Tree Management Plan

City of Massena, New York

June 2018

Prepared for:

City of Massena

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Executive Summary

ArborPro, Inc. developed this plan for the Village of Massena, New York with a focus on the short- and long-term maintenance needs of all inventoried trees within the Village limits. ArborPro completed a tree inventory to better understand the current state of the urban forest and to create a framework for future tree care and maintenance planning. This Tree Management Plan was developed by analyzing tree inventory data in relation to the Village's current and future urban forestry goals. In addition to maintenance and planning needs, this report addresses the economic, environmental, and social benefits that trees provide to the Village of Massena.

Significant Findings from the Inventory

The July 2018 tree inventory included trees and stumps within Village parks as well as trees, stumps, and vacant sites along public street rights-of-way (ROW). The inventory recorded a total of 2,716 sites, which included 1,763 trees (64.9%), 9 stumps (0.3%), and 944 vacant sites (34.8%). Of the inventoried sites, 2,049 (75.4%) are located along street ROWs and 667 (24.6%) are in Village parks and open spaces. Analysis of the tree inventory found:

1. The five most common species found in Massena are Norway maple (229 trees: 13.0%); crabapple (194 trees: 11.0%); sugar maple (152 trees: 8.6%); Colorado spruce (136 trees: 7.7%); and red maple (125 trees: 7.1%).
2. The three most common young trees (under 6" DBH) are crabapple (145 trees); red maple (90 trees); and sugar maple (46 trees).
3. The three most common mature trees (over 25" DBH) are silver maple (77 trees); Norway maple (38 trees); and sugar maple (36 trees).
4. A total of 66 distinct species of trees were recorded during the inventory.
5. 90.6% of Massena's tree population is in "Fair" or better condition.
6. Trees provide approximately $198,214 in annual environmental benefits.
7. Total environmental benefits
    - Energy savings: $85,852/year.
    - Stormwater interception: valued at $22,319/year.
    - Carbon sequestration: valued at $2,091/year.
    - Improved air quality: $15,964/year.
    - Improved property value associated with aesthetics: $71,988.
8. Total replacement cost for all trees is $6,379,093.

Tree Maintenance Needs

Maintenance recommendations recorded during the tree inventory were removal (3.1%); pruning (61.8%); stump removal (0.3%); and planting (34.8%).

While tree maintenance can be very costly and time consuming, the benefits that trees provide justify the expense. Proper pruning and regular maintenance help ensure that trees provide maximum benefits throughout their life span. In addition to maximizing benefits, regular maintenance mitigates tree-related risk by removing hazardous limbs, reducing future storm damage clean-up, removing limb conflicts on sidewalks and roadways, improving the overall appearance of urban trees, and promoting proper growth patterns in young trees. Trees that pose the highest risk (Priority 1 removal and prunes) should be addressed first to properly mitigate risk and prioritize maintenance. After all Priority 1 maintenance has been completed, the Priority 2 prunes and removals should be addressed.

Several high-risk trees (Priority 1 Prune and Removal) were recorded during the inventory. These should be pruned or removed immediately to promote public safety.

Tree Removal	Priority 1 Removal = 26 trees Priority 2 Removal = 58 trees
Priority Pruning	Priority 1 Prune = 40 trees Priority 2 Prune = 158 trees
Routine Pruning	Routine Prune = 1,072 trees Training Prune = 409 trees

In addition to high priority maintenance and risk mitigation, would greatly benefit the Village of Massena. While the cycle's length may vary depending on budget and tree maintenance needs, ArborPro recommends a five-year cycle for established trees. For young trees, ArborPro recommends a three-year Young Tree Training Cycle to improve the structure, health, and longevity of these newly planted trees.

Maintaining a proactive pruning and tree training cycle means that young trees are visited every three years while established trees are pruned every five years. Massena has a considerable number of newly planted trees that would benefit greatly from a tree training cycle. Proper tree training will reduce both structural defects and maintenance needs as trees mature and become established. Investing the time and money to address these issues while trees are young will reduce future pruning costs and help ensure the longevity of newly planted trees. Long-term planning and maintenance cycles are discussed at length later in this report.

In addition to regular maintenance, tree planting is an important part of a comprehensive tree management plan. Adding new trees to the landscape is necessary to promote canopy growth, offset loss of trees due to natural mortality and other causes, and increase biodiversity.

Introduction

The Village of Massena is home to more than 10,000 full-time residents. The Village is responsible for maintaining thousands of trees in parks, public spaces, and along street ROWs. Massena's trees provide a host of benefits to both residents and visitors. The Village can only maximize these benefits when trees are properly managed for long-term health and public safety. A Tree City USA for over nine years, the Village of Massena continues to show dedication to its natural resources. In 1999, a tree inventory and management plan were created to better manage Massena's urban forest. The 2018 inventory is intended to update the previous tree inventory and revitalize Massena's commitment to maintain and grow a healthy urban forest.

Approach to Tree Management

The best approach to successfully managing an urban forest is to implement a proactive, organized program that sets goals and monitors progress. The first steps in this process are to complete a tree inventory and prioritize maintenance in order to guide short- and long-term planning. The Village can utilize these tools to establish tree care priorities, generate strategic planting plans, draft cost-effective budgets based on projected needs, and ultimately reduce costly, reactive solutions to emergency situations to a minimum.

In July of 2018, Massena worked with ArborPro to conduct a comprehensive tree inventory and develop a Tree Management Plan. This plan considers the size characteristics, condition, and species distribution of the inventoried trees and provides a prioritized system for the maintenance of all trees within the survey area.

The following tasks were completed:

- Inventory of trees, stumps, and vacant sites along street ROWs and in public parks.
- Analysis of tree inventory data.
- Development of a plan that prioritizes the recommended tree maintenance.

Tree maintenance plan addresses:

- **Results of the Inventory.**
- **Benefits of a healthy Urban Forest.**
- **Prioritization of tree maintenance.**
- **Short- and long-term goals.**

Trees are an important part of a community's green infrastructure. They are as essential as roads, bridges, or sewer mains. However, trees, unlike other types of infrastructure, perform better and gain value over time. They are the only infrastructure that improves with age. A tree management plan, like a stormwater, street, or sewer management plan, protects the important infrastructure on which we depend. The tree management plan outlines how Massena will protect and care for one component of its green infrastructure — its trees.

The management plan is divided into five sections:

- Section 1: Highlights and Results of Inventory Data
- Section 2: Benefits of a Healthy Urban Forest
- Section 3: Tree Management
- Section 4: Emerald Ash Borer Management
- Section 5: Caring for Over Mature Trees

Section 1: Highlights and Results of Inventory Data

In July of 2018, ArborPro, Inc. assigned an ISA Certified Arborist to inventory trees and vacant sites along Village street ROWs and in public parks. Of the total 2,716 sites collected within the Village of Massena, the inventory found 1,763 trees (64.9%), 9 stumps (0.3%), and 944 vacant sites (34.8%). Table 1 shows a breakdown of sites collected by area.

Area	Count	%
Street Trees	2,049	75.4%
Parks/Other	667	24.6%
Total	**2,716**	

Table 1: Sites collected by area

Methods of Data Collection

Tree inventory data were collected using ArborPro's proprietary software, ArborPro version 3.5.1. Loaded on pen-based tablets, the software is equipped with geographic information systems (GIS) and uses aerial imagery and global position system (GPS).

The following data fields were collected at each tree location:

- address
- condition
- clearance
- hardscape damage
- height
- mapping coordinates
- notes
- observations
- overhead utilities
- parkway type
- parkway size
- recommended maintanence
- side
- site number
- species
- tree diameter

Assessment of Tree Inventory Data

ArborPro uses professional judgment based on experience and industry standards to determine maintenance recommendations. Data analysis is then applied to summarize and make

generalizations about the state of the inventoried urban forest. Understanding and recognizing these trends will help guide short- and long-term management planning. The following criteria of the inventoried tree population are summarized in this section of the management plan:

- Size characteristics
- Tree condition
- Species and genus distribution

Size Characteristics

A tree's general size provides insight into its age and value as well as the overall age of the urban forest. Two size characteristics that are recognized industry-wide are height and diameter at breast height (DBH). While height is self-explanatory, DBH is determined by the diameter of the tree at 4.5 feet above grade. DBH range distribution can be used to analyze the relative age distribution of an urban forest. This allows a city to adjust their planting plans to ensure that there are enough young trees to replace aging and over-mature trees. It is important that all age classes are adequately represented throughout the urban forest to ensure a healthy, vibrant tree canopy for future generations. Figure 1 illustrates the distribution of trees by diameter class for Village of Massena.

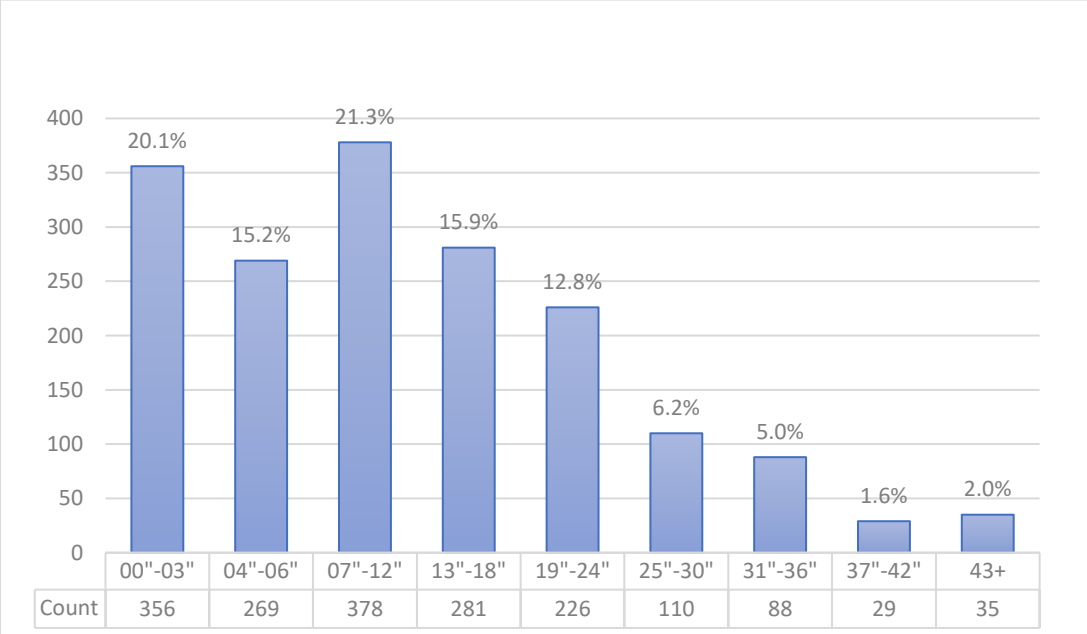


Figure 1: Diameter class distribution

Discussion

As the above graph shows, Massena has a desirable distribution of size classes throughout the Village. The diameter distribution is somewhat skewed towards young to semi-mature trees. While this is not entirely ideal, the young to semi-mature trees will grow over time and will

provide a healthy mature canopy if properly managed. **ArborPro recommends continuing to plant new trees to further improve canopy cover and air quality.**

Tree Condition

Not necessarily about desirability, tree condition is a subjective, qualitative representation of overall health, vigor, and structure. Likewise, appearance is not a complete indication of overall condition. Table 2 and Figure 2 show the number of trees recorded in each condition as well as the percentage of the total population that they represent.

Good – The tree has no major structural problems; no significant damage from diseases or pests; no significant mechanical damage; a full, balanced crown; and normal twig condition and vigor for its species. Trees in this category are considered to be 80-90% healthy.

Tree Condition	Tree Count	%
Good	868	32.0%
Fair	730	26.9%
Poor	151	5.6%
Dead	14	0.5%
Stump	9	0.3%
Vacancy	944	34.8%
Total	**2,716**	

Table 2: Tree condition by count and percentage

Fair – The tree may exhibit the following characteristics: minor structural problems and/or mechanical damage; significant damage from non-fatal or disfiguring diseases; minor crown imbalance or thin crown; minor structural imbalance; or stunted growth compared to adjacent trees. Trees in this category are considered to be 60-80% healthy.

Poor – The tree can appear healthy but may have structural defects. This classification also includes healthy trees that have unbalanced structures or have been topped. Trees in this category may also have severe mechanical damage, decay, severe crown dieback or poor vigor/failure to thrive. Trees in this category are considered to be 40-60% healthy.

Critical – The tree is in a physical state that requires immediate attention. Generally, these trees are recommended for a Priority One Removal. Trees in this category are considered to be 20-40% healthy.

Dead – This category refers only to trees that are completely dead. Trees in advanced states of decline but still alive are generally recorded as poor or critical but not dead.

Stump – These stumps interfere with pedestrian traffic or pose a tripping hazard. Stumps are not included in dead tree count.

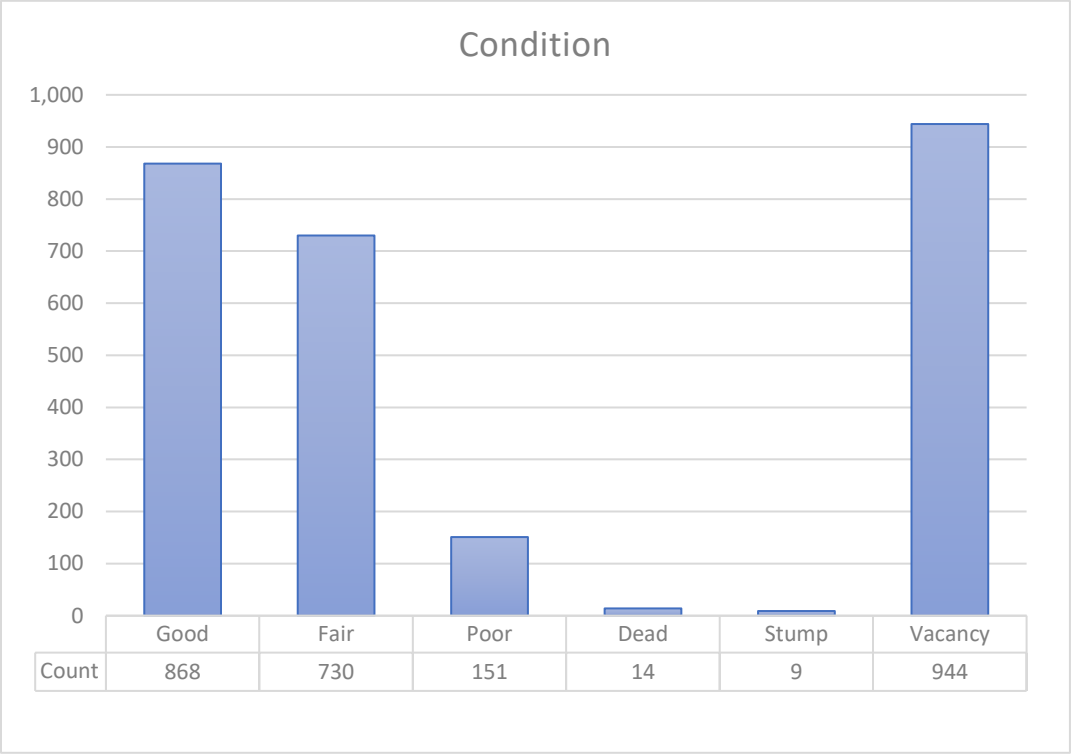


Figure 2: Tree condition by count and percentage

Discussion

ArborPro observed a majority of trees in Massena (90.6%) in either 'Fair' or better condition at the time of the inventory. This number excludes stumps and vacant sites and is used only to compare the condition of trees recorded in the inventory. Therefore, the overall health and condition of the Village's trees would be rated as Good. However, around 8.6% of the Village's trees are in poor condition and another 1% are dead. Figure 3 shows the maintenance recommendations by condition.

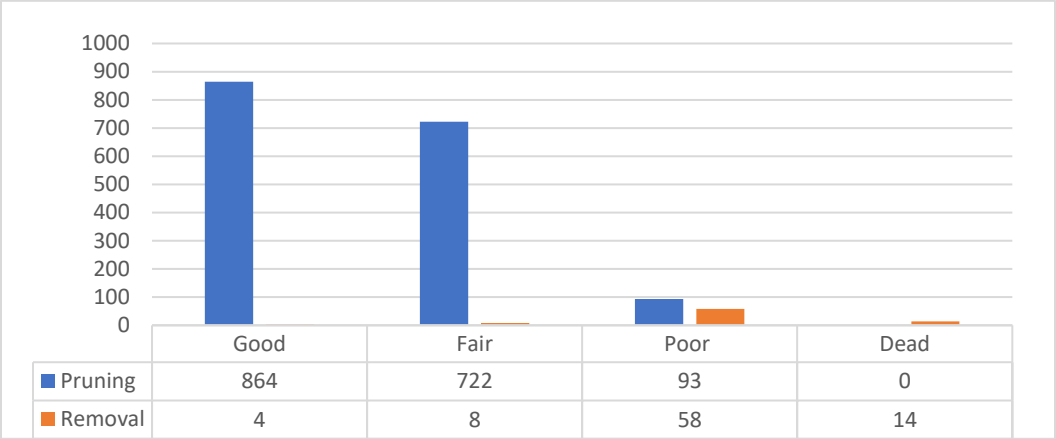


Figure 3: Maintenance recommendations by condition

Species and Genus Distribution

Understanding species and genus distribution is important when determining which species should be planted and which ones are currently overrepresented in the urban forest. Biodiversity is extremely important to the overall health and longevity of a tree population. The accepted guideline for urban biodiversity is the 10-20-30 rule: no species should represent more than 10%; no genus should represent more than 20%; and no family should represent more than 30% of the total tree population. Figure 4 shows the distribution of genera representing 2% or more of the total tree population.

