

PUBLIC TREE INVENTORY REPORT AND MANAGEMENT PLAN

**FOR THE
VILLAGE OF MENOMONEE FALLS, WI**



**PREPARED BY:
WACHTEL TREE SCIENCE, INC.
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**Public Tree Inventory Report & Management Plan
For the Village of Menomonee Falls, WI
By Wachtel Tree Science (262)538-1900
November 2018**

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EXECUTIVE SUMMARY

The Village of Menomonee Falls recognizes a properly maintained urban forest provides numerous benefits and an increased quality of life to its citizens. These benefits range from air pollution reduction, energy conservation, increased property values, aesthetics and more. The Village contracted with Wachtel Tree Science to do a tree inventory analysis and develop an urban forest management plan designed to increase these benefits for the community.

This document reports the findings of the street, park and municipal property tree inventory that was conducted during the summer of 2018 by Wachtel staff. The results include:

STREET TREES

- 8,893 street records were collected made up of 6,399 trees, 2,349 vacant planting sites and 145 stumps.
- The stocking level is 73.6%, 6,544 of the 8,893 street records are either trees or stumps.
- This population contains 47 genera and 107 different species of tree. Only six species (Norway Maple, Green Ash, Crab Apples Spp., Honeylocust (Thornless), Colorado Spruce and Silver Maple) and tree genera (Maples, Spruce and Ash) fail to meet the newest guidelines for species diversity. Special attention should be made to limit the number of Maples species planted, as they consist of 25.88% of the population. This Genus (*Acer*) component is too high.

PARK AND MUNICIPAL PROPERTY TREES

- 2,422 park and municipal property records were collected consisting of 2,386 trees and 36 stumps. No vacant planting site information was inventoried for these sites.
- This population contains 43 genera and 85 different species of tree. Only Colorado Spruce and the Spruce genera fail to meet the guidelines for species diversity. Green Ash and Northern White-Cedar species and Maple and Ash genera do not meet the newer recommendations.

ALL PUBLIC TREES

- 11,315 records were collected, consisting of 8,785 tree records, 2,349 vacant planting sites and 181 stumps.
- This population contains 50 genera and 110 different species of tree. Overall, the urban forest meets the guidelines for species diversity, but should strive to achieve newer standards. Some species and genera that should be stopped or limited in their planting are Green Ash, Norway Maple, Colorado Spruce, Honeylocust (Thornless) species, and Maple and Spruce genera.

- The Village of Menomonee Falls' public tree inventory shows an ideal size distribution of trees. The majority of trees (66.52%) are in the smaller diameter classes of 1 to 6 and 7 to 12 inches in diameter. As diameter classes increase, the trees in those groups make up subsequently smaller and smaller portions of the overall tree population.
- The majority of the trees (56.88%) are in condition classes of 70% or greater, which is ideal given your average street tree has a condition between 70 and 75%. Spruce, Maples and Crab Apple genera have the most trees within the 50 to 65% condition classes. These trees would benefit from routine and safety pruning to increase their condition and overall value.
- Co-dominant branching was noted in 56.97% of the younger trees (1 to 6 inches in diameter) and 57.64% of the larger trees. Training pruning should be utilized to improve young tree structure which can reduce future maintenance costs and improve overall tree health.
- With a young aged tree population, the Village can expect forestry budgets to gradually increase year after year to account for increased routine maintenance costs as trees grow larger. The Village should continue their commitment to planting new trees which replace large trees as they die. Committing to funding planting operations and tree maintenance needs is necessary to maintain an ideal distribution of all size classes in the Village tree population.

GENERAL OBSERVATIONS

- Total public tree value is estimated at \$10,179,523, with an average individual tree value of \$900. This low individual tree value is reflective of how many younger trees make up the Village's urban forest. The valuation formula is explained in detail on **Page 16**.
- A resource of this magnitude (valued at roughly **\$10.2 million**) justifies increased expenditures for providing urban forest management including new tree plantings, young tree maintenance, training, routine and clearance pruning, removal of dead and very poor condition trees and stumps.
- The Village has very good species diversity that predominantly meet the old guidelines and should now work towards achieving newer recommendations for species diversity. This would involve limiting the planting of species such as Norway Maples, Crab Apple Spp., Honeylocust (Thornless) and Silver Maples along streets and Colorado Spruce along streets and at park and municipal properties. There should be no planting of species in the Genera *Fraxinus* (Ashes) and no or extremely limited planting of *Acer* (Maples) or *Picea* (Spruce) species.
- The current tree inventory covered approximately 95% of the Village. It encompasses the actively managed trees in the parks, municipal properties and street right of ways (ROW) and vacant planting sites along major roadways and in several neighborhoods. The sections of the Village left un-inventoried are not actively managed, thus were not high

priorities sites for inventorying. Some rural sections within the ROW were left un-inventoried. These areas mostly consist of wooded natural areas.

