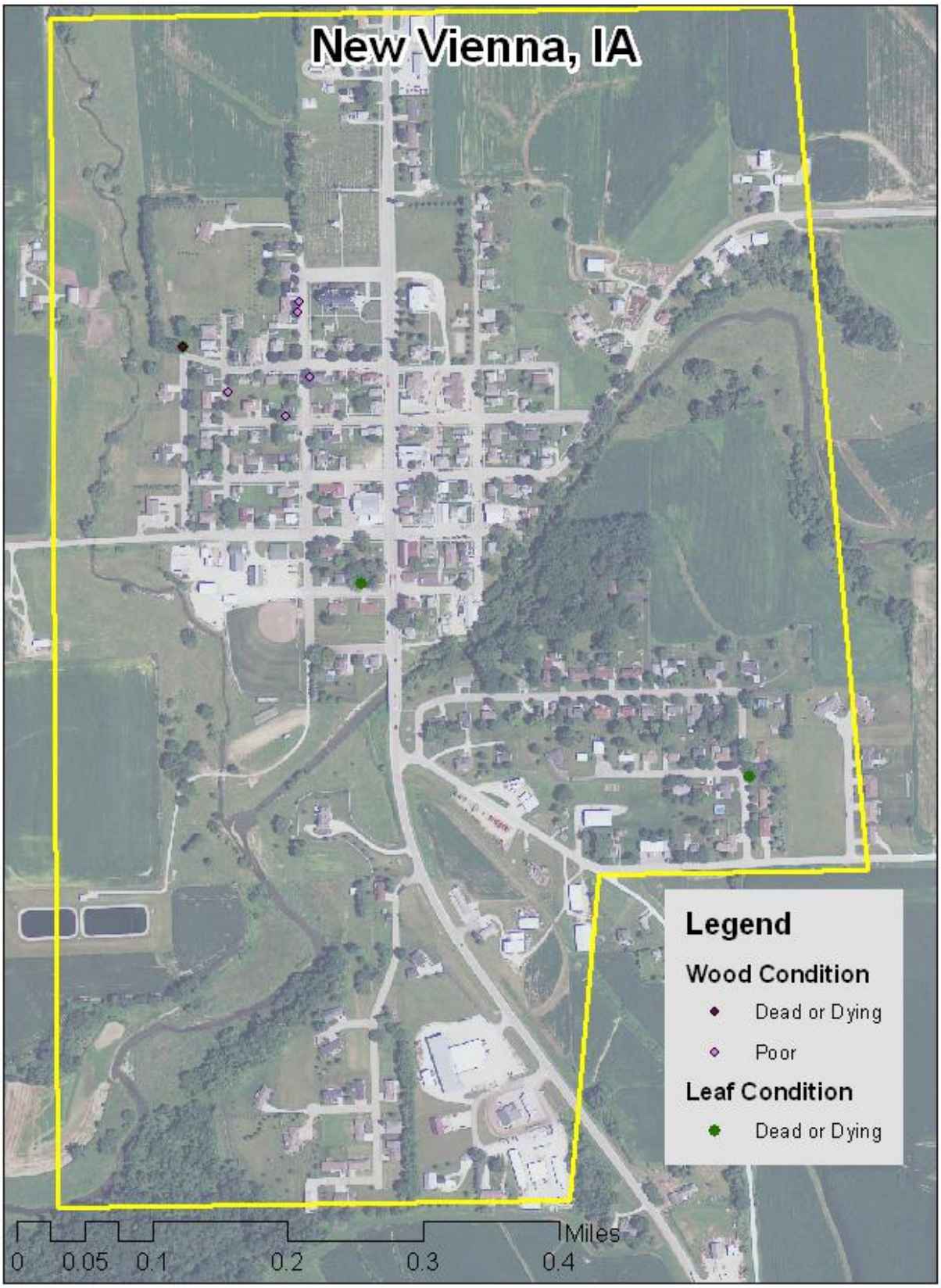


Figure 3: Location of Poor Condition Trees

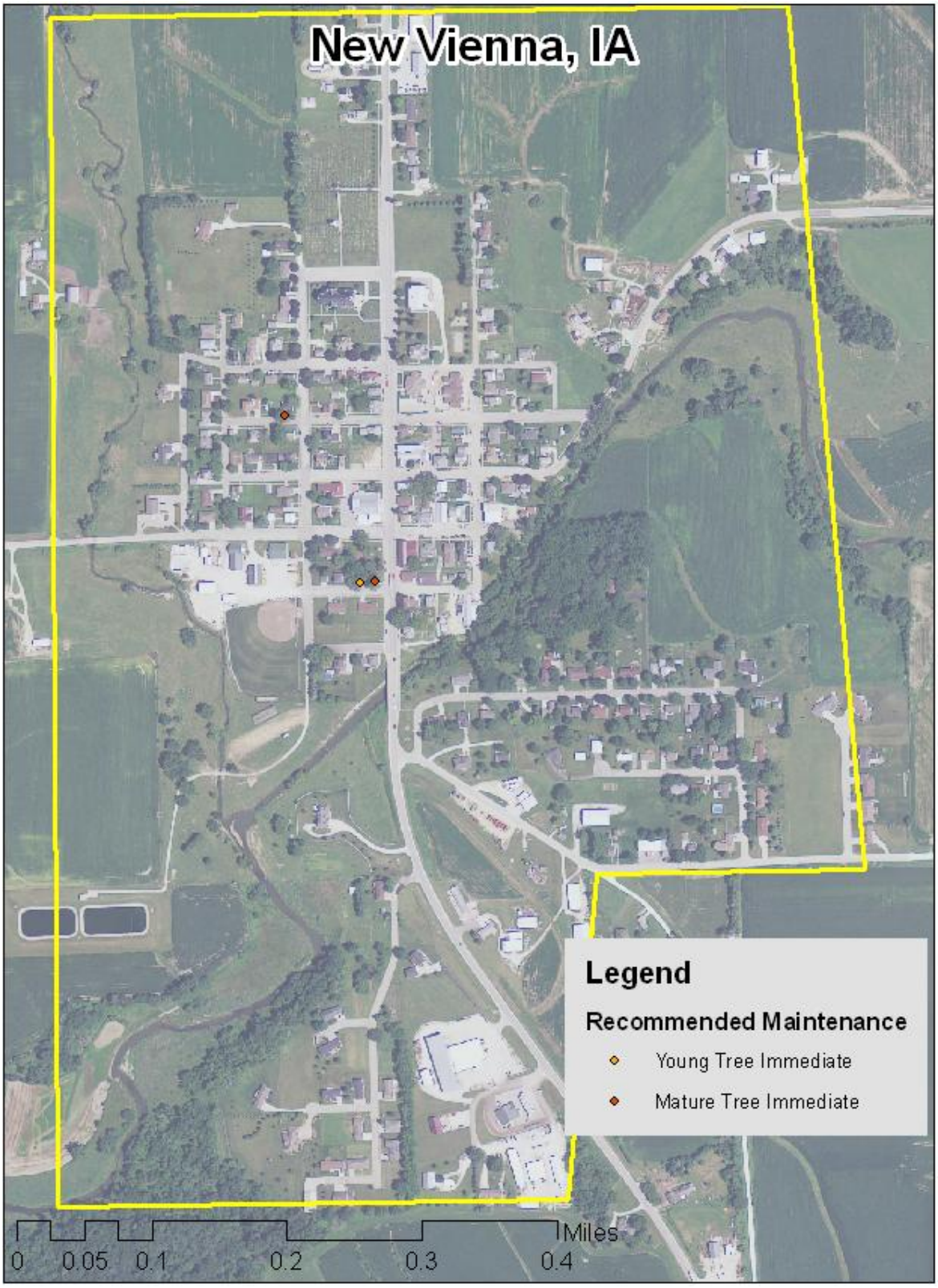