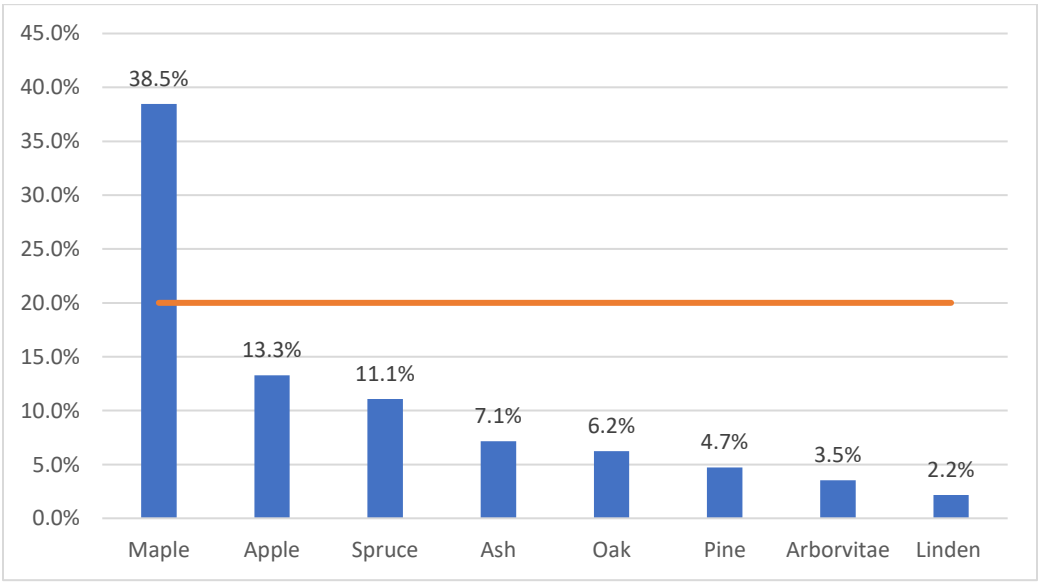


Figure 4: Genus distribution by count and percentage over 2%

Table 3 contains Massena's top 10 tree species by count and percentage of the total tree population. A full species frequency report can be found in Appendix A.

Botanical Name	Common Name	Count	%
Acer plantanoides	Norway Maple	229	13.0%
Malus floribunda	Crabapple	194	11.0%
Acer saccharum	Sugar Maple	152	8.6%
Picea pungens	Colorado Spruce	136	7.7%
Acer rubrum	Red Maple	125	7.1%
Acer saccharinum	Silver Maple	118	6.7%
Fraxinus pennsylvanica	Green Ash	91	5.2%
Pinus strobus	White Pine	77	4.4%
Thuja occidentalis	American Arborvitae	62	3.5%
Quercus rubra	Red Oak	54	3.1%

10%

Table 3: Ten most common species by percentage of total population

Discussion

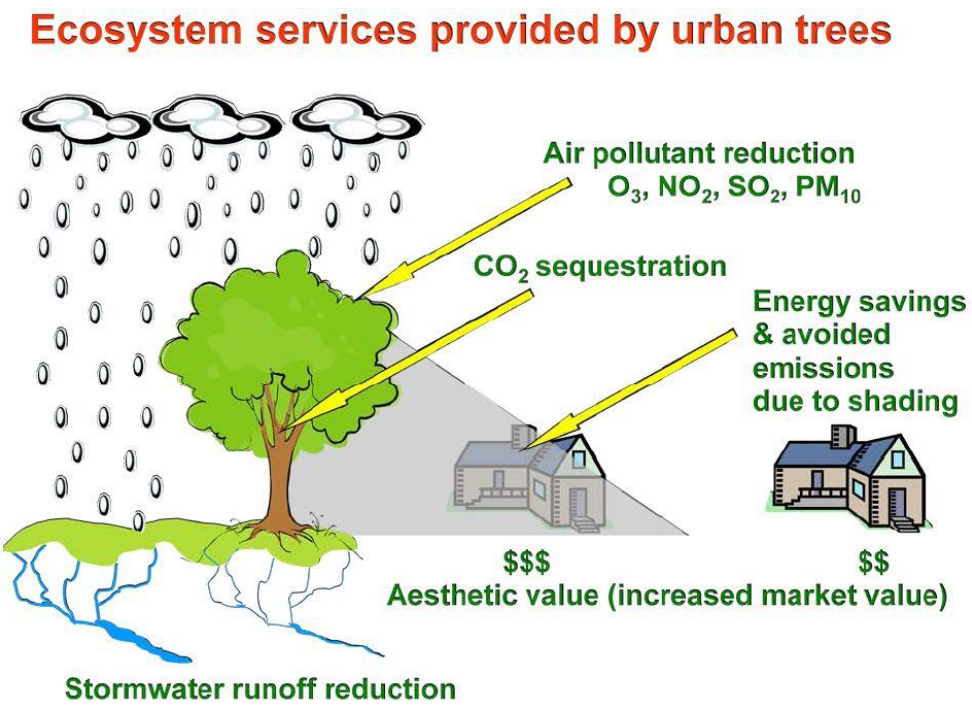
The Village of Massena maintains 66 distinct species of urban trees. The distribution of these trees across species, genus, and family trends toward ideal but could be improved over time. ArborPro recommends the Village of Massena reduce or discontinue planting Norway maple and crabapple trees as they exceed the recommended 10% threshold for a particular species. Additionally, the genus *Acer* (maples) is widely over represented throughout the Village. Maples make up 38.5% of the total tree population, which far exceeds the recommended 20% threshold for a particular genus. While it is common for most cities to have an excess of certain species, it leaves Massena susceptible to future outbreaks of insects and diseases. This risk can be mitigated by analyzing the current list of species being planted by the Village; focusing on species that do well in the area; and actively promoting biodiversity in the landscape. A list of recommended tree species for future plantings can be found in Appendix B.

Section 2: Benefits of a Healthy Urban Forest

Trees provide a host of environmental, social, and economic benefits in urban areas. When properly maintained, trees can reduce pollution, divert stormwater runoff, and lower energy costs. It is important to understand the benefits trees provide as these can offset the cost associated with tree maintenance. A properly implemented tree maintenance program will not only maximize tree benefits in the urban setting but also allow trees to provide benefits that meet or exceed the time and money invested in those maintenance activities.

ArborPro used the i-Tree Streets application to quantify the benefits provided by Massena's trees. This application uses growth and benefit models designed around predominant urban trees to calculate the specific benefits that trees provide in dollar amounts. The benefits calculated by i-Tree Streets include energy conservation, air quality improvements, carbon dioxide (CO_2)

reduction, stormwater control, and aesthetic/other. It creates annual benefit reports that demonstrate the value urban trees provide to the surrounding community.



Energy Conservation

Public trees contribute to energy conservation. In summer, their shade reduces cooling costs. In winter, they divert wind to reduce heating costs. The electricity and natural gas savings are converted into monetary values to illustrate the annual energy savings that trees provide. Massena's trees account for a savings of $85,852 in energy consumption each year.

Zone	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Tree Numbers	% of Total $	Avg. $/Tree
Street Trees	86.49	12,116.74	31,245.30	43,993.38	56,110.12	(N/A)	62.28	65.36	51.10
Parks	34.55	4,841.04	12,661.50	17,827.40	22,668.44	(N/A)	25.98	26.40	49.49
Other	10.93	1,531.52	3,936.08	5,541.99	7,073.51	(N/A)	11.74	8.24	34.17
Total	**131.97**	**18,489.30**	**47,842.88**	**67,362.77**	**85,852.07**	**(N/A)**	**100.00**	**100.00**	**48.70**

Air Quality

Trees improve air quality by removing a number of pollutants from the atmosphere, including ozone, nitrogen dioxide, and particulate matter. The estimated value of pollutants removed by the inventoried tree population each year is $15,964.

Species	Deposition O3 (lb)	Deposition NO2 (lb)	Deposition PM10 (lb)	Deposition SO2 (lb)	Total Deposition ($)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($)
Street Trees	527.70	231.06	271.76	95.65	6,073.90	736.00	47.62	28.20	379.55	5,159.97	- 311.64	- 719.89	2,005.90	10,513.97
Parks	203.65	87.95	102.08	34.73	2,307.57	295.87	19.16	11.36	151.65	2,071.27	- 85.61	- 197.75	820.85	4,181.09
Other	61.00	26.72	31.89	11.45	707.50	92.89	6.01	3.56	47.97	651.48	- 38.93	- 89.92	242.57	1,269.07
Citywide Total	**792.35**	**345.74**	**405.73**	**141.83**	**9,088.97**	**1,124.77**	**72.79**	**43.12**	**579.18**	**7,882.72**	**- 436.17**	**- 1,007.56**	**3,069.32**	**15,964.13**

Carbon Dioxide Sequestration

It is well known that trees absorb carbon dioxide and release oxygen into the atmosphere as a product of photosynthesis. Trees ultimately store the carbon absorbed during this process in their wood. Massena's inventoried tree population sequesters an amount of carbon valued at $2,091 annually.

Zone	Sequestered (lb)	Sequestered ($)	Decomposition Release(lb)	Maintenance Release (lb)	Total Release ($)	Avoided (lb)	Avoided ($)	Net Total (lb)	Total ($)
Zone 2	216,220.92	713.53	- 42,121.39	- 12,133.09	- 179.04	260,495.50	859.64	422,461.94	1,394.12
Zone 3	82,060.39	270.80	- 15,971.35	- 4,698.12	- 68.21	104,076.59	343.45	165,467.52	546.04
Zone 4	19,657.68	64.87	- 5,265.82	- 1,480.37	- 22.26	32,925.87	108.66	45,837.36	151.26
Citywide Total	**317,938.99**	**1,049.20**	**- 63,358.57**	**- 18,311.58**	**- 269.51**	**397,497.97**	**1,311.74**	**633,766.82**	**2,091.43**

Stormwater Control

Trees reduce the costs associated with diverting stormwater by intercepting rainfall before it hits the ground and enters the storm runoff system. This greatly reduces the strain placed on public stormwater runoff systems and can represent a significant monetary savings by reducing the amount of infrastructure needed to divert stormwater throughout the Village. The estimated savings for the Village in the management of stormwater runoff is $22,319 annually.

Zone	Total rainfall interception(Gal)	Total ($)	Standard Error	% of Tree Numbers	% of Total $	Avg. $/tree
Street Trees	1,874,586.29	14,996.69	(N/A)	62.28	67.19	13.66
Parks	717,873.28	5,742.99	(N/A)	25.98	25.73	12.54
Other	197,440.50	1,579.52	(N/A)	11.74	7.08	7.63
Citywide total	**2,789,900.07**	**22,319.20**	**(N/A)**	**100.00**	**100.00**	**12.66**

Aesthetic/Other

Trees provide many social and economic benefits that are classified as aesthetic/other in the i-Tree Streets application. The major economic benefit in this category is increased property values. Trees contribute to higher property values when compared to similar properties that do not have trees. The major social benefits provided by trees are lower crime rates, improved mental health, greater time spent in businesses with tree lined streets, and higher productivity in the workplace when a view of nature is available. Massena's inventoried trees contribute $71,988 annually in aesthetic/other benefits.

Zone	Total ($)	Standard Error	% of Tree Numbers	% of Total ($)	Avg $/tree
Zone 2	46,027.97	(N/A)	62.28	63.94	41.92
Zone 3	19,644.21	(N/A)	25.98	27.29	42.89
Zone 4	6,315.37	(N/A)	11.74	8.77	30.51
Citywide Total	**71,987.55**	**(N/A)**	**100.00**	**100.00**	**40.83**

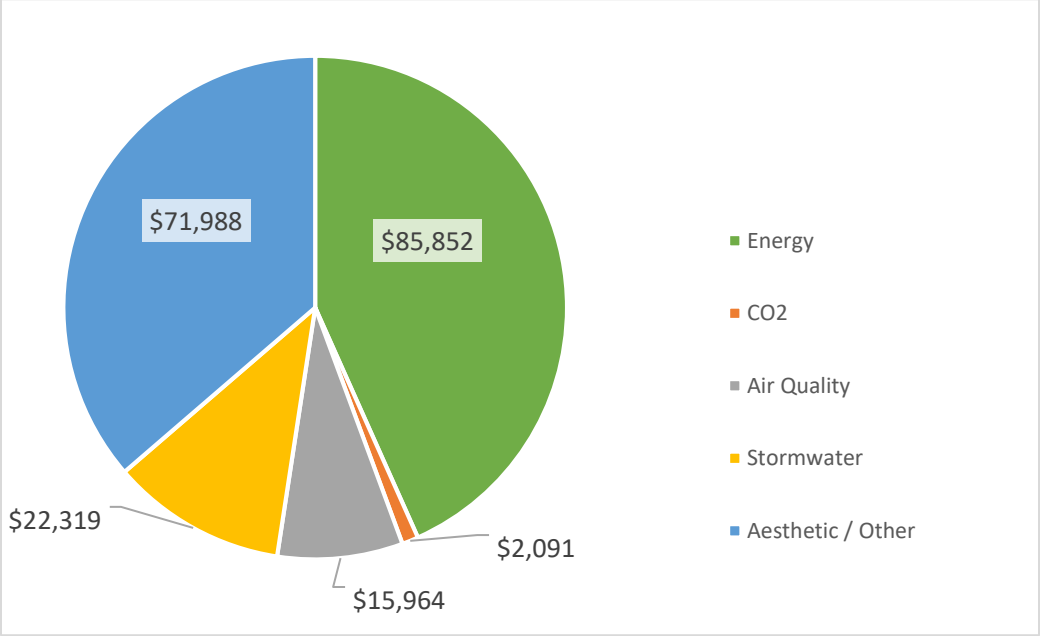


Figure 5: Annual monetary benefits provided by Massena's trees

Total Replacement Value

In addition to Environmental Benefits, the Village can consider the Total Replacement Value for its urban forest. Total Replacement Value is the amount of money it would take to completely replace the existing urban forest with trees of the same size. While this is a scenario that will likely never happen, it gives the Village the specific dollar value of its trees in their current state. Replacement value differs from Environmental Benefits in that it shows how much the trees are

worth instead of the dollar values that they provide in benefits. For example, a mature sugar maple could provide $2,100 in environmental benefits by reducing stormwater runoff, improving air quality, etc. but the total cost of replacing an 18" DBH sugar maple would be $24,270. According to i-Tree Streets, the total replacement cost for Massena's trees is $3,081,725. Table 4 shows the breakdown of Replacement Value by Diameter Class.

DBH Class	Replacement Value
00"-03"	$39,300
04"-06"	$137,676
07"-12"	$635,492
13"-18"	$1,115,843
19"-24"	$1,360,385
25"-30"	$1,047,180
31"-36"	$1,081,428
37"-42"	$447,175
43+	$514,614
Total	**$6,379,093**

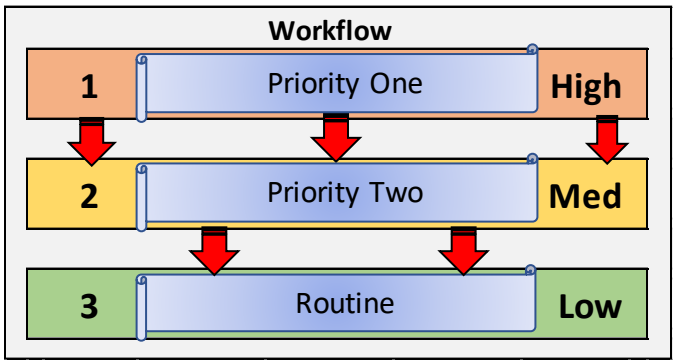
Table 4: Replacement value by diameter class

Section 3: Tree Management

The purpose of this tree management plan is to provide a framework for the short- and long-term maintenance of Massena's urban trees. It is also complements and enhances the existing maintenance program. The main goal of this five-year program is to reduce risk by prioritizing maintenance while establishing a proactive pruning schedule.

Also important, the tree inventory data provides a snapshot of the current conditions of Massena's trees. Prioritized tree maintenance will help reduce the overall risk of tree related catastrophes. However, note that conditions can change drastically. Routine maintenance should be coupled with identifying and monitoring trees that may become hazardous in the future. This report focuses on identifying and mitigating the trees that were deemed maintenance prioritizations at the time of the inventory, while planning for the future through proactive maintenance.

Recommended Maintenance and Tree Risk



A description and summary of the maintenance recommendations for the entire inventory are below. As the labels imply, Priority 1 pruning and removals pose the highest risk and should be dealt with first. Priority 2 pruning and removals should be considered after the Village has completed all Priority 1 pruning and removals. The remaining trees will be considered as either routine pruning or young tree training activities that can be proactively pruned on a five-year and three-year basis respectively. The following is a description for each maintenance recommendation.