Policy recommendations, maintenance schedules and budget requirements are outlined in the included management plan to assist the Village of Menomonee Falls in both short and long term municipal tree maintenance planning.

INVENTORY REPORT

I. INTRODUCTION

Trees give some of the first impressions of the Village of Menomonee Falls to visitors and provide intangible benefits to the everyday lives of its citizens. Trees add beauty to the Village of Menomonee Falls by softening and complementing of building architecture and creating a pleasant environment. Trees improve the quality of life now and will continue to do so in the future, provided they are managed to their fullest potential.

The energy savings trees produce are well documented. Trees planted around a home can reduce cooling costs by up to 30%, up to \$250 in savings per home per year. Windbreaks aid in reducing winter heating bills. Proper tree placement can reduce solar radiation (creating shaded areas), focus air movement, and lessen air temperature (offsetting the urban "heat island" effect).

Trees improve the quality of the air around us. One acre of full-grown medium-sized trees removes up to 2.6 tons of carbon dioxide each year and produces enough oxygen for 18 people for a year. Trees trap dust particles and absorb a large variety of harmful gases. The proper placement of trees can reduce noise and pollution to more tolerable levels.

Trees play an important role in storm water management reducing soil erosion, runoff and providing storm water treatment. Trees intercept falling raindrops, resulting in less runoff, while green spaces encourage infiltration, lowering runoff volumes. Trees, taking up water through their roots, take up nutrients that can harm water quality.

The trees in our communities improve recreation opportunities by providing comfortable, inviting parks for a variety of activities. They create wildlife diversity in the Village of Menomonee Falls by providing habitat for birds and small animals that otherwise would not be present.

The urban forest increases economic stability by helping to attract and keep businesses. The National Arbor Day Foundation has reported that people will linger longer in shaded shopping areas. Properties rent faster and have fewer turnovers in areas that are well stocked with trees. Studies by the United State Department of Agriculture – Forest Service, show that trees can add 10% or more to property values. It is a fact that people will pay more for a property with trees.

The Village of Menomonee Falls' urban forest can add great value to the community, but it can also be a liability or hazard if not taken care of. Trees that are not managed can fall apart in storms, damaging property and interrupting electric and telephone service. These same trees can pose a risk to people. The Village of Menomonee Falls needs to plan so the best suited trees are planted. No management is an option that always costs more in the long run.

The public trees in the Village of Menomonee Falls are owned by every citizen. Most other public investments a community makes depreciate in value. By investing wisely in trees, values increase for both present and future generations.

II. INVENTORY METHODOLOGY

A. Inventory System

A street and park/municipal property tree inventory and inventory update was conducted along Village streets and within Village parks and public properties. The sections of the Village left un-inventoried are not actively managed, thus were not high priorities sites for inventorying. These sites were predominantly along rural roads that may contain wooded areas populated with ash trees. A less intensive “drive-by” assessment of these roadways would suffice to manage these areas and address EAB.

Field data was collected on tablet computers using Pin Point 3.0, a GIS (geographic information system) tree inventory collector application. A tree inventory database of all inventoried public trees was created in Microsoft Access 2016. All trees and potential planting sites in the public ROW of the Village were inventoried per street mapping supplied by the Village.

B. Public Tree Record Information

- Object Identification - tree or vacant growth space unique identification number
- Inspection Date - date the site record was collected or updated
- Species or Site Status - tree species, vacant plantable or stump
- Address - the house number
- Street Name - the street that corresponds to the address
- Location - the general site type or characteristic (street, park, natural area, etc.)
- Growth Space Type - a more detailed description of the growth space, usually the distance between impermeable surfaces
- Diameter at Breast Height (DBH) - tree diameter measured at 4.5 feet above ground, rounded to nearest inch, for multi-stemmed trees the largest stem was used as the basis for measurement and additional stem diameters were recorded in the inventory notes section
- Height Class - the approximate height range of the tree
- Deadwood Percent - an estimate of the percentage of deadwood in the crown of the tree
- Condition Rating - an overall assessment of the health of the tree
- Planting Depth - the location of the root flare with regards to planting depth