Figure 4: Location of Trees with Recommended Maintenance

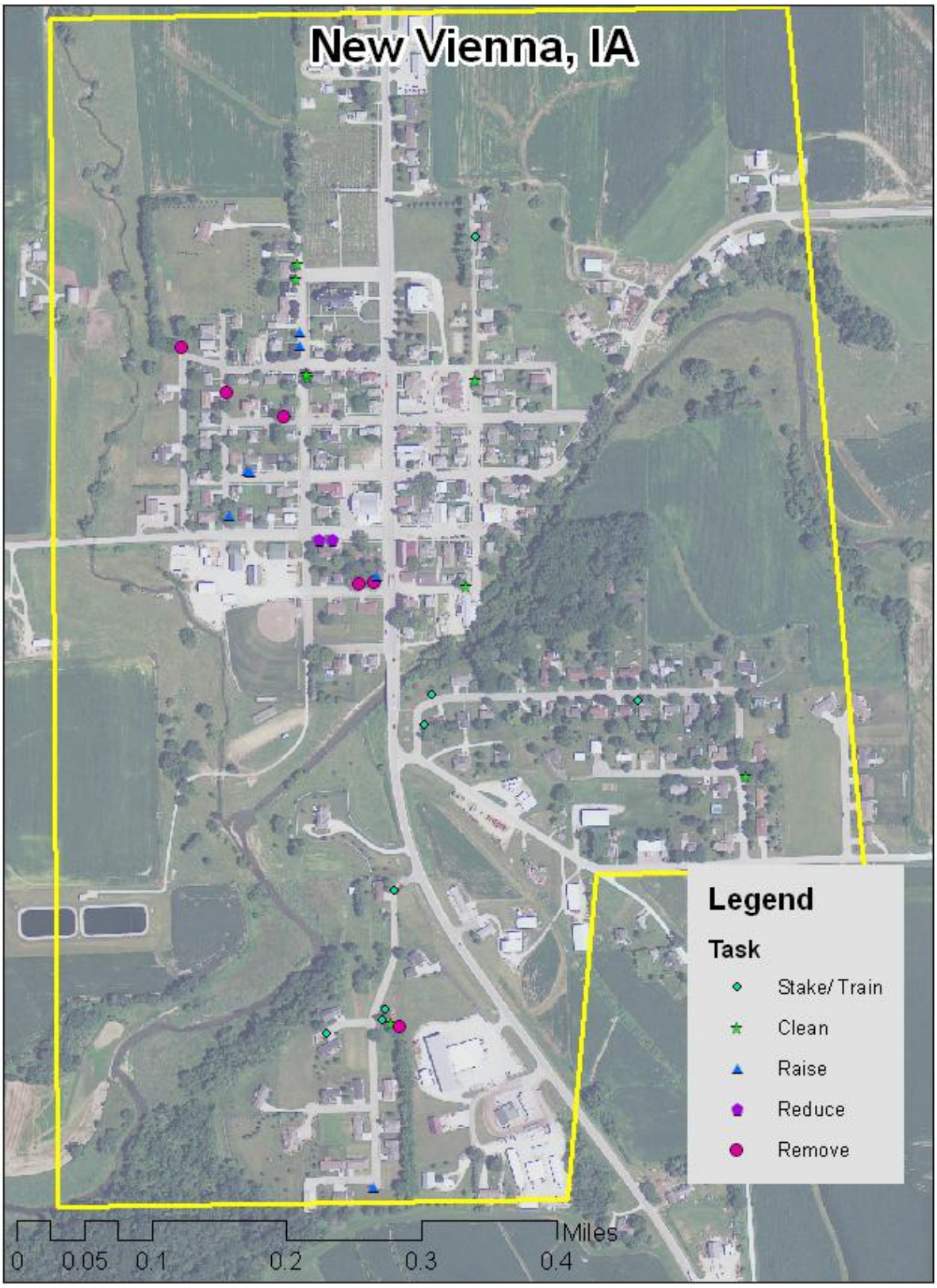


Figure 5: Maintenance Tasks *City ownership of the trees recommended for removal should be verified prior to any removal*