Maintenance	Tree Count	%
Priority 1 Prune	40	1.5%
Priority 1 Removal	26	1.0%
Priority 2 Prune	158	5.8%
Priority 2 Removal	58	2.1%
Routine Prune	1072	39.5%
Training Prune	409	15.1%
Stump Removal	9	0.3%
Plant Tree	944	34.8%
Total	**2,716**	

Table 5: Recommended maintenance by tree count

Priority 1 Prune Trees requiring Priority 1 pruning are recommended for trimming to remove hazardous deadwood, hangers, or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead, dying, or diseased limbs or leaders greater than four inches in diameter.

Priority 1 Removal – Trees designated for removal have defects which cannot be cost-effectively or practically treated. A majority of trees in this category have a large percentage of dead crown and pose an elevated level of risk for failure. This category includes trees with any hazards that cannot be mitigated with pruning and pose potential dangers to persons or property as well as potential liabilities. Large dead and dying trees that are high liability risks are included in this category.

Priority 2 Prune – These trees are recommended for trimming to remove deadwood, correct structural problems, or resolve clearance issues. These trees do not pose as much risk as Priority 1 trees.

Priority 2 Removal – These trees should be removed but do not pose a liability as great as the first priority. This category would need attention as soon as Priority 1 trees are removed.

Routine Prune – These trees require routine horticultural pruning to correct structural problems or growth patterns, which would eventually obstruct traffic, grow into utility wires, or interfere with buildings. Trees in this category are large enough to require bucket truck access or manual climbing.

Training Prune – Young, large-growing trees that are still small must be pruned to correct or eliminate weak, interfering, or objectionable branches in order to minimize future maintenance requirements. A person standing on the ground can work these trees, which are up to 12 feet in height, with a pole-pruner.

Stump Removal – Typically located in high use areas, these stumps interfere with pedestrian traffic and pose a tripping hazard.

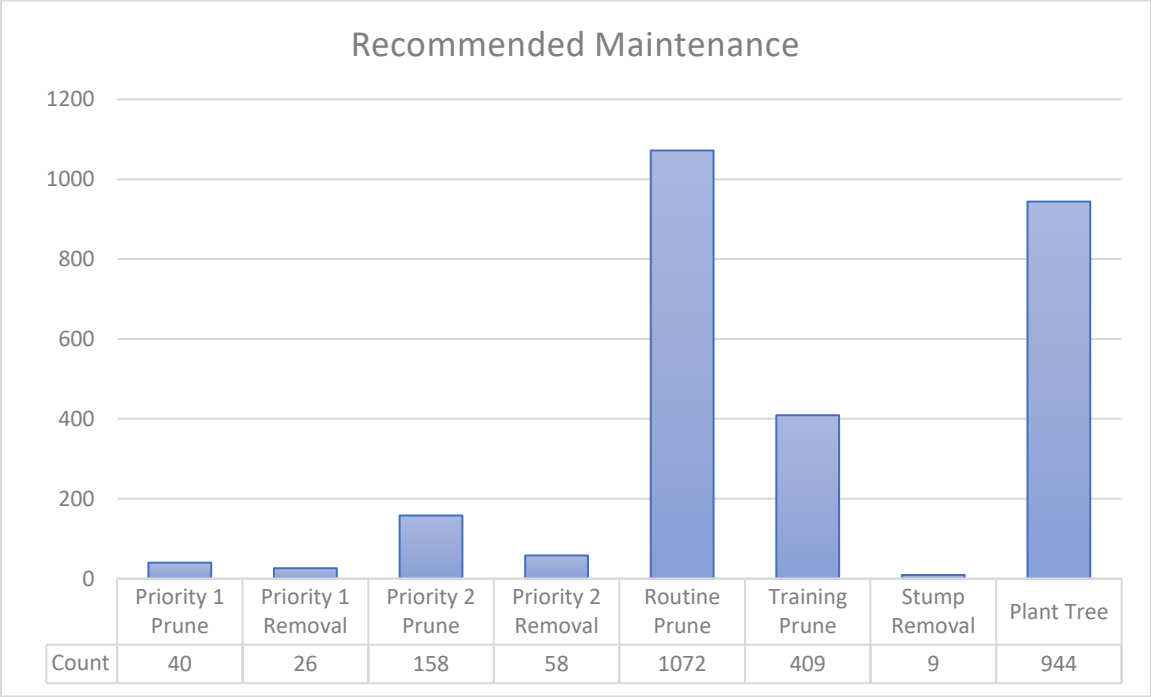


Figure 6: Breakdown of recommended maintenance

Priority and Proactive Maintenance

Not all communities are able to implement a proactive maintenance schedule and often rely on an on-demand response to hazardous or urgent situations. **However, a proactive program systematically reduces risk while improving the overall health of urban trees**. A proactive program will also help stabilize maintenance budgets and improve long-term planning.

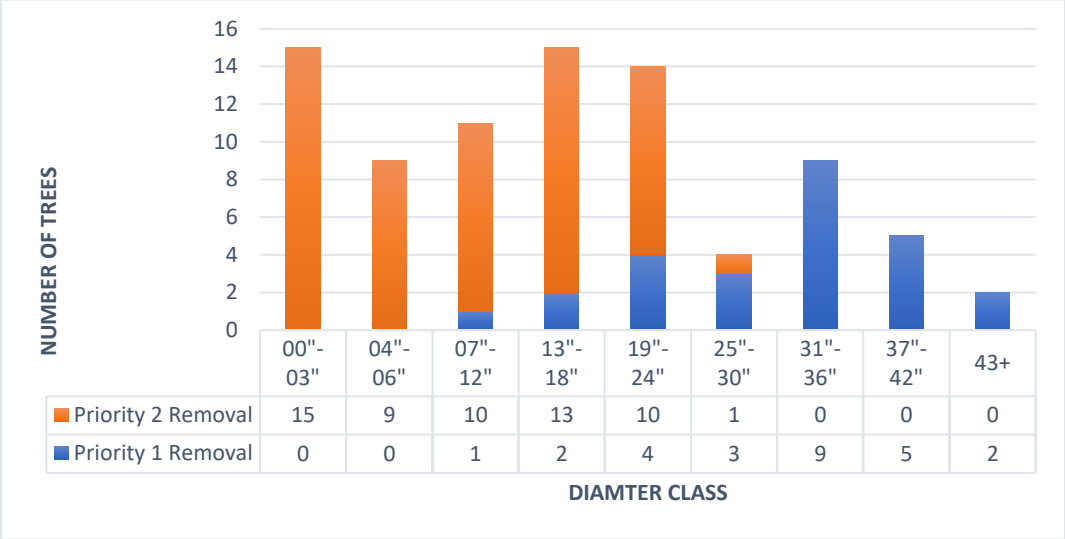
In this plan, we chose to use a five-year cycle for routine tree trimming and a three-year cycle for young tree training. As previously explained, this involves pruning each tree every five years while conducting structural pruning on young trees every three years. These activities are considered proactive maintenance while trees in the Priority 1 and 2 categories are priority maintenance.

Priority Maintenance

Prioritizing maintenance is one of the main objectives of a tree inventory. It allows tree work to be assigned based on observed risk over multiple years. Once prioritized, the work can be approached systematically to mitigate risk by addressing the highest priority trees first. In this plan, all trees designated as Priority 1 prunes and removals will be considered first. Priority 2 prunes and removals will be considered after all Priority 1 trees have been addressed. Trees in the Routine Prune and Training Prune category will be entered into the proactive maintenance schedule.

Priority Removals

While tree removal is often a last resort, it cannot be avoided in some situations. In parks and other high-use areas, creating a safe environment is more important than preserving hazard trees that may have a social or cultural significance.



	00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+
Priority 2 Removal	15	9	10	13	10	1	0	0	0
Priority 1 Removal	0	0	1	2	4	3	9	5	2

Figure 7: Priority removals by diameter class

Trees in the Priority 1 Removal category pose a risk that cannot be mitigated through pruning. ArborPro recommends that these trees be removed in the first year of the five-year maintenance plan. The inventory assessed a total of 26 trees as Priority 1 Removals. Figure 8 shows a breakdown of the number of Priority 1 removals by diameter class.

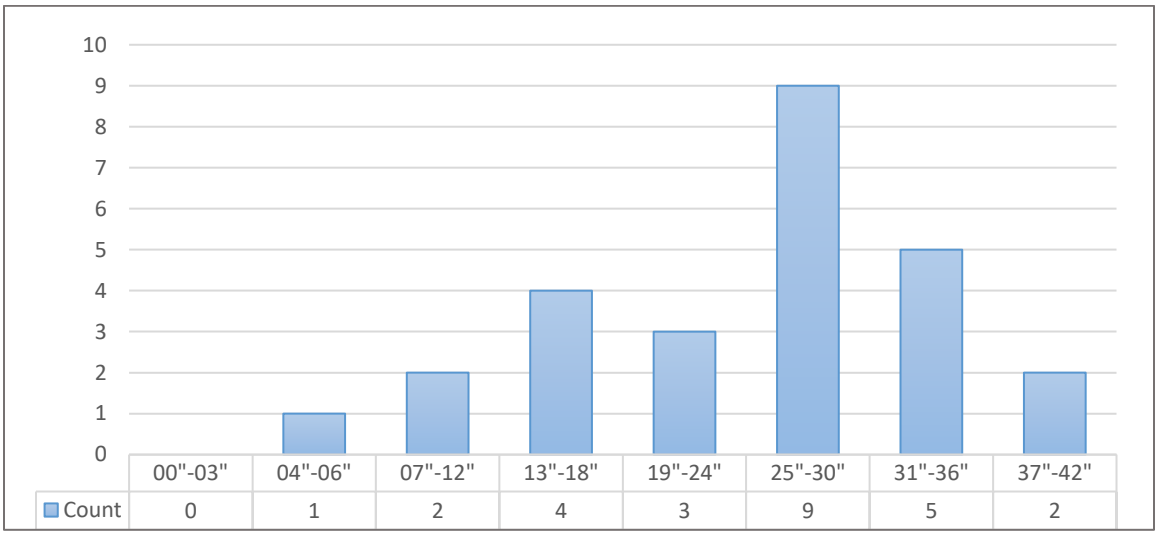


Figure 8: Priority 1 Removals by diameter class

Because Priority 2 Removals do not pose significant risk to people or property, they should be addressed after all Priority 1 Removals have been completed. ArborPro recommends that these trees be removed in the second year of the five-year maintenance plan. The inventory found a total of 58 Priority 2 Removals. Figure 9 shows a breakdown of the number of Priority 2 removals by diameter class.

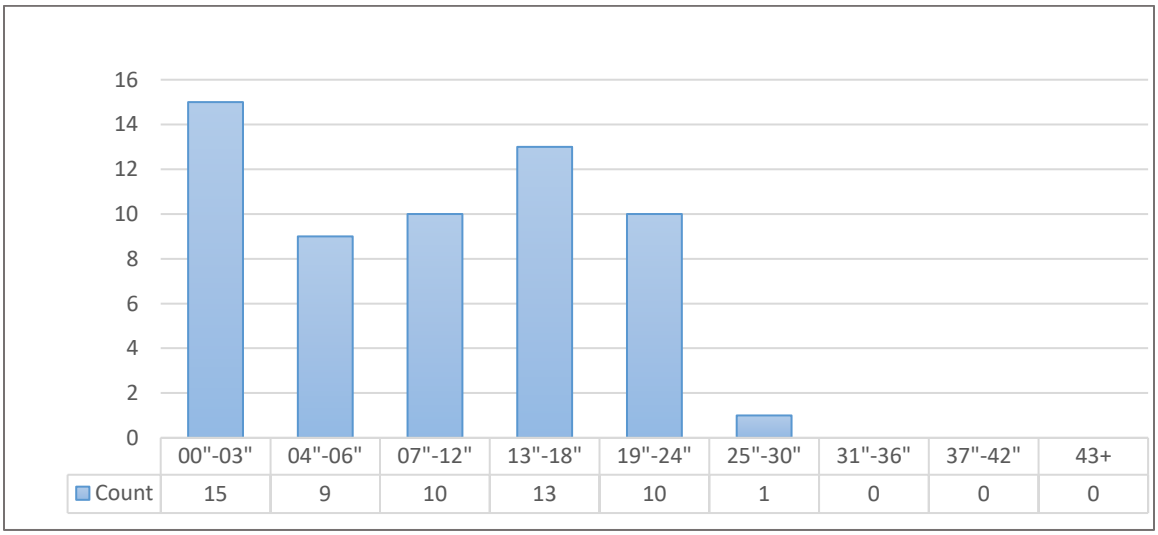


Figure 9: Priority 2 Removals by diameter class

Priority Pruning

Priority pruning includes trees in the Priority 1 and Priority 2 categories that require pruning to mitigate risk and remove obstructions to sidewalks, roads, etc. Figure 10 shows all of the trees and their respective diameter classes for these two categories.

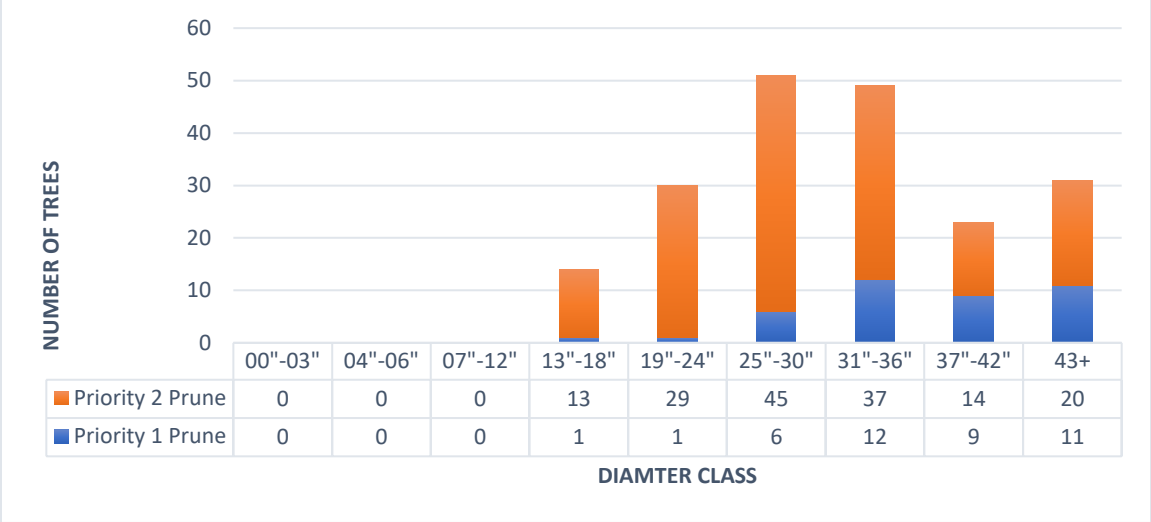


Figure 10: Priority Pruning by diameter class

Trees in the Priority 1 Prune category pose a high risk to public safety that can be mitigated through pruning. ArborPro recommends that these trees be pruned in the first year of the five-year maintenance plan. The inventory found a total of 40 Priority 1 Prunes. Figure 11 shows a breakdown of the number of Priority 1 Prunes by diameter class.

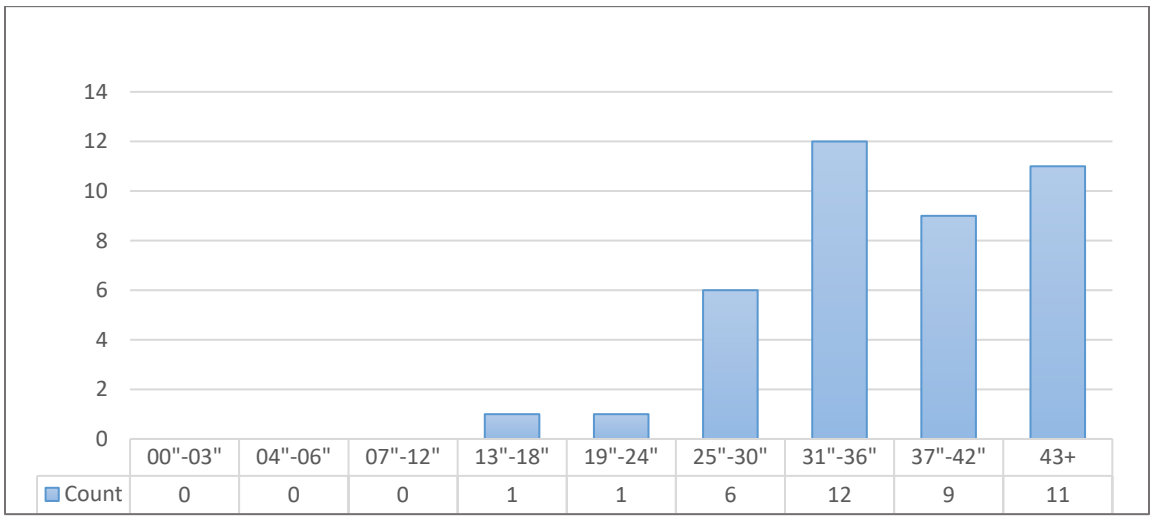


Figure 11: Priority 1 Prunes by diameter class

Trees in the Priority 2 Prune category pose a limited risk to public safety that can mitigated through pruning. ArborPro recommends that these trees be pruned in the second and third year of the five-year maintenance plan. The inventory found a total of 158 Priority 2 Prunes. Figure 12 shows a breakdown of the number of Priority 2 Prunes by diameter class.