- Primary Maintenance Need - the highest priority maintenance need, usually removals or safety pruning
- Secondary Maintenance need - the next most important maintenance need, usually structural pruning or plant health care treatment
- Work Priority - the date by which the primary maintenance need should be completed
- Clearance - hazardous branches, usually low hanging branches that impede vehicle or pedestrian traffic or visually block sight lines
- Utility - a record within a close proximity to overhead or underhead utilities
- Notes - a general section to capture other useful information about the site or tree

See **Appendix A - Inventory Criteria** for more details on the different types of inventory data collected for each site or tree record.

III. INVENTORY RESULTS AND DISCUSSION

The current tree inventory encompasses the actively managed trees in the parks, municipal properties and street right of ways (ROW) and vacant planting sites along major roadways and in several neighborhoods.

For analysis, the Village of Menomonee Falls' tree population was divided into two categories, street trees and park/municipal property trees. The two categories were defined based on the location information collected. Trees inventoried with the locations termed Street or Natural Area were analyzed as street trees. Park/municipal property trees included the locations labeled Building Site, Other, Park and Parking Lot.

A. Street Tree Inventory

The Village of Menomonee Falls' street tree population consists of 6,399 street trees, 2,349 potential planting sites and 145 stumps for a total of 8,893 street sites inventoried.

i. Planting Site Summary

There are 2,349 potential planting sites within the street tree inventory area that meet the criteria for being a suitable planting site. Suitable planting site records were only collected along the major roadways and within several neighborhoods. Medians were also inventoried for tree records, but no potential planting sites were inventoried.

During the inventory, some data on buried utilities and overhead wires was collected. No buried utilities were noted for any of the suitable planting sites, but some of these sites may still be impacted by underground utility conflicts which may prohibit planting.

One of the criteria for being a suitable planting site is the absence of overhead wires. This means all the vacant planting sites inventoried have no limitations in term of growth and overall height, but sites with overhead utilities could be planted sites when the appropriate tree species is selected for those locations. Small growing trees such as Serviceberry, American Hornbeam, Amur Maackia, Hawthorn and Ironwood could be utilized at these locations to limit future maintenance. Vacant planting sites made up 26.4% of the records collected within the street inventory records, but there a potentially more sites within the Village, along medians, within neighborhoods and subdivisions and under or near overhead wire that could be suitable planting locations.

The vacant planting sites were identified in several different growth spaces: greater than five feet of space (usually the space between the sidewalk and the street curb), open (no sidewalk present) and behind sidewalk (when a sidewalk is present and the ROW extends beyond the far edge of the sidewalk). There are 1,414 vacant planting sites in growth spaces greater than five feet in width, 919 sites in open growth spaces and 19 behind the sidewalk.

Trees prefer large planting spaces because they have more space for root growth. Identifying a suitable planting site with a large measured width (greater than five feet) creates many options when selecting species to plant and is a feature that many municipalities do not have. Distinguishing between different suitable growth spaces allows managers to prioritize planting sites with larger areas. The larger planting areas in these sites allow a wider variety of trees to be planted and will help the Village of Menomonee Falls have healthier trees.

All in all, 6,544 (73.6%) of the 8,893 street tree sites in the inventoried areas have trees or stumps (stocking level). This is a higher stocking level than for most of the communities we have analyzed. The norm stocking level is in the 50 to 60% range.

Emphasis should continue to focus on new tree plantings and promoting greater species diversity during the planting process. Since stocking is at an above average level, planting trees is not urgent, but it is an important component of urban forest management. This scenario presents an opportunity to select superior quality tree species when planting budgets are established. If superior tree species replace undesirable species that are removed from the street tree population, the overall value of the urban forest has a greater potential to increase over time.

ii. Species Frequency

Providing for species and age diversity in the urban forest are the two most significant ways to reduce the impact of a destructive pest or disease. Dutch Elm Disease (DED) should have taught us this lesson, but we weren't listening. The current guidelines are, "no more than 30% of one family, 20% of one genus and 10% of one species." The Department of Natural Resources (DNR), University of Wisconsin, and urban forestry profession representatives have recently provided the following recommendation to consider in striving for greater species diversity, "no more than 20% in one family, no more than 10% in one genus and no more than 5% of any single species, including cultivars and varieties."