Appendix C: *CITY* Tree Ordinances

TITLE III COMMUNITY PROTECTION
CHAPTER 2 NUISANCES

3-2-1 DEFINITIONS. For use in this Ordinance, the following terms are defined:
1. The term "nuisance" means whatever is injurious to health, indecent, or unreasonably offensive to the senses or an obstacle to the free use of property, so as essentially to unreasonably interfere with the comfortable enjoyment of life or property. The following are declared to be nuisances:

(Code of Iowa, Sec. 657.1)
(Ord. 4-2, passed November 4, 2002)

h. Cotton-bearing cottonwood trees and all other cotton-bearing poplar trees in the City.
(Code of Iowa, Sec. 657.2(8))

l. Trees infected with Dutch elm disease.
(Code of Iowa, Sec. 657.2(13))

3-2-3 OTHER CONDITIONS REGULATED. The following actions are required and may also be abated in the manner provided in this Ordinance:

1. The removal of diseased trees or dead wood, but not diseased trees and dead wood outside the lot and property lines and inside the curb lines upon the public street.
(Code of Iowa, Sec. 364.12(3)(b))

TITLE VI PHYSICAL ENVIRONMENT
CHAPTER 11 TREES

6-11-1 Title
6-11-2 Purpose
6-11-3 Definitions
6-11-4 Tree Board
6-11-5 Authority
6-11-6 Permits
6-11-7 Commercial Tree Operators Within the City Limits
6-11-8 Maintenance
6-11-9 Species, Cultivars, and Varieties
6-11-10 Nuisance and Condemnation
6-11-11 Protection of Trees
6-11-12 Appeals
6-11-13 Interference
6-11-14 Penalties PLANTING & TRIMMING
6-11-15 Planting
6-11-16 Trimming Trees

6-11-1 TITLE. This Ordinance shall be known as the Municipal Tree Ordinance for the community of New Vienna, in Dubuque County, State of Iowa.
(Ord. 2-93, Passed March 1, 1993)

6-11-2 PURPOSE. It is the purpose of this Ordinance to promote and protect the public health, safety, and general welfare by providing for the regulation of the planting, maintenance, and removal of trees, shrubs, and other plants within the City of New Vienna.
(Ord. 2-93, Passed March 1, 1993)

6-11-3 DEFINITIONS.
1. Large Trees. Those trees attaining a height of 45 feet (45') or more.
2. Park. All public parks having individual names.
3. Tree Lawn. That part of a street or highway, not covered by sidewalk or other paving, lying between the property line and that portion of the street or highway usually used for vehicular traffic. (Ord. 2-93, Passed March 1, 1993)

6-11-4 TREE BOARD. There is hereby created and established a Tree Board for the City of New Vienna, which shall consist of five members, citizens and residents of this City, who shall be appointed by the Mayor with the approval of the City Council. Members of the Board shall serve without compensation. The term of the Tree Board shall be three years, except that the term of two members appointed to the first Board shall be only one year and the term for two members of the first Board shall be for two years. In the event that a vacancy shall occur during the term of any member, his or her successor shall be appointed for the unexpired portion of the term. The Tree Board will assist the City Council or their designee in the development of a comprehensive plan for the City of New Vienna, Iowa, including planning, tree planting, and maintenance programs for all public trees. The Board will promote the goals of the tree program.
(Ord. 2-93, Passed March 1, 1993)

6-11-5 AUTHORITY. The City Council or their designee shall have the authority and jurisdiction of regulating, maintenance, and removal of trees on streets and other publicly owned property to ensure safety or preserve or enhance the aesthetics of such public sites. The City Council or their designee shall have the authority to supervise or inspect all work done under a permit issued in accordance with terms of this Ordinance. The City Council or their designee shall have the authority to formulate and publish a master tree plan with the advice, hearing, and approval of the Tree Board.

6-11-6 PERMITS. No person shall plant on any street or municipal-owned property without first filing an application and procuring a permit from the City Clerk or otherwise specified municipal authority. (Ord. 2-93, Passed March 1, 1993)

6-11-7 COMMERCIAL TREE OPERATORS WITHIN CITY LIMITS. It shall be unlawful for any person to engage in the commercial business of tree care, pruning or removal without first filing evidence of adequate workers compensation insurance and liability insurance in the minimum amounts of $300,000 for bodily injury or death and $100,000 property damage indemnifying the City or any person for damages resulting from the pursuit of such endeavor as herein described. The person receiving the permit shall abide by the arboricultural specifications and standards of practice adopted by the Tree Board.