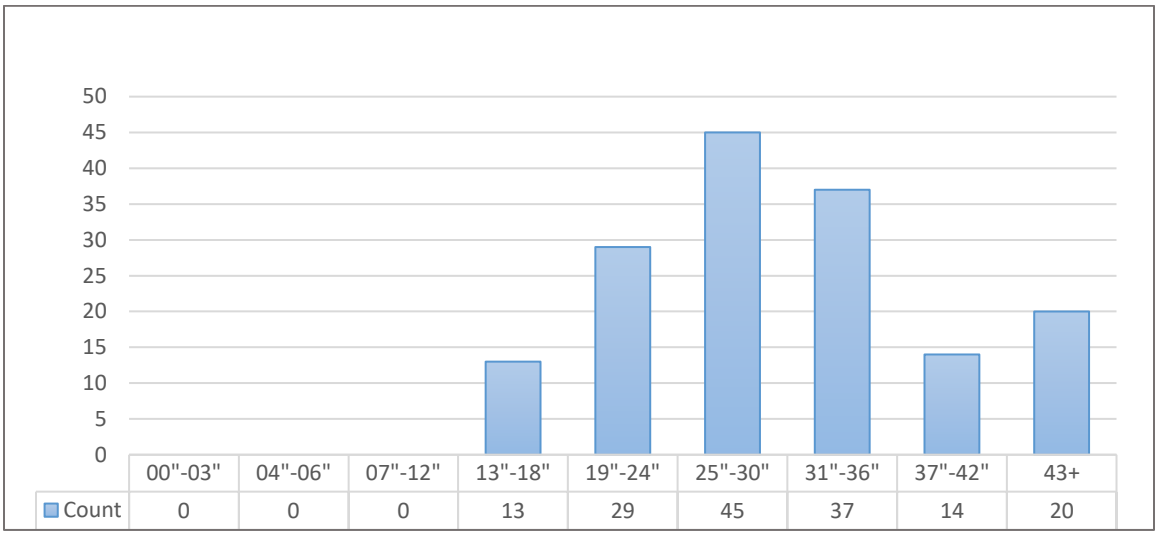


Figure 12: Priority 2 Prunes by diameter class

Proactive Maintenance

Proactive tree maintenance requires that trees are systematically managed over time. To accomplish this, trees are placed in a pruning cycle, which routinely addresses tree health and form. While implementing a routine pruning cycle may be costly, it will reduce both risk and maintenance costs over time. Maintaining a routine pruning cycle will allow the Village to address minor maintenance needs on a regular basis. Over time, this will both reduce the number of emergency situations and allow the Village to regularly monitor potential problem trees.

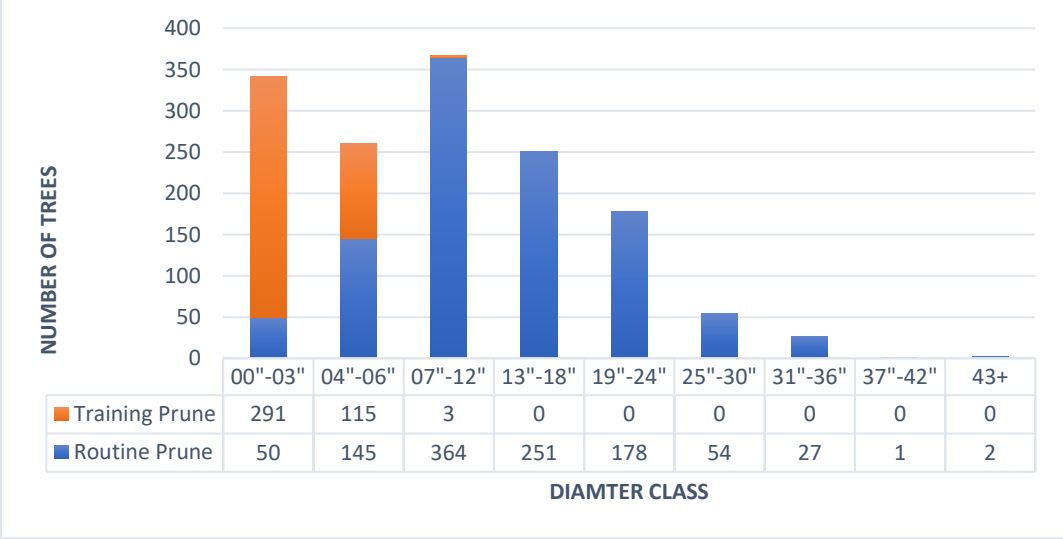


Figure 13: Proactive Maintenance by diameter class

Routine Pruning Cycle

The routine pruning cycle includes all trees that were entered as a Routine Prune during the inventory. While these trees pose little to no risk, they would benefit from regular pruning to mitigate tree related risk by: removing hazardous limbs; reducing future storm damage clean-up; removing limb conflicts on sidewalks and roadways; improving the overall appearance of urban trees; and promoting proper growth patterns in young trees. The length of a routine pruning cycle depends on the size of the tree population.

ArborPro recommends a five-year cycle for the trees included in the inventory. Approximately one-fifth of the tree population will need to be pruned each year. This number will fluctuate as trees are removed, priority maintenance is completed, and young trees grow into maturity. The recommended routine pruning cycle referenced in this report and five-year maintenance plan only considers trees placed in the Routine Prune category at the time of the inventory.

The 2018 tree inventory found a total of 1,072 trees that would benefit from routine pruning. Approximately 214 trees (one-fifth of the total population) will need to be pruned each year, starting in year three of the five-year maintenance plan. Figure 14 shows a breakdown of the number of Routine Prunes by diameter class.

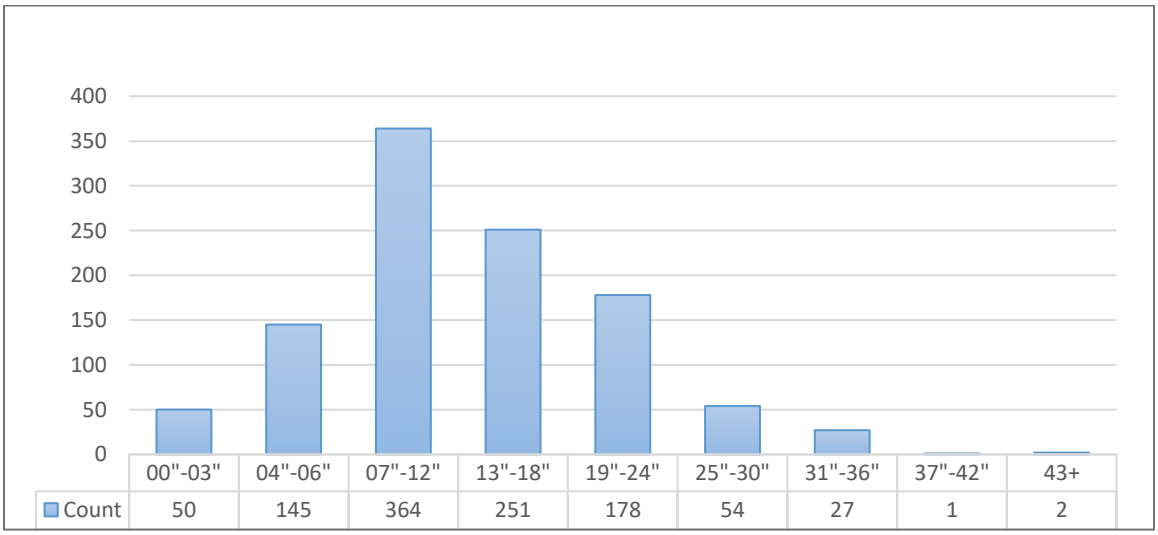


Figure 14: Routine Prunes by diameter class

Young Tree Training Cycle

Planting trees is necessary to increase canopy cover and to replace trees lost to natural causes (expected to be 1–3% per year)

Although the Village of Massena has an adequate number of newly planted trees, planting additional trees will help promote a healthy urban forest for years to come. It is important to remember that older, more mature trees provide the most benefits to the community. The Village must promote tree preservation and proactive tree care to ensure older trees survive as long as possible. One of Massena's objectives is to have an uneven-aged distribution of trees at the street, neighborhood, and citywide levels. **ArborPro recommends that Massena support a strong planting and maintenance program to ensure that young, healthy trees are in place to fill in gaps in tree canopy and provide for gradual succession of older tree**s. Tree planting and tree care will allow the distribution to normalize over time.

Trees included in the Young Tree Training Cycle are typically less than 8 inches DBH and will benefit from structural pruning. Young trees tend to have higher growth rate and therefore require a shorter pruning cycle than mature trees. For this reason, ArborPro recommends a three-year cycle for young tree training.

Establishing a training cycle for young trees is equally important for Massena's parks. A significant amount of money has been spent to plant new trees in many of the parks. Investing time and money to properly prune these trees will greatly reduce future structural problems and maintenance issues. Figure 15 illustrates the number of trees that would benefit from young tree training.

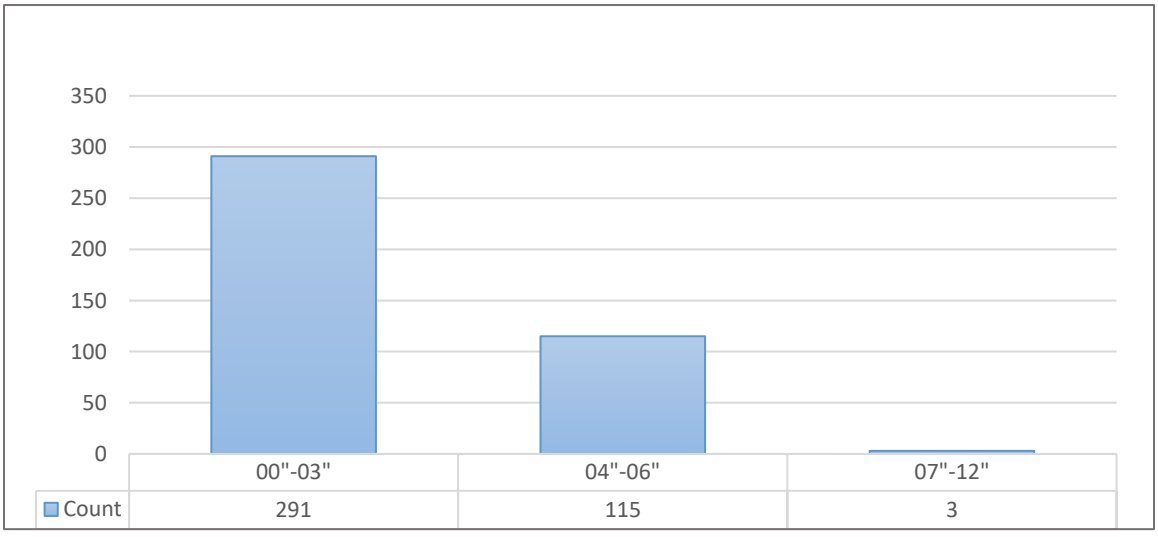


Figure 15: Number of trees in the Young Tree Training Cycle

For the sake of this management plan, the three-year Young Tree Training Cycle should begin on year three of the maintenance plan and only include existing young trees. One-third of young trees should be structurally pruned each year. In reality, the number of trees in the training cycle will fluctuate as new trees are planted and as older plantings become established and no longer require training. Therefore, the amount of money spent and the number of trees in the training cycle will not remain constant.

The inventory found a total of 409 trees under 8 inches DBH that would benefit from structural pruning. Approximately 136 trees (one-third of the total population) should be trained each year beginning in year three of the five-year maintenance plan. However, if budget allows, the Young Tree Training Cycle could be moved to year one to benefit all of the recently planted trees.

Importance of Tree Maintenance

As naturally occurring, organic organisms, trees are often treated as though they do not need human interference to thrive. While this may be true in undisturbed forests, it is certainly not true for urban trees. Urban trees require regular maintenance to maximize the benefits they provide. When maintenance is neglected, trees can pose a serious risk to people and property. Trees in poor health also represent a liability to the agencies tasked to maintain them. In addition, trees in urban environments are subject to many more stressors than trees in forests or rural areas. Urban trees grow in restricted spaces, are exposed to pollutants and road salt, are subject to soil compaction, and can be easily damaged by mowers or other maintenance activities.

Proactive pruning and hazard mitigation greatly reduce the risk of tree failure and subsequent damage. In addition, proactive maintenance will prolong the life of a tree and reduce future maintenance costs. A well-maintained urban forest will be less susceptible to disease and disaster. Trees that are regularly pruned and maintained will not be as prone to disease as trees that have been neglected. When trees are pruned on a regular basis and removed when they become diseased or hazardous, some of the pathways for potential pests and diseases are eliminated. Many of these pests and diseases attack stressed trees or enter through open wounds or dead branches. Therefore, a well-maintained urban forest will be less likely to succumb to pest infestations. In addition, species selection is an important part of maintaining a healthy urban forest. Careful species selection will increase biodiversity and reduce the risk of a catastrophic pest infestation. Most pests have preferred hosts (EAB for example) so increasing biodiversity will limit the number of species that are susceptible to individual pests.

While it is impossible to predict when a natural disaster will strike, a level of disaster preparedness can be achieved through regular maintenance. Trees that have been pruned to remove dead or hanging limbs will be less likely to experience branch failure in high winds, thus reducing storm damage clean-up. Also, removing diseased or declining trees from the landscape will reduce the risk of whole tree failure in major storm events.

The importance of urban tree maintenance cannot be overstated. A well-maintained urban forest will provide the community maximum benefits while reducing the inherent risk of tree failure.

Importance of Updating Inventory Data

Trees are living organisms that change with time. Inventory data, however, is static and will not reflect the current state of an urban forest unless it is continually updated. Whenever a tree is removed, inspected, pruned or planted, it should be updated in the inventory. If inventory data is not properly maintained, it will quickly become obsolete and ultimately be of little use. Massena has invested significant time and money in surveying its trees. The only way to protect this investment is to continually update the inventory.

Vacant Sites and Tree Planting

During the inventory, a total of 944 vacant sites were recorded in areas suitable for planting new trees. ArborPro broke down the vacant sites into three categories based on the size of planting space.

- Small Vacant Site – 4'to 6' planting space or any vacant site under electric utilities.
- Medium Vacant Site – 6' to 8' planting space.
- Large Vacant Site – 8'+ planting space.

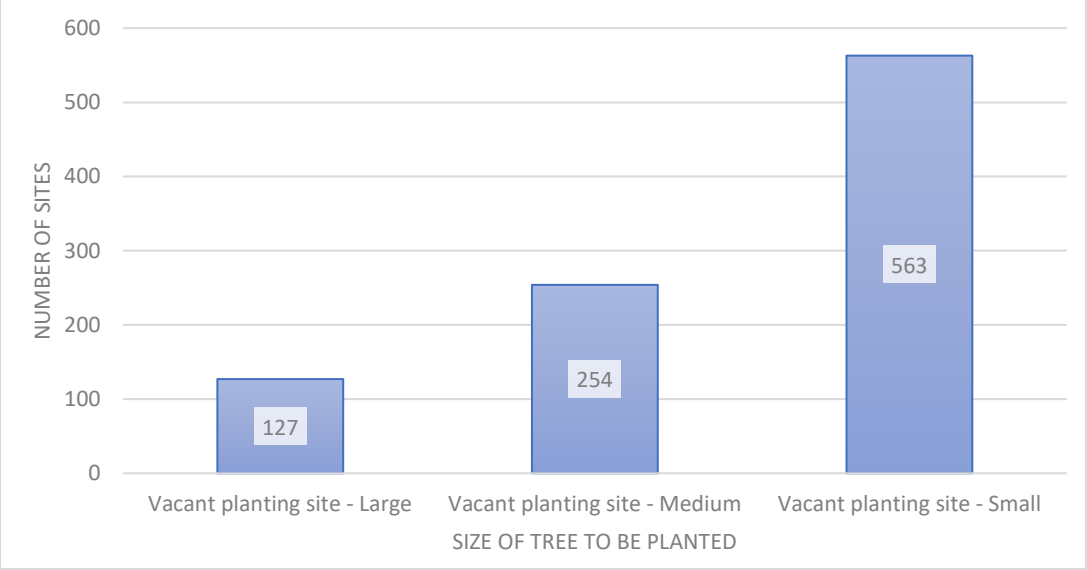


Figure 16: Vacant sites by size

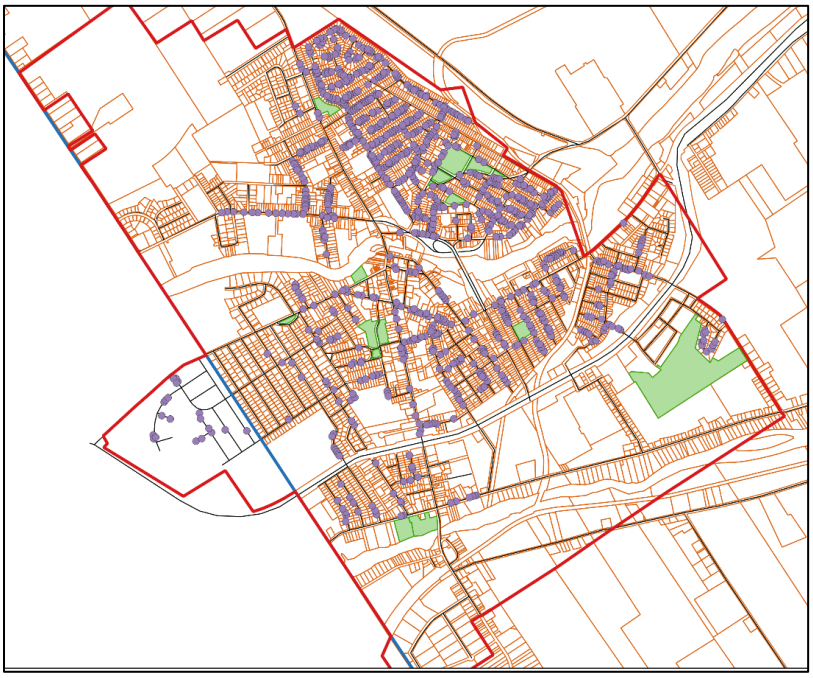


Figure 17: Vacant site locations

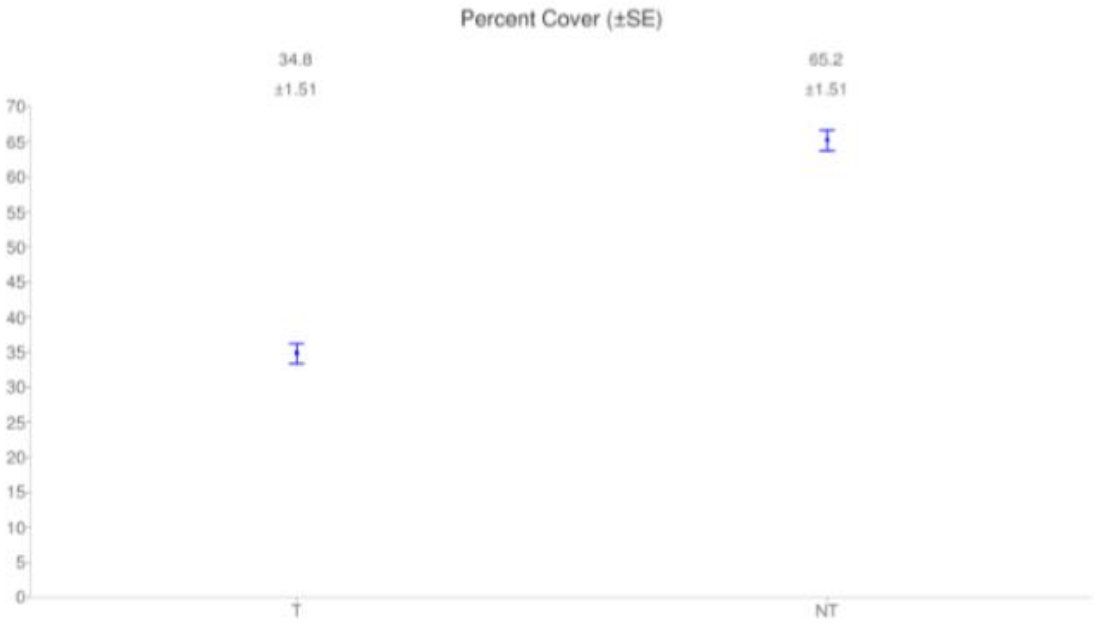
It is important that the Village of Massena implement and support a comprehensive planting plan. Areas within the Village, for example, the Northeast side of town, have very few street trees and a significant number of vacant sites. Planting new trees would greatly benefit these neighborhoods while increasing the entire Village's overall canopy cover.

In addition to recording vacancies during the inventory, the i-Tree Canopy software quantified the total canopy cover within the Village limits. To calculate the canopy cover for the entire survey area, this software uses a series of sample points that are visually designated as either Tree or Non-Tree. ArborPro analyzed a total of 1,000 sample sites to determine that the canopy cover for the Village of Massena was 34.8%, with a standard error of +/- 1.51%.

i-Tree Canopy v6.1

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 9/17/18



Cover Class	Description	Abbr.	Points	% Cover
Tree	Tree, non-shrub	T	348	34.8 ±1.51
Non-Tree	All other surfaces	NT	652	65.2 ±1.51

Abbr.	Benefit Description	Value (USD)	±SE	Amount	±SE
CO	Carbon Monoxide removed annually	50.14 USD	±2.17	820.13 lb	±35.50
NO2	Nitrogen Dioxide removed annually	144.30 USD	±6.25	1.83 T	±0.08
O3	Ozone removed annually	6,935.33 USD	±300.19	20.54 T	±0.89
PM2.5	Particulate Matter less than 2.5 microns removed annually	15,468.39 USD	±669.54	1.04 T	±0.04
SO2	Sulfur Dioxide removed annually	21.82 USD	±0.94	1,673.19 lb	±72.42
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	2,705.29 USD	±117.10	5.16 T	±0.22
CO2seq	Carbon Dioxide sequestered annually in trees	145,579.75 USD	±6,301.37	4,129.29 T	±178.74
CO2stor	Carbon Dioxide stored in trees (Note: this benefit is not an annual rate)	4,664,617.86 USD	±201,906.47	132,309.41 T	±5,726.97

Canopy cover percentage is a good metric for setting goals and monitoring total canopy growth in the Village. Many major cities use the goal of 40% canopy cover as their guideline for canopy growth. ArborPro recommends that the Village of Massena use this metric in conjunction with available vacant sites to guide an annual planting plan. This plan will depend on the budget and availability of grant money for new tree planting.

Parkway Type and Vacant Sites

Throughout the Village, vacant sites were located in various parkway types. Currently, planting trees in tree lawns is not a common practice in the Village due to concerns regarding sidewalk damage, salt spray, snow accumulation, etc. However, plenty of young trees planted in tree lawns are surviving and becoming established with no major issues. ArborPro recommends taking advantage of open tree lawns to plant new trees along Village street ROWs.

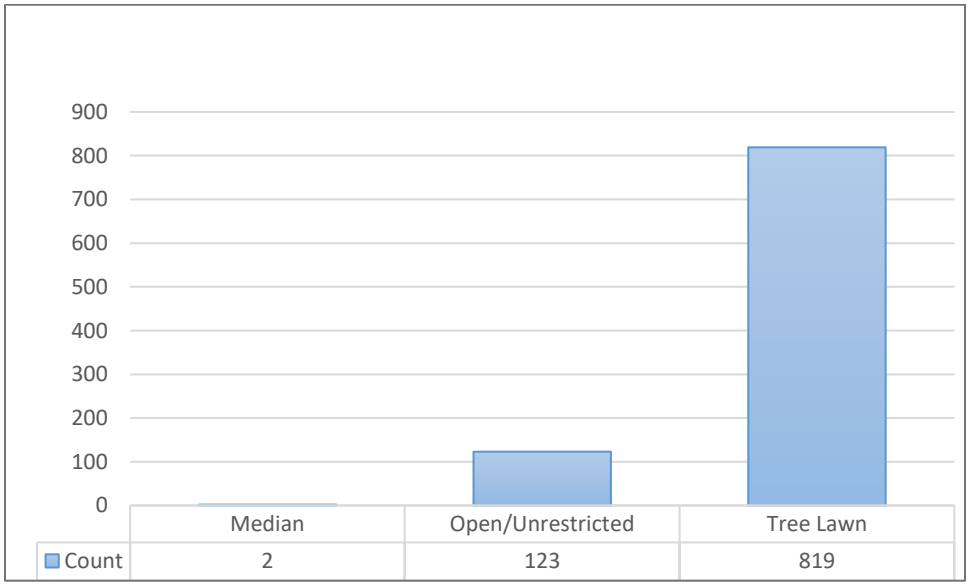


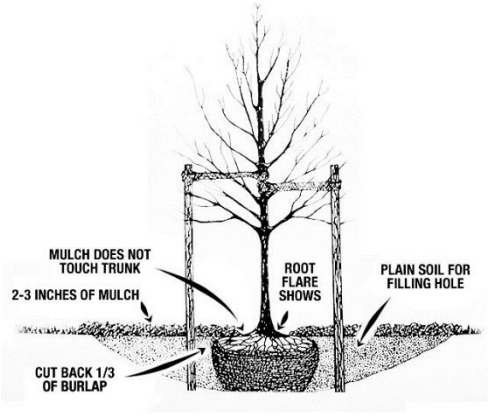
Figure 18: Parkway type for vacant sites

Tree Planting

Tree planting is an important part of maintaining and cultivating a healthy urban forest. Newly planted trees will become the foundation of the urban tree canopy as older trees start to die and are removed from the landscape. However, tree planting is only a worthwhile activity when trees are properly selected, properly planted, and properly cared for as they become established. If trees are not properly planted and maintained, they will become a future problem and will not provide the benefits associated with healthy, mature trees.

When planting new trees, consider the purpose of the tree that is being planted.

- Assess the site conditions and note any growth limitations or space requirements (e.g., overhead utilities, proximity to buildings, existing tree canopy, etc.).
- Select the best species for the site conditions.
- Ensure that the tree is properly planted.
- Have a plan in place for follow-up tree care.
- Monitor and record how newly planted species react to the site conditions and incorporate this information into future planting plans.



Tips for Planting Trees

To ensure that newly planted trees will survive the planting process:

- Handle trees with care during the transportation process. Avoid any damage to the trunk or branches when loading and unloading.
- Avoid storing trees for lengthy periods before planting. Make sure the root ball remains moist if they are not being immediately planted.
- Dig the hole 2 to 3 times the size of the root ball, using hand tools when possible. When augers are used, the sides of the hole can become compacted and will negatively affect root growth.
- Fill the hole with native soil when possible. If the native soil is undesirable, add soil amendments to improve soil structure. Gently tamp down the soil. Add water to promote a proper mixture of air, water, and soil.
- Stake trees for the first year of growth to protect against wind and provide a barrier against mechanical damage from mowing.
- Add a thin layer of mulch, making sure not to let mulch build up around the trunk. Over-mulching is extremely common and will do irreversible damage in the long run.

Newly Planted Tree Maintenance

Proper young tree maintenance is just as important as proper planting techniques. If trees are not cared for after planting, they have little chance of surviving and becoming established. Newly planted trees will require maintenance for several years after planting.

Water

Watering newly planted trees is the most important key to their survival. It will typically take at least two months of watering for a new tree to become established. The time of year and species

of tree will dictate how much water should be applied after this period. The general rule is to keep soil moist in order to promote root growth.

Mulching

Applying mulch to newly planted trees has many benefits. Mulch will help retain soil moisture and regulate temperatures around the root ball. However, over-mulching will have devastating effects on the tree's long-term health. It is extremely important to avoid piling mulch around the trunk. Spread 3 to 4 inches of mulch around newly planted trees while ensuring that the root flare is visible, and mulch is not touching the trunk.

Caring for Established Young Trees

Trees will take a few years to become established after planting. The general rule: to become established, trees take one year for each inch in caliper when planted. (Caliper is the diameter at 6 inches above ground.) For example, if you are planting a 2-inch caliper tree, it will take 2 years for the roots to become fully established. Established trees still require regular watering and will need structural pruning as they begin to grow. Structural pruning establishes a central leader, removes dead or diseased branches, removes crossing limbs, and creates an overall structure that will benefit the tree into maturity.

Maintenance Cycle

Utilizing data from the 2018 tree inventory, ArborPro developed an annual maintenance schedule detailing the number and type of tasks to be completed each year. Budget projections were calculated by using average cost of tree work based on diameter class. These costs are not specific to the Village of Massena; they simply represent average costs based on industry knowledge and experience.

Maintenance Plan

This summary includes tree data collected within the Village limits during the inventory. It represents the total cost of maintaining all inventoried trees. A summary of the maintenance schedule is presented here. The complete table of estimated costs for this five-year plan can be found in Appendix C.

To implement this maintenance schedule, the budget should be no less than $42,085 for Year One; $37,845 for Year Two; $44,295 for Year Three; $26,620 for Year Four; and $26,410 for Year Five of the maintenance plan. While the Village of Massena may not be able to implement a proactive maintenance cycle immediately, it is an important goal to work towards. At very least, the Priority Maintenance should be budgeted for and completed within the first three years. ArborPro recommends using the five-year maintenance plan as soon as possible.

2018

Count	Activity	Estimated Cost
26	Priority 1 Removal	$26,875
40	Priority 1 Prune	$15,210
Total Cost		**$ 42,085**

2019

Count	Activity	Estimated Cost
58	Priority 2 Removal	$14,230
81	Priority 2 Prune	$22,920
9	Stump Removal	$695
Total Cost		**$ 37,845**

2020

Count	Activity	Estimated Cost
77	Priority 2 Prune	$22,100
211	Routine Prune	$22,195
Total Cost		**$ 44,295**

2021

Count	Activity	Estimated Cost
215	Routine Prune	$23,465
136	Young Tree Train	$3,155
Total Cost		**$ 26,620**

2022

Count	Activity	Estimated Cost
215	Routine Prune	$23,255
136	Young Tree Train	$3,155
Total Cost		**$ 26,410**

Total Five Year Cost	**$ 177,255**

Figure 19: Five-year maintenance plan

Section 4: Emerald Ash Borer Management Strategies

Emerald Ash Borer

Emerald ash borer (EAB) is a small insect native to Asia. Since its introduction to the North America in the 1990s through solid wood packing materials near Detroit, Michigan, it has spread to 29 states, largely concentrated in the Midwest and Northeast. Because EAB has been confirmed in New York and surrounding states, Massena will eventually need a management strategy. EAB attacks all species of ash trees by boring into the tree and disrupting nutrient flow, ultimately causing the tree to die. Constantly moving to new areas, the insect is responsible for killing hundreds of millions of trees throughout North America. The following image shows the distribution of EAB infestations by state.

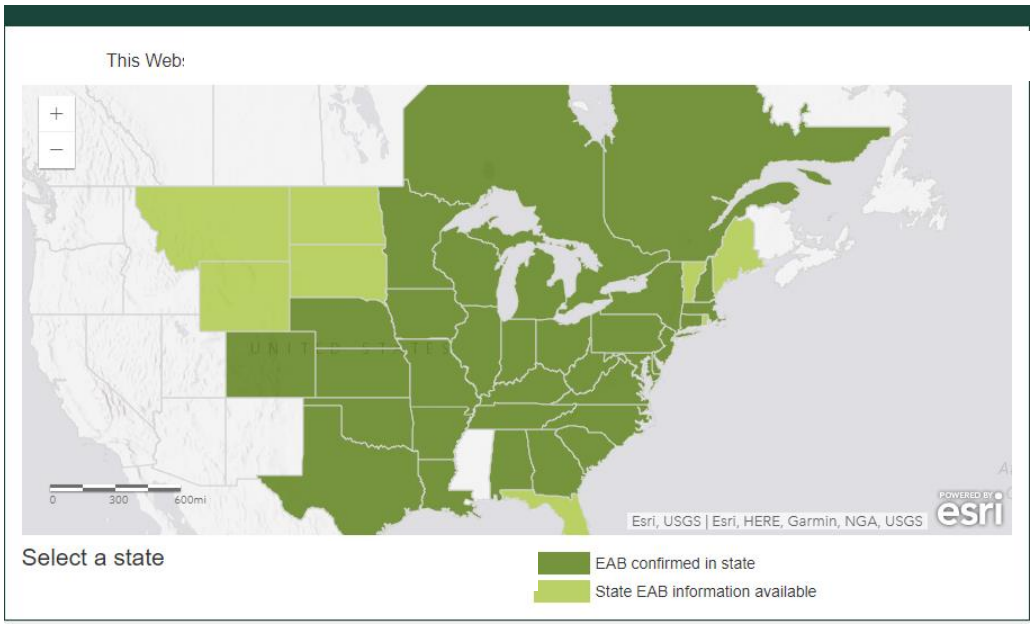


Figure 20: Emerald ash borer Infestations by state

Identification

The adult beetle is 3/8- to 5/8-inches long and is metallic green in color. The adult beetles may be seen from late May to early August when they emerge from the trees to feed on leaves. Leaf

feeding does not significantly damage the trees but is an important part of the insect's life-cycle. After feeding, the female beetles lay eggs in the branches and trunk of ash trees. The eggs hatch into larvae that bore into the wood beneath the bark. White in color, the larvae can only be seen by removing the bark to expose galleries beneath. The larvae feed on the inner bark and phloem tissue, which disrupts the flow of nutrients to the tree and does the most significant damage throughout the life-cycle of the insect.

EAB Gallery
Photograph courtesy of Missouri Department of Conservation

Very difficult to detect, EAB often goes unnoticed for years before the infestations are confirmed. This is because the insect spends a majority of its life-cycle inside the tree. Early warning signs of an infestation are: yellowing/thinning of the foliage; canopy dieback; drooping branches in the upper canopy; woodpecker damage to the bark; and the presence of epicormic shoots at the tree base or in branches. The most easily identifiable sign of an infestation are the D-shaped exit holes left by the beetles when they emerge from the tree as adults. However, during early phases of infestation, these exit holes are often high up in the canopy and not easily identifiable by the naked eye. Once a tree is infested, it will often die within two years if not treated with insecticide.

Ash Population

Massena is fortunate to have a relatively small ash population compared to other cities. The inventory found 126 ash trees within the survey area, which account for 7.1% of the total inventoried population. Of the 126 trees, 35 are white ash (Fraxinus americana) and 91 are green ash (Fraxinus pennsylvanica). Table 9 shows a breakdown of ash trees by diameter class and condition.

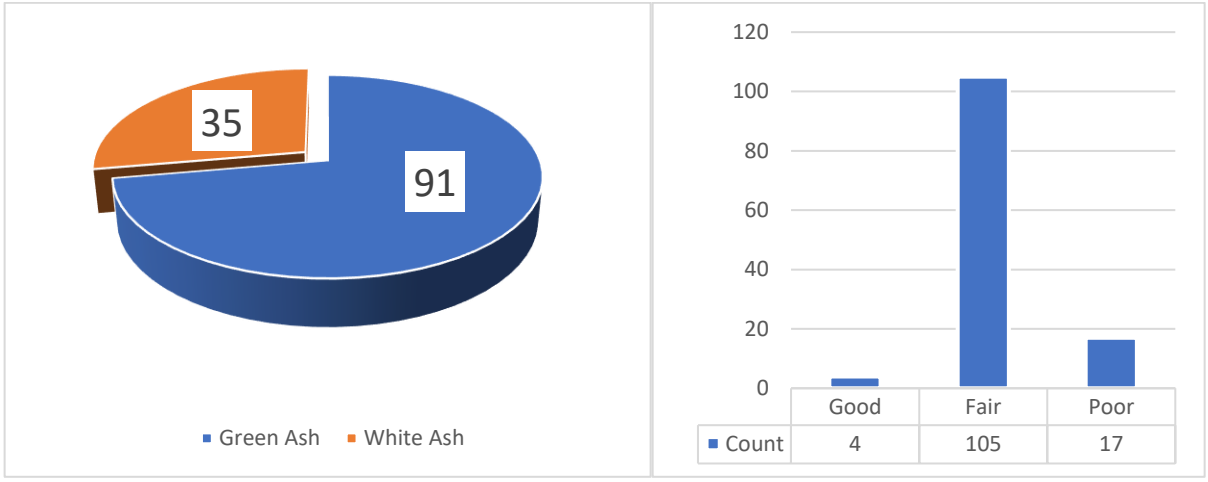


Figure 21: Species and condition of ash trees

		Diameter Class									
		00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+	**Total**
Condition Class	Good	0	1	2	1	0	0	0	0	0	**4**
	Fair	1	2	13	22	39	18	6	3	1	**105**
	Poor	0	0	2	7	4	1	2	1	0	**17**
	Total	**1**	**3**	**17**	**30**	**43**	**19**	**8**	**4**	**1**	**126**

Figure 22: Diameter class of ash trees by condition

A majority of Massena's ash trees are over 12 inches in diameter and in 'Fair' condition. Small diameter ash trees in poor condition are good candidates for removal. These trees would require treatment for decades and are already showing signs of decline.

EAB Management Options

The three basic options for EAB management are (1) treat all ash trees, (2) remove all ash trees, or (3) a combination of treatment and removal. When deciding which approach to take, it is important to consider a number of factors that will affect Massena's health, safety, and financial stability. For example, treating all of the ash trees would be extremely costly and would not benefit trees that are already in active decline due to EAB infestation. Removing all of the ash trees will greatly reduce the risk of EAB related tree failure but involves not only the cost of removing the trees but the cost of replanting to compensate for canopy loss. When removing ash trees, it is extremely important that these trees be replaced. A well thought out planting plan should be in place before starting any removal operations. A mix of removals and treatment tends to be the best option. However, careful consideration should be used to determine which trees will be retained and receive treatment.

Strategy 1: Treat All Ash Trees in 'Fair' and 'Good' Condition

Treating all of Massena's ash trees will reduce the annual mortality rate and stabilize removals. Treatment also allows these trees to continue providing benefits to the community into the foreseeable future. Initially, treatment will be cheaper than removing all of the ash trees, but it represents a recurring cost. EAB trunk injections need to be repeated every two years to remain effective, a process which becomes quite costly.

Because they will not likely benefit from treatment, trees in poor condition have been recommended for removal. In addition, ArborPro recommends removing ash trees under 6 inches in DBH as they would need to be treated for their entire life span. These trees are also very easily and cost-effectively removed due to their size.

In order to estimate treatment costs, the general price of $7 per inch DBH was used for trees 10 inches and smaller and $10 per inch DBH for trees 11 inches or larger (at the time of the inventory).

Removal										
	00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+	**Total**
Good	0	1	0	0	0	0	0	0	0	**1**
Fair	1	2	0	0	0	0	0	0	0	**3**
Poor	0	0	2	7	4	1	2	1	0	**17**
	1	**3**	**2**	**7**	**4**	**1**	**2**	**1**	**0**	**21**
Treatment										
Good	0	0	2	1	0	0	0	0	0	**3**
Fair	0	0	13	22	39	18	6	3	1	**102**
Poor	0	0	0	0	0	0	0	0	0	**0**
	0	**0**	**15**	**23**	**39**	**18**	**6**	**3**	**1**	**105**

Activity	DBH	Cost/Tree	# of Trees	Total Cost
Removal	00"-03"	$25	1	$25
	04"-06"	$105	3	$315
	07"-12"	$220	2	$440
	13"-18"	$355	7	$2,485
	19"-24"	$525	4	$2,100
	25"-30"	$845	1	$845
	31"-36"	$1,140	2	$2,280
	37"-42"	$1,470	1	$1,470
	43+	$1,850	0	$0
Total			**21**	**$9,960**
Treatment	00"-03"	$7/Inch	0	$0
	04"-06"	$7/Inch	0	$0
	07"-12"	$7/Inch	15	$1,347
	13"-18"	$10/inch	23	$3,550
	19"-24"	$10/inch	39	$8,170
	25"-30"	$10/inch	18	$4,920
	31"-36"	$10/inch	6	$2,020
	37"-42"	$10/inch	3	$1,120
	43+	$10/inch	1	$430
Total			**105**	**$21,557**

*treatment is a recurring cost every two years

Figure 23: Cost of removal and treatment for ash trees

Strategy 2: Remove All Ash Trees

This strategy involves removing and replacing all of the 126 inventoried ash trees. This would represent a significant cost upfront while removing all of the trees in "Good" and "Fair" condition, trees that are still providing benefits. While this option will greatly reduce the risk of damage and/or death due to whole tree failure, it will significantly decrease the total canopy cover in Massena. If this strategy is implemented, it is extremely important to develop a plan to replace every tree is removed. This requires a detailed, well thought out planting plan that will promote biodiversity and compensate for the loss of canopy cover.

Removal										
	00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+	**Total**
Good	0	1	2	1	0	0	0	0	0	**4**
Fair	1	2	13	22	39	18	6	3	1	**105**
Poor	0	0	2	7	4	1	2	1	0	**17**
	1	**3**	**17**	**30**	**43**	**19**	**8**	**4**	**1**	**126**

Activity	DBH	Cost/Tree	# of Trees	Total Cost
Removal	00"-03"	$25	1	$25
	04"-06"	$105	3	$315
	07"-12"	$220	17	$3,740
	13"-18"	$355	30	$10,650
	19"-24"	$525	43	$22,575
	25"-30"	$845	19	$16,055
	31"-36"	$1,140	8	$9,120
	37"-42"	$1,470	4	$5,880
	43+	$1,850	1	$1,850
Total			**126**	**$70,210**

Figure 24: Cost of removal for ash trees

Strategy 3: Combination of Treatment and Removal

Often the best strategy and most cost-effective in the long run, this strategy involves treating all of the ash trees over 6 inches DBH in "Good" condition and half of the trees in "Fair" condition while removing the remaining trees in "Fair" condition and all of the trees in "Poor" and "Dead" condition. To implement this strategy, 55 trees would be treated while 71 would be removed.

Removal										
	00"-03"	04"-06"	07"-12"	13"-18"	19"-24"	25"-30"	31"-36"	37"-42"	43+	**Total**
Good	0	1	0	0	0	0	0	0	0	**1**
Fair	1	2	7	11	19	9	3	1	0	**53**
Poor	0	0	2	7	4	1	2	1	0	**17**
	1	**3**	**9**	**18**	**23**	**10**	**5**	**2**	**0**	**71**
Treatment										
Good	0	0	2	1	0	0	0	0	0	**3**
Fair	0	0	6	11	20	9	3	2	1	**52**
Poor	0	0	0	0	0	0	0	0	0	**0**
	0	**0**	**8**	**12**	**20**	**9**	**3**	**2**	**1**	**55**

Activity	DBH	Cost/Tree	# of Trees	Total Cost
Removal	00"-03"	$25	1	$25
	04"-06"	$105	3	$315
	07"-12"	$220	9	$1,980
	13"-18"	$355	18	$6,390
	19"-24"	$525	23	$12,075
	25"-30"	$845	10	$8,450
	31"-36"	$1,140	5	$5,700
	37"-42"	$1,470	2	$2,940
	43+	$1,850	0	$0
Total			**71**	**$37,875**
Treatment	00"-03"	$7/Inch	0	$0
	04"-06"	$7/Inch	0	$0
	07"-12"	$7/Inch	8	$834
	13"-18"	$10/inch	12	$2,010
	19"-24"	$10/inch	20	$4,210
	25"-30"	$10/inch	9	$2,480
	31"-36"	$10/inch	3	$1,000
	37"-42"	$10/inch	2	$750
	43+	$10/inch	1	$1
Total			**55**	**$11,285**

*treatment is a recurring cost every two years

Figure 25: Cost of removal and treatment for ash trees

It is important that Massena implement an EAB management strategy. Having a proactive management strategy that fits the needs of both the Village and surrounding community will greatly reduce the financial burden of an EAB infestation.

Section 5: Caring for Over Mature Trees

Bur Oak on Main Street

Caring for trees in a municipal setting can be complicated. In particular, the care of older trees that have a cultural significance can be difficult due to the public perception of pruning or removing such a prominent tree. The Village of Massena is responsible for maintaining a 64" DBH bur oak located at 72 Main Street. This tree has been providing shade and other benefits to the residents of Massena for many decades. It will require special care and monitoring for the remainder of its life.

Maintaining such a significant tree in the landscape will require more than just pruning or removal. To keep residents informed and involved, public outreach component should be a part of any major maintenance activity.

Figure 26: Location of mature bur oak

Overall, this tree is in relatively fair shape for its age. It does have visible signs of decline, but they are consistent with the age of the tree and how trees typically respond to environmental stressors over time.

Once the crown of a mature tree reaches the optimum size for its species, it stops getting taller and only grows in diameter or girth. The amount of food produced by the tree through photosynthesis will even out and then begin to decline. As the food supply declines, the tree will start to lose branches as it spreads the diminished resources throughout the tree.

Essentially, the tree is finding a new balance between woody growth and leaf production to fit the decreasing flow of nutrients. This process is call *retrenchment* and is a natural part of aging. Trees in this state are not necessarily dying and can remain viable for decades in this condition.

The bur oak on Main Street should be regularly monitored and assessed by a qualified arborist. ArborPro recommends taking a soil sample to see if the tree could benefit from fertilization. It is important to do a full analysis before starting to fertilize the tree to make sure that it will be beneficial.

Any pruning activities should be limited to crown cleaning or reduction to remove deadwood. Large cuts on a tree of this age will be difficult for the tree to heal and should be avoided if

possible. As can be seen in the picture on the right, there are many dead branches throughout the crown that could be removed without causing major damage to the tree.

In addition to pruning and fertilization, there are some minor pockets of decay near the base of the tree that should be inspected on a regular basis. The decay did not appear to be pervasive but no special equipment was used to assess the extent of the decay.

Conclusions

Properly managing urban trees requires planning, communication, public support, and adequate funding. For these reasons, it is complicated and can only be accomplished through a well-defined vision for the future. The combination of priority and proactive maintenance detailed in this Tree Management Plan will create a framework for short- and long-term management that will help ensure a healthy, vibrant tree canopy for Massena's future generations. Using this plan, Massena will be able to succeed at the important tasks of balancing its residents' needs with a knowledge and understanding of tree management that creates a safe, enjoyable environment for everyone in the Village.

Appendix A – Species Distribution

Botanical Name	Common Name	Count
Abies balsamea	Balsam Fir	3
Acer negundo	Box Elder	52
Acer plantanoides	Norway Maple	229
Acer rubrum	Red Maple	125
Acer saccharinum	Silver Maple	118
Acer saccharum	Sugar Maple	152
Acer x freemanii	Freeman Maple	2
Aesculus hippocastanum	Common Horsechestnut	1
Amelanchier canadensis	Canadian Serviceberry	7
Betula nigra	River Birch	1
Betula papyrifera	Paper Birch	9
Betula pendula	European White Birch	1
Betula populifolia	Gray Birch	13
Carpinus caroliniana	American Hornbeam	5
Carya cordiformis	Bitternut Hickory	5
Carya ovata	Shagbark Hickory	1
Cladrastis kentukea	American Yellowwood	1
Crataegus crus-galli inermis	Thornless Hawthorn	17
Fagus grandifolia	American Beech	1
Fraxinus americana	White Ash	35
Fraxinus pennsylvanica	Green Ash	91
Ginkgo biloba	Maidenhair Tree	6
Gleditsia triacanthos forma inermis	Thornless Honey Locust	33
Juglans nigra	Black Walnut	4
Juniperus virginiana	Eastern Red Cedar	1
Larix laricina	Tamarack	1
Malus domestica	Edible Apple Species	12
Malus floribunda	Crabapple	194
Malus 'Prairie Fire'	Prairie Fire Crabapple	28
Ostrya virginiana	American Hophornbeam	1
Picea abies	Norway Spruce	31
Picea glauca	White Spruce	28
Picea pungens	Colorado Spruce	136
Pinus nigra	Austrian Black Pine	3
Pinus strobus	White Pine	77
Pinus sylvestris	Scotch Pine	3
Populus alba	White Poplar	1
Populus balsamifera	Balsam Poplar	1
Populus deltoides	Cottonwood	16

Populus tremuloides	Quaking Aspen	1
Prunus cerasifera	Purple-leaf Plum	13
Prunus domestica	Plum	4
Prunus serotine	Eastern Black Cherry	2
Prunus serrulata	Japanese Flowering Cherry	8
Prunus serrulata “Kwanzan”	“Kwanzan” Flowering Cherry	2
Prunus yeodensis	Yoshino Cherry	1
Pseudotsuga menziesii	Douglas Fir	7
Pyrus calleryana	Ornamental Pear	4
Quercus alba	White Oak	6
Quercus bicolor	Swamp White Oak	12
Quercus macrocarpa	Bur Oak	34
Quercus robur	English Oak	4
Quercus rubra	Red Oak	54
Rhamnus cathartica	Common Buckthorn	2
Rhus typhina	Staghorn Sumac	2
Robinia pseudoacacia	Black Locust	9
Salix nigra	Black Willow	3
Sorbus americana	American Mountain Ash	2
Stump	Stump	9
Syringa reticulata	Japanese Tree Lilac	10
Syringa vulgaris	Common Lilac	4
Thuja occidentalis	American Arborvitae	62
Tilia Americana	American Linden	4
Tilia cordata	Little-Leaf Linden	34
Tsuga canadensis	Eastern Hemlock	9
Ulmus americana	American Elm	19
Ulmus pumila	Siberian Elm	6
Vacant planting site - Large	Vacant planting site - Large	127
Vacant planting site - Medium	Vacant planting site - Medium	254
Vacant planting site - Small	Vacant planting site - Small	563

Appendix B – Suggested Species List for New Plantings

Small to Medium Trees	
Botanical Name	**Common Name**
Acer ginnala	Amur Maple
Acer tataricum	Tatarian Maple
Amelanchier species	Serviceberry Varieties
Carpinus caroliniana	American Hornbeam
Maackia amurensis	Amur Maackia
Malus species (upright varieties)	Upright Flowering Crabapples
Prunus virginiana “Canada Red Select”	Canada Red Select Cherry
Sorbus thuringiaca fastigiata	Columnar Oakleaf Mountain Ash
Syringa reticulata (varieties)	Japanese Tree Lilac
Cornus mas	Cornelian Cherry Dogwood
Carpinus caroliniana	American Hornbeam
Cercis canadensis	Eastern Redbud
Maclura pomifera “White Shield”	Osage Orange “White Shield”

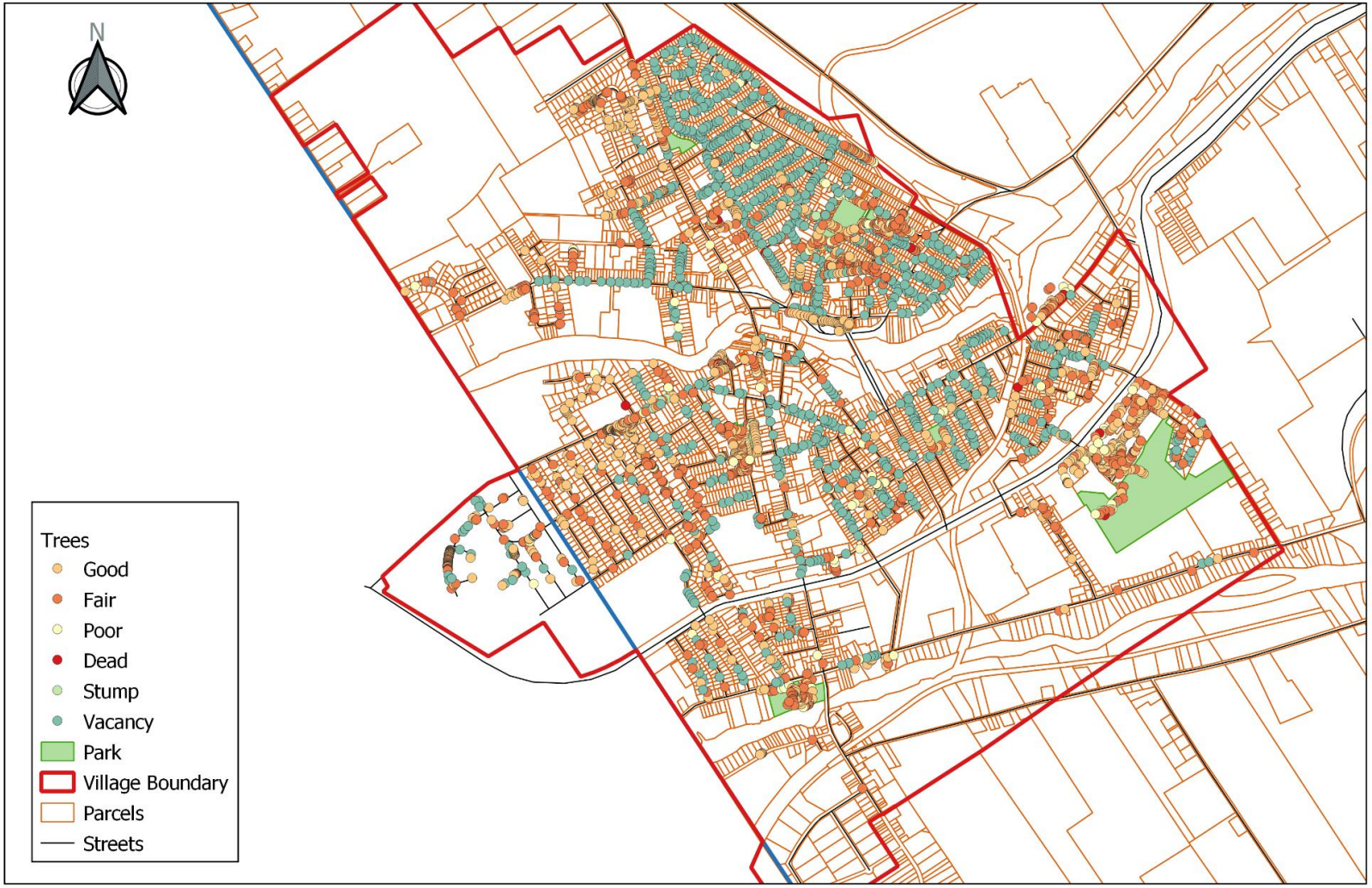
Large Trees	
Botanical Name	**Common Name**
Acer x fremanii (varieties)	Freeman Maple
Acer platanoides (varieties)	Norway Maple
Acer rubrum (varieties)	Red Maple
Aesculus hippocastanum (varieties)	Horsechestnut
Aesculus x carnea (varieties)	Horsechestnut
Alnus glutinosa	Black Alder
Carpinus betulus “fastigiata”	European Hornbeam
Catalpa speciosa	Northern Catalpa
Celtis occidentalis	Hackberry
Corylus colurna	Turkish Filbert
Gingko biloba	Gingko
Gleditsia triacanthos inermis	Thornless Honeylocust
Gymnocladus dioicus	Kentucky Coffeetree
Liriodendron tulipifera	Tulip Tree
Ostrya virginiana	American Hophornbeam (Ironwood)
Phellodendron amurense “Macho”	Macho Amur Corktree
Platanus x acerfolia	London Planetree
Prunus sargentii	Sargent Cherry
Pyrus calleryana (varieties)	Callery Pear
Quercus bicolor	Swamp White Oak

Quercus macrocarpa	Bur Oak
Quercus rubra	Northern Red Oak
Robinia pseudoacacia	Blacklocust
Tilia cordata	Littleleaf Linden
Ulmus species	Elm
Metasequia glyptostoboides	Dawn redwood
Nyssa sylvatica	Black tupelo
Quercus alba	White oak
Quercus coccinea	Scarlet oak
Quercus imbricaria	Shingle oak
Quercus muehlengergii	Chinkapin oak
Quercus shumardii	Shumard oak
Quercus robur	English oak
Taxodium distichum	Bald cypress
Tilia Americana	American linden
Tilia tomentosa	Silver linden

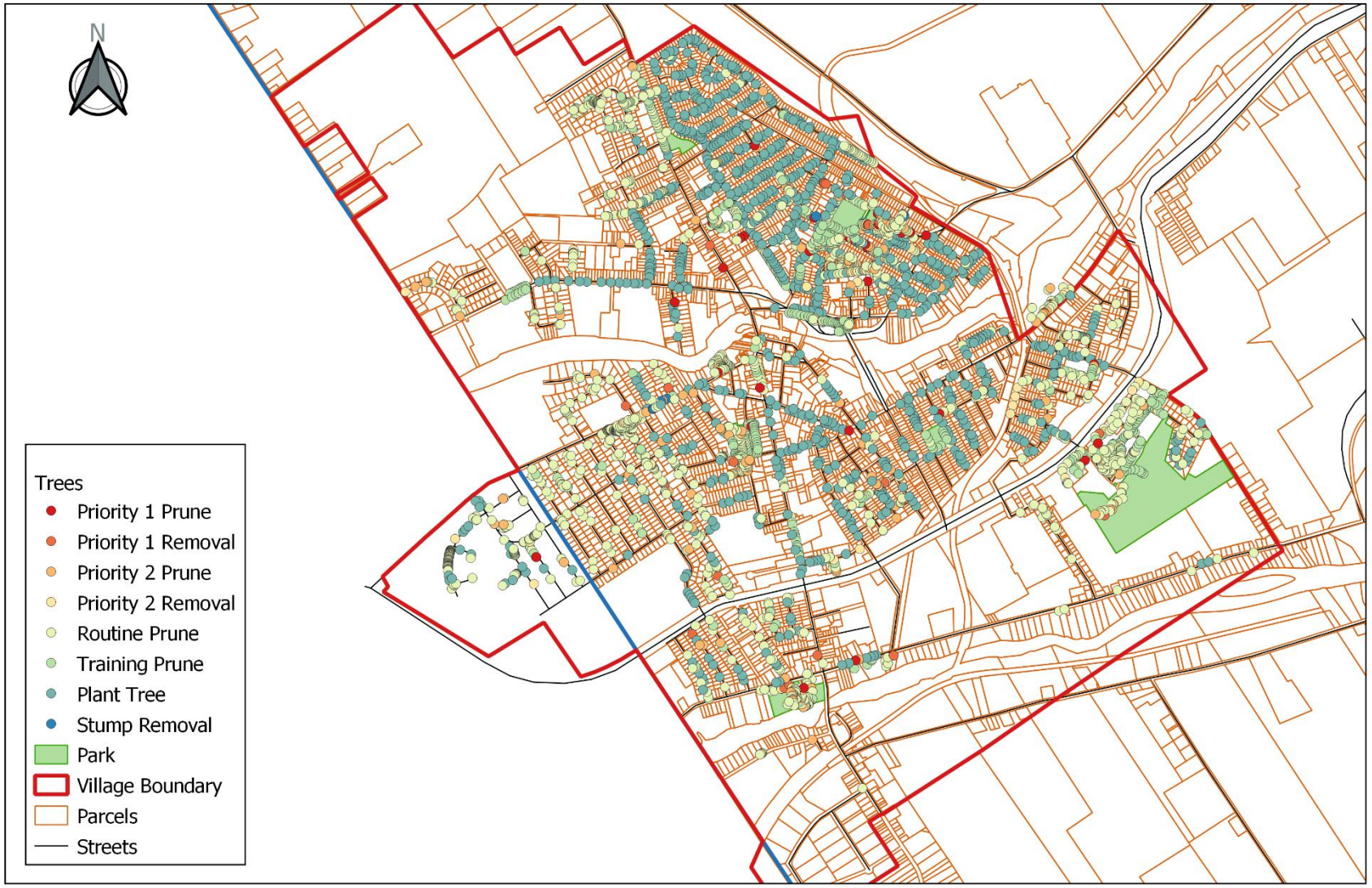
Appendix C – Five-year Budget

Year			2018		2019		2020		2021		2022		Five-Year
Activity	DBH	Cost/Tree	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	# of Trees	Total Cost	Cost
Priority 1 Removal	00"-03"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	04"-06"	$105	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	07"-12"	$220	1	$220	0	$0	0	$0	0	$0	0	$0	$220
	13"-18"	$355	2	$710	0	$0	0	$0	0	$0	0	$0	$710
	19"-24"	$525	4	$2,100	0	$0	0	$0	0	$0	0	$0	$2,100
	25"-30"	$845	3	$2,535	0	$0	0	$0	0	$0	0	$0	$2,535
	31"-36"	$1,140	9	$10,260	0	$0	0	$0	0	$0	0	$0	$10,260
	37"-42"	$1,470	5	$7,350	0	$0	0	$0	0	$0	0	$0	$7,350
	43+	$1,850	2	$3,700	0	$0	0	$0	0	$0	0	$0	$3,700
Total			**26**	**$26,875**	**0**	**$0**	**0**	**$0**	**$0**	**$0**	**0**	**$0**	**$26,875**
Priority 2 Removal	00"-03"	$25	0	$0	15	$375	0	$0	0	$0	0	$0	$375
	04"-06"	$105	0	$0	9	$945	0	$0	0	$0	0	$0	$945
	07"-12"	$220	0	$0	10	$2,200	0	$0	0	$0	0	$0	$2,200
	13"-18"	$355	0	$0	13	$4,615	0	$0	0	$0	0	$0	$4,615
	19"-24"	$525	0	$0	10	$5,250	0	$0	0	$0	0	$0	$5,250
	25"-30"	$845	0	$0	1	$845	0	$0	0	$0	0	$0	$845
	31"-36"	$1,140	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	37"-42"	$1,470	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	43+	$1,850	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Total			**0**	**$0**	**58**	**$14,230**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$14,230**
Stump Removal	00"-03"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	04"-06"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	07"-12"	$25	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	13"-18"	$40	0	$0	1	$40	0	$0	0	$0	0	$0	$40
	19"-24"	$60	0	$0	4	$240	0	$0	0	$0	0	$0	$240
	25"-30"	$85	0	$0	1	$85	0	$0	0	$0	0	$0	$85
	31"-36"	$110	0	$0	3	$330	0	$0	0	$0	0	$0	$330
	37"-42"	$130	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	43+	$160	0	$0	0	$0	0	$0	0	$0	0	$0	$0
Total			**0**	**$0**	**9**	**$695**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$695**
Priority 1 Prune	00"-03"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	04"-06"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	07"-12"	$75	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	13"-18"	$120	1	$120	0	$0	0	$0	0	$0	0	$0	$120
	19"-24"	$170	1	$170	0	$0	0	$0	0	$0	0	$0	$170
	25"-30"	$225	6	$1,350	0	$0	0	$0	0	$0	0	$0	$1,350
	31"-36"	$305	12	$3,660	0	$0	0	$0	0	$0	0	$0	$3,660
	37"-42"	$380	9	$3,420	0	$0	0	$0	0	$0	0	$0	$3,420
	43+	$590	11	$6,490	0	$0	0	$0	0	$0	0	$0	$6,490
Total			**40**	**$15,210**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$15,210**
Priority 2 Prune	00"-03"	$20	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	04"-06"	$30	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	07"-12"	$75	0	$0	0	$0	0	$0	0	$0	0	$0	$0
	13"-18"	$120	0	$0	7	$840	6	$720	0	$0	0	$0	$1,560
	19"-24"	$170	0	$0	15	$2,550	14	$2,380	0	$0	0	$0	$4,930
	25"-30"	$225	0	$0	23	$5,175	22	$4,950	0	$0	0	$0	$10,125
	31"-36"	$305	0	$0	19	$5,795	18	$5,490	0	$0	0	$0	$11,285
	37"-42"	$380	0	$0	7	$2,660	7	$2,660	0	$0	0	$0	$5,320
	43+	$590	0	$0	10	$5,900	10	$5,900	0	$0	0	$0	$11,800
Total			**0**	**$0**	**81**	**$22,920**	**77**	**$22,100**	**0**	**$0**	**0**	**$0**	**$45,020**
Routine Prune	00"-03"	$20	0	$0	0	$0	10	$200	10	$200	10	$200	$600
	04"-06"	$30	0	$0	0	$0	29	$870	29	$870	29	$870	$2,610
	07"-12"	$75	0	$0	0	$0	72	$5,400	73	$5,475	73	$5,475	$16,350
	13"-18"	$120	0	$0	0	$0	50	$6,000	50	$6,000	50	$6,000	$18,000
	19"-24"	$170	0	$0	0	$0	35	$5,950	35	$5,950	36	$6,120	$18,020
	25"-30"	$225	0	$0	0	$0	10	$2,250	11	$2,475	11	$2,475	$7,200
	31"-36"	$305	0	$0	0	$0	5	$1,525	5	$1,525	5	$1,525	$4,575
	37"-42"	$380	0	$0	0	$0	0	$0	1	$380	0	$0	$380
	43+	$590	0	$0	0	$0	0	$0	1	$590	1	$590	$1,180
Total			**0**	**$0**	**0**	**$0**	**211**	**$22,195**	**215**	**$23,465**	**215**	**$23,255**	**$68,915**
Young Tree Training	00"-03"	$20	0	$0	0	$0		$0	97	$1,940	97	$1,940	$3,880
	04"-06"	$30	0	$0	0	$0		$0	38	$1,140	38	$1,140	$2,280
	07"-12"	$75	0	$0	0	$0		$0	1	$75	1	$75	$150
Total			**0**	**$0**	**0**	**$0**		**$0**	**136**	**$3,155**	**136**	**$3,155**	**$6,310**
Cost Grand Total				**$42,085**		**$37,845**		**$44,295**		**$26,620**		**$26,410**	**$177,255**

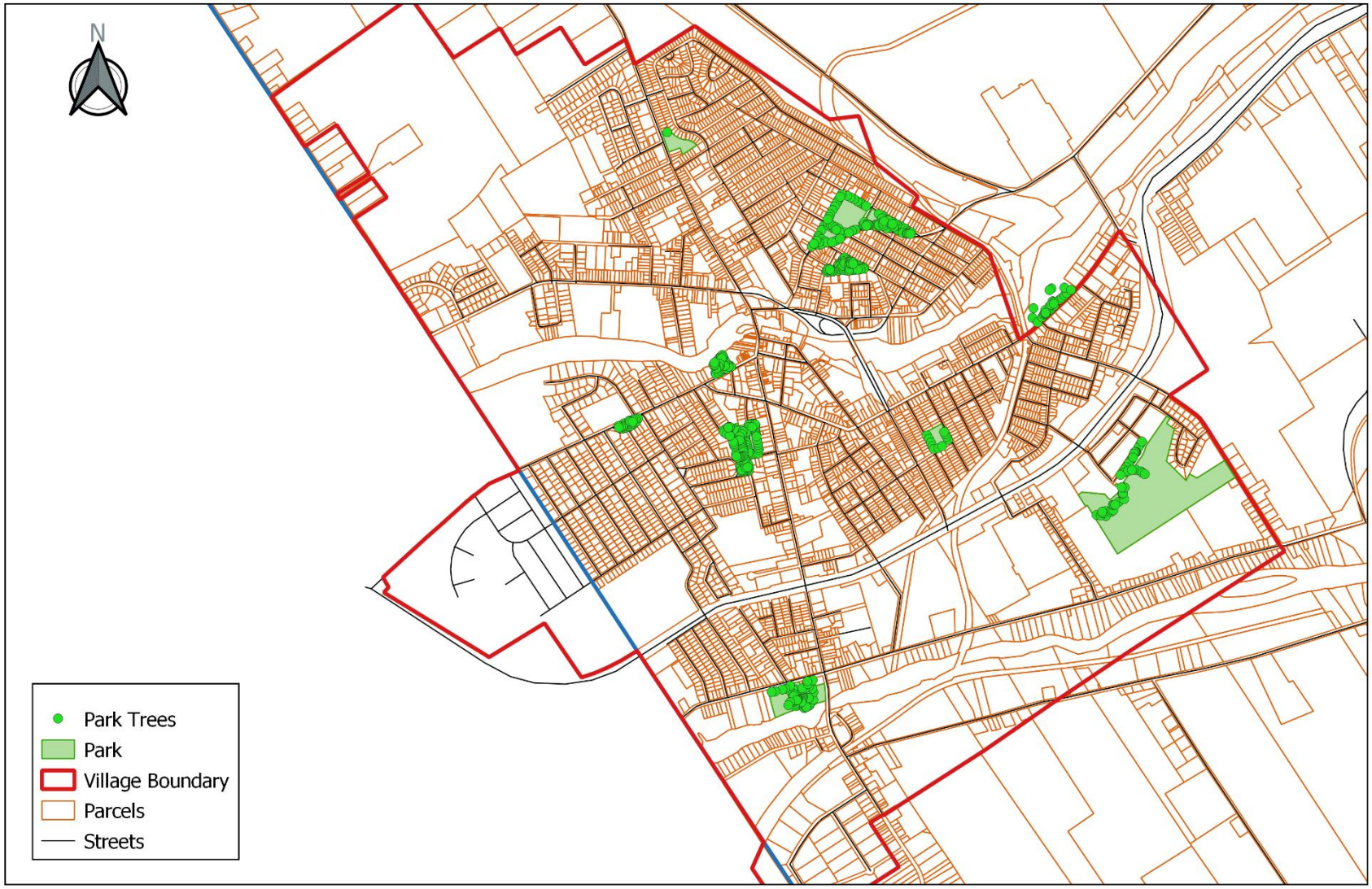
Appendix D – Maps



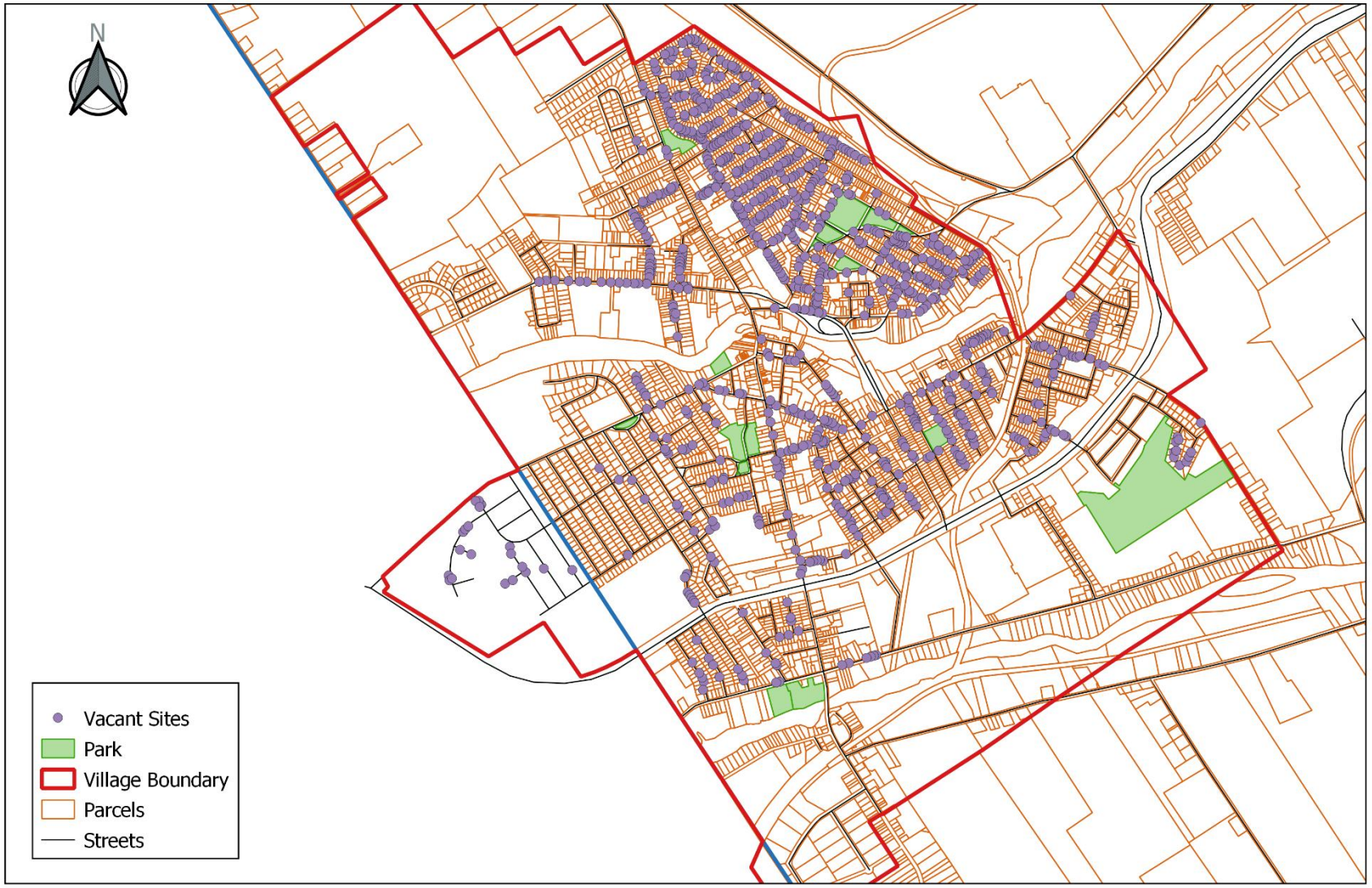
Village of Massena Tree Inventory - Condition Map



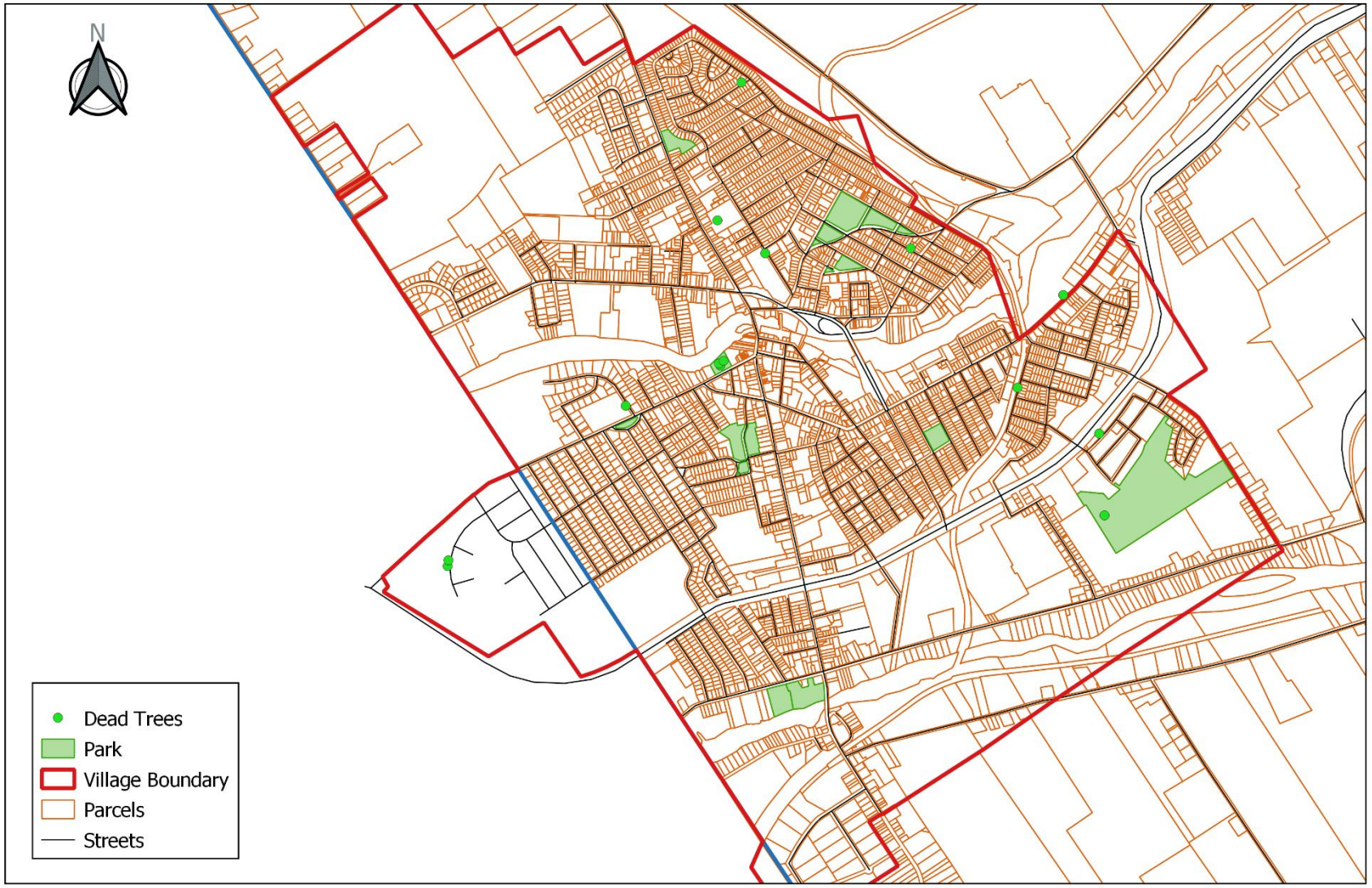
Village of Massena Tree Inventory - Maintenance Map



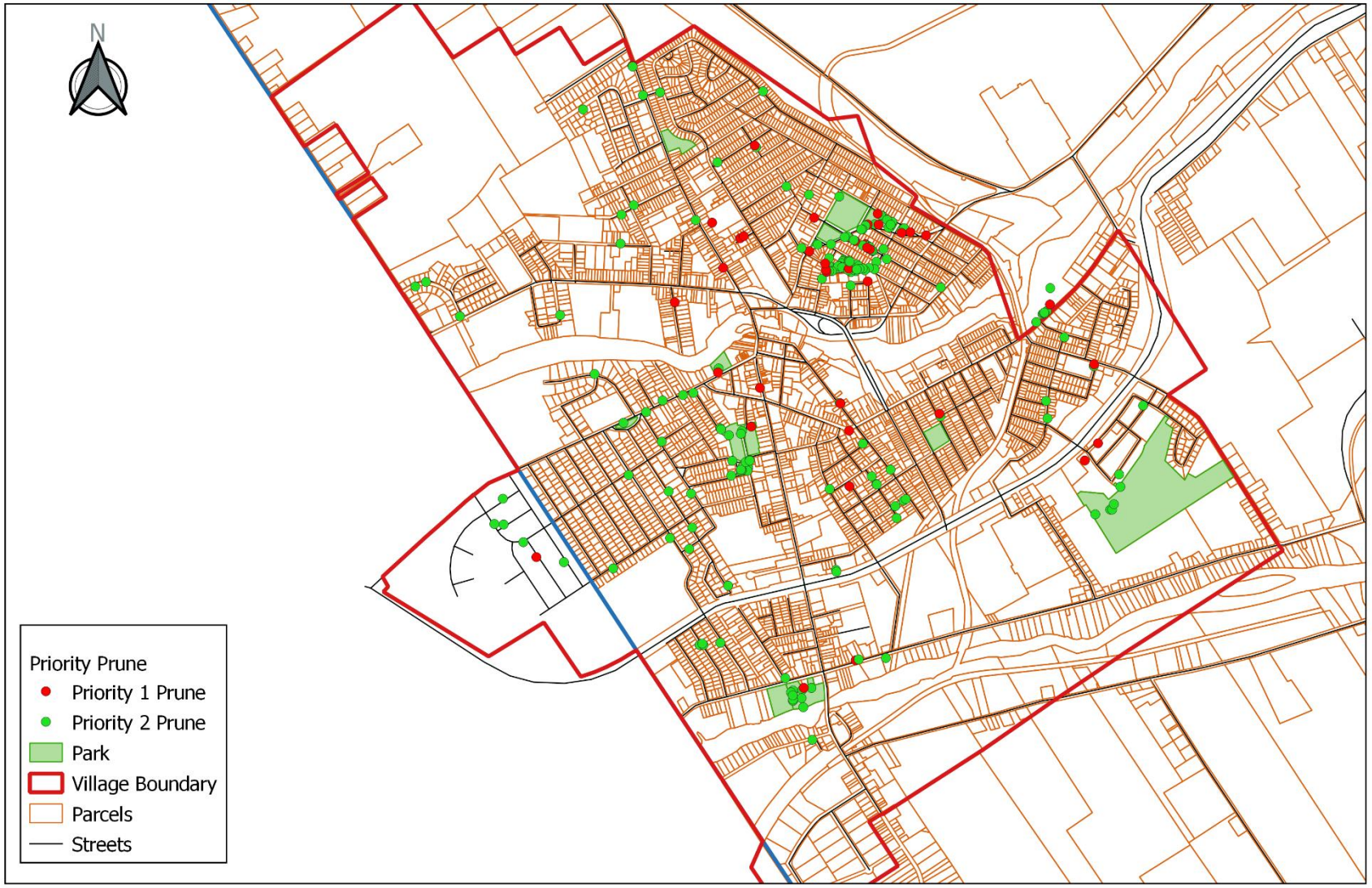
Village of Massena Tree Inventory - Park Trees



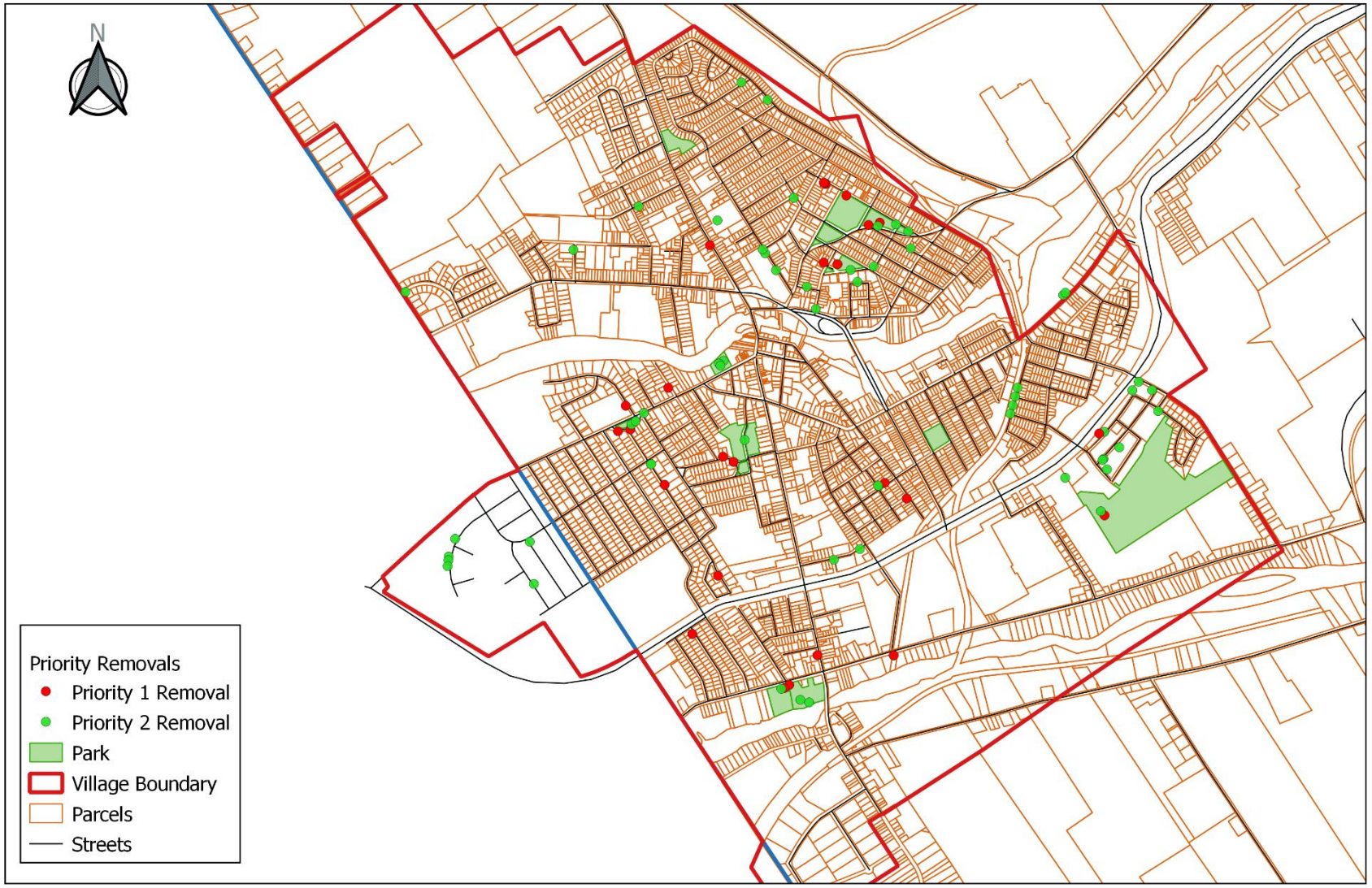
Village of Massena Tree Inventory - Vacant Sites



Village of Massena Tree Inventory - Dead Trees



Village of Massena Tree Inventory - Priority Pruning



Village of Massena Tree Inventory - Priority Removals


ArborPro
Management Software