Shown below is an example of how this works:

Plant no more than 20% of a family: i.e. Aceraceae (Maple Family)

Plant no more than 10% of a genus: i.e.

1. *Acer* × *freemanii* (Autumn Blaze Maple)
2. *Acer rubrum* (Red Maple)
3. *Acer platanoides* (Norway Maple)
4. *Acer miyabei* (Rugged Maple)
5. *Acer saccharum* (Sugar Maple), etc.

Plant no more than 5% of a species: i.e. *Acer platanoides*

Optimally, try to have the greatest diversity of species that can be managed. Start planning now for a more diverse urban forest. Finding a wider variety of species will be harder and more expensive, but it is worth it. Work with local nurseries to come up with innovative solutions. Educate policy makers on the necessity to do it right, not fast and cheap. In the long run this will save money, time and effort and increase the benefits a healthy, sustainable urban forest provides.

The 6,399 street trees include 47 genera and 107 different species. The top ten species break down as follows:

Table 1. Top Ten Street Tree Species.

Genus	Common Name	Count	Percentages
<i>Acer</i>	Norway Maple	712	11.13%
<i>Fraxinus</i>	Green Ash	604	9.44%
<i>Malus</i>	Crab Apple Spp.	475	7.42%
<i>Gleditsia</i>	Honeylocust (Thornless)	472	7.38%
<i>Picea</i>	Colorado Spruce	413	6.45%
<i>Acer</i>	Silver Maple	384	6.00%
<i>Picea</i>	White Spruce	234	3.66%
<i>Acer</i>	Freeman Maple	207	3.23%
<i>Fraxinus</i>	White Ash	186	2.91%
<i>Acer</i>	Sugar Maple	174	2.72%

See **Appendix B - Tree Species Frequency**, for the entire break down.

The only species that does not fit the current recommendation for species frequency is Norway Maple which are 11.13% of the street tree population, which is over 10% of the total. The *Acer* (Maples) genus fails to meet the recommendations comprising 25.88% of the population, well over the 20% guideline. The rest of the species, genera and families meet these criteria.

It is very promising to see that only six of the 107 different species (Norway Maple, Green Ash, Crab Apple Spp., Honeylocust (Thornless), Colorado Spruce and Silver Maple) break the most recent recommendation of no more than 5% in one species. These species should not be planted due to their current species frequency, tree structure and pest problems. If Norway Maple, Crab Apple Spp., Honeylocust (Thornless), Colorado Spruce and Silver Maple are planted they should be limited in number. As Emerald Ash Borer (EAB) management strategies are implemented, Green Ash and White Ash will lose their dominant standing in the species diversity mix. It will be imperative that more species on the recommended street tree species list (see **Appendix C - Planting Recommendations**) be planted as Ash trees are removed.

Three genera, *Acer* 25.88% (Maples), *Picea* 12.52% (Spruce) and *Fraxinus* 12.42% (Ash) don't meet the newest guidelines of no more than 10% in one genus. These genera make up over half (50.82%) of the population. The Village is already dealing with the ramifications of EAB on the Village's ash population and plans have been made to reduce the number of ash trees in the Village. Any problems with Maples or Spruce could have a similar impact on the Village's urban forest and budgets. No one genus should make up more than 10% of the population and no one species should make up more than 5%.

All future planting projects should continue to focus on adding more diversity and quantities to the species mix. Species that could be increased in numbers planted annually include: Amur

Corktree, Yellow Buckeye, Ironwood, Ginkgo, Kentucky Coffeetree, and Swamp White x Bur Oak hybrid.

Norway Maple are present at a highest frequency (11.13% or 712 trees) within the street tree population. A concern is their tendency to develop girdling roots which is a major maintenance issue. Girdling roots are a combination of a nursery problem, a characteristic of the species, and deep planting. The girdling roots tend to kill the trees about thirty to thirty-five years after planting, just as the trees are getting nice sized. This species, because of its opposite branching habit, has the propensity to develop co-dominant stems and included bark. If left unchecked, serious structural issues can develop. This can be prevented by performing training pruning when trees are young. Weak branch unions lead to this species being more susceptible to large branch failure in storms. They also can become invasive through seed dispersal and germination in unwanted areas. For these reasons, Norway maples are not highly desirable street trees.

Ash species (Green, White, and European), have a combined total of 795 trees or 12.42% of the street tree population. Trees within this genus host a number of disease and insect problems other than EAB. Although most of these will not cause the tree's demise, they can be a nuisance. Native ash borers, flower gall mites and plant bugs are the most common insect pests of Ash, while anthracnose and ash yellows lead the list of diseases.

The biggest threat to the native ash population is EAB. This is an exotic wood borer that was found attacking and killing ash trees in Michigan during 2002. Since its detection, EAB has killed millions of ash trees and is now found in Arkansas, Connecticut, Colorado, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Minnesota, Missouri, Nebraska, New Hampshire, New York, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, West Virginia, Wisconsin and the Quebec and Ontario provinces of Canada. EAB is easily spread through the movement of firewood, logs and nursery stock.

Now that EAB has arrived and is expanding in Wisconsin, the Department of Agriculture, Trade and Consumer Protection (DATCP) has quarantined all Wisconsin counties, and is assisting with developing plans of action based on the size of the infestation.

It is recommended that an indefinite moratorium continue on all future Ash plantings. The Village of Menomonee Falls EAB management strategy is outlined in the separate 5-Year EAB Implementation Plan.

Crab Apples comprise 7.42% (475 trees) of the street tree population. Species within this genus are very prone to disease, such as apple scab. Apple scab is a disease that has increasingly impacted local crabapple populations. Under normal circumstances, apple scab only causes minor defoliation and reduction in overall tree health. Over the past several years, apple scab has been causing more extreme defoliation. This has largely impacted older crabapples, whereas younger trees tend to be more disease resistant. Even though these trees are ideal for planting under overhead wires and at smaller planting sites. Given the current population, the number of crabapples planted should be very limited, but if planting, disease resistant varieties should be utilized.

Honeylocusts are 7.38% (472 trees) of the street tree population. Some common pests and diseases that impact Honeylocusts include plant bugs, leafhoppers and cankers. Plant bugs and leafhoppers feed on the leaves of the tree causing distorted and damaged leaves. Severe infestations can cause tip dieback. Neither insects is a major health concern or management problem. Honeylocusts can also get cankers that will eventually girdle and kill the tree. The spread of these cankers can be reduced by ensuring young trees are being watered during droughts and trees are being pruned properly. Oftentimes, Honeylocusts don't suffer from pests and make good street trees that are very urban tolerant.

Spruce account for (801 trees) 12.52% of the population, especially Colorado Spruce which makeup (413 trees) 6.45% of the population. White Spruce also make up a larger portion of the street trees (234 trees or 3.66%) There are several common diseases which negatively impact these trees. Both *Rhizosphaera* needle cast and *Cytospora* canker cause needle loss and kill branches in the lower portion of the tree. These diseases destroy a tree's form and aesthetics, damage overall health and creates a lot of pruning work. These trees should not be used as street trees because of their pest problem and they cause view and clearance obstructions in many street settings. They may not initially be a problem on street, but as they grow, increasing in size, they can become problems. All conifers, including Spruce, should be watched to determine when they become a hazard so appropriate action can be taken to mitigate their risk. These trees were likely planted by homeowners. Steps should be taken to discourage homeowners from planting trees in the ROW.

Silver Maples make up 6.00% (384 trees) of the street tree population. They are large fast growing trees. This may seem appealing when planting new trees, but this same growth rate causes them to form weak wood and develop poor structure. These characteristics make Silver Maples prone to storm, wind and ice damage. Their roots systems are also known for growing into sewer pipes causing infrastructure damage. They don't have any major pest problems that affect the overall health of the tree, but given the prevalence of Maple trees within the community if a pest were to damage or kill of Maples trees it would have the same effect as EAB or DED.

It is important to continue the planting of trees with mature heights of 30 feet or less. Some smaller scale trees include: Korean Mountain-Ash and more Ironwood, Serviceberry and American Hornbeam. These are important to use in areas with power lines where shorter trees are preferred or in smaller growspaces (less than five feet between the back of curb and sidewalk). Disease resistant varieties of crabapples with persistent fruit should be specified for any new plantings, if used.

iii. Street Tree Planting

Given the large number of qualifying potential planting sites (2,349) within the Village, planting is an important component in the overall urban forest plan. Proper species selection is a key to reducing future problems and costs. **Appendix C - Planting Recommendations** contains a list of recommended trees and ones to avoid. Planting sites should be greater than 5 feet in width between sidewalk and curb (or median, boulevard, etc.) or open within the ROW to allow for more choices in species and healthier plants due to larger root zones.

When planting, it is best to plant trees of the same species in groupings or using mixed species with similar mature size and growth habit. Alternating species every other tree can create a checkerboard effect that is not very attractive as the trees mature. By planting in groups of three to five, the desired effect of the plants will be achieved. Also, when possible, plant in the back half of the ROW to protect from vehicular and road salt damage. This is particularly important with unrestricted locations when those areas are chosen for planting in the future.

The following modifications are recommended to be incorporated into an “Arboricultural Specifications Manual”.

- Place an indefinite moratorium on the planting of Ash species, due to insect threat.
- Limit the planting of Norway Maples, Crab Apples Spp., Honeylocusts and Silver Maples species.
- Under power lines, plant only trees that are small at maturity (less than 30 feet in height).
- Whenever possible add groups of new species that are currently not being used to any great extent.
- Discourage planting of conifers such as Spruce and Pine species in the ROW by abutting property owners.

Early care is important. Trees will need watering for a two to five-year period depending on how bad the dry periods are. The longer the drought, the more the trees will need to be watered. Water is probably the single most important limiting factor to establishment and good growth in our harsh urban environment.

Pruning after the trees are established (Structural Pruning) is also very important. Try to visit and prune newly planted trees, on average, at least every three years up until they are 6 inches in diameter. The frequency of training pruning will vary depending on the tree species. Some species of young trees, such as hybrid Elms, will require more frequent training pruning (one to two years) than other species, such as Oaks (three years or more). Yearly inspections of new tree species should occur for the first five to eight years to determine the frequency of appropriate training pruning. This will ensure that proper structural pruning is taking place. What can be taken off a tree with a hand pruner or handsaw in year three will need a chain saw in year fifteen. It is not only more expensive but is also more stressful on the tree to wait. Early training pruning will go a long way to reduce costs and provide a safer urban forest by directing future growth.

B. Park/Municipal Property Tree Inventory

Numerous Village parks, parking lot, public and municipal buildings, water towers, pump house/well sites, lift stations, stormwater and outlots sites were inventoried. The parks include: Centennial Plaza, Heron Alley, John Taylor Park, Kiwanis Park, Lilly Creek Parkway, Lime Kiln Park, Menomonee River Parkway, Mill Pond Park/Plaza, Municipal Park, Oakwood Park, Old Falls Village, Richard A. Farrenkopf Plaza, River Road Park, River Edge Park, Rotary Park, Tamarack Preserve, Tower Hill Park, Village Park and Willowood Park. Public and municipal buildings include: Village Hall, Police Department, Library, Centralized Public Works Facility, Community Center and Fire Stations.

A total of 2,422 sites were inventoried which includes 2,386 trees and 36 stumps.

i. Species Frequency

The 2,386 existing park trees are made up of 85 different species and 43 genera. The top ten break down as follows:

Table 2. Top Ten Park and Municipal Tree Species.

Genus	Common Name	Count	Percentages
Picea	Colorado Spruce	266	11.15%
Fraxinus	Green Ash	191	8.01%
Thuja	Northern White-Cedar	144	6.04%
Gleditsia	Honeylocust (Thornless)	119	4.99%
Picea	White Spruce	96	4.02%
Malus	Crab Apple Spp.	89	3.73%
Picea	Black Hills Spruce	77	3.23%
Picea	Norway Spruce	77	3.23%
Fraxinus	White Ash	77	3.23%
Acer	Freeman Maple	77	3.23%

See **Appendix B - Tree Species Frequency**, for the entire break down.

It should be noted that combining all the species in their respective genus puts the *Picea* (Spruce) at 22.67%, *Acer* (Maple) at 12.95% and *Fraxinus* (Ash) at 11.27%. This means that Spruce are breaking the current recommendation that no one genus should make up more than 20% of a public tree population. These three genera do not meet the newer guidelines that a genus should not exceed 10% of a population. More of other genera, species and varieties on the recommended street and park tree species list need to be planted (see **Appendix C - Planting Recommendations**). These three genera making up such a large portion (46.90%) of the park

tree population. Problems with one of these genera would have a big impact on the Village of Menomonee Falls' park and municipal property landscapes which have already seen the impacts of EAB.

More of other species such as Kentucky Coffeetree, Serviceberry, Ginkgo, White