(Ord. 2-93, Passed March 1, 1993)

6-11-8 MAINTENANCE. Parkings must be at least four feet in width for tree planting on public area. No trees shall be planted within 35 lateral feet from corners or intersections. Low growing trees (reference to I.S.U. publication PM-1429D low growing trees for urban areas) are permitted under utility lines only. All trees and shrubs on public or private property, which have branches overhanging a public street or sidewalk, shall have said branches trimmed to a clearance height of 14 feet on the street side and 10 feet on the sidewalk side.

(Ord. 2-93, Passed March 1, 1993)

6-11-9 SPECIES, CULTIVARS, AND VARIETIES. Trees can be planted on city parking by permit except the following: Boxelder, Cottonwood, European Mt. Ash, American Elm, Black Locust, Bolleana Poplar, Siberian Elm, White Poplar, Willows, Silver Maple, Russian Olive, Chinese Elm, Lombardy Poplar, Tree of Heaven, Catalpa, Weeping Birch.

(Ord. 2-93, Passed March 1, 1993)

6-11-10 NUISANCE AND CONDEMNATION. All street trees planted in violation of, or not maintained in strict compliance with the provisions of this Ordinance, or that are dead or dangerous, are declared to constitute a public nuisance. The City Council or their designee shall cause written notice to be served on the property owner requiring such nuisances to be corrected within 30 days or the cost of correction will be assessed against the property owner.

(Ord. 2-93, Passed March 1, 1993)

6-11-11 PROTECTION OF TREES. No person shall intentionally damage, cut, carve, attach any rope, wire, nails, advertising posters, or other contrivance to any tree; allow any gaseous, liquid, chemical, or solid substance that is harmful to such trees to come in contact with them; or set fire or permit fire to burn when such fire or the heat will injure any portion of any tree. No person shall excavate any ditches, tunnels, trenches, or lay any drive within a radius of 20 feet from any public tree. Tree topping is not allowed on any public owned tree.

(Ord. 2-93, Passed March 1, 1993)

6-11-12 APPEALS. Any person who received an order from the City Council or their designee and objects to all or a part thereof, may, within 30 days of receipt thereof, notify the City Council or their designee, in writing, of the nature of the objection and request a hearing thereon. The hearing shall be held within 30 days of notice to the City Council. Within 30 days after such hearing, the Mayor shall notify the appellant of the final decision.

(Ord. 2-93, Passed March 1, 1993)

6-11-13 INTERFERENCE. No person shall prevent, or interfere with the City Council or their designee in the execution or enforcement of the Ordinance.

(Ord. 2-93, Passed March 1, 1993)

6-11-14 PENALTIES. Any person or firm, or corporation violating or failing to comply with any of the provisions of this Ordinance, shall be guilty of a misdemeanor.

(Ord. 2-93, Passed March 1, 1993)

PLANTING AND TRIMMING

6-11-15 PLANTING. All trees planted in any street, avenue or highway, shall be planted midway between the outer lines of the sidewalk and the curb, where the curb line is established, and where the curb line is not established on a line ten feet (10') from the property line. All trees now or hereafter planted in any street, avenue, or highway that interferes with the making of any improvements thereon, or with travel, or becomes dangerous, shall be removed by order of the Council, and any trees planted in any street, avenue or highway, shall be planted upon such condition and subject to such removal.

6-11-16 TRIMMING TREES. It shall be unlawful to trim or cut out in any manner any tree in any street, avenue highway or public place, unless such trimming or cutting shall be done under the personal supervision of the Inspector of Public Works except that the owner agent or occupant of any lot or parcel of land shall keep the trees on and adjoining his or her property in the street, avenue or highway so trimmed that the overhanging branches shall be at least ten feet (10') above the surface of the sidewalk or surface of the street, and in all cases all trees shall be trimmed as high as the size and shape of the tree will permit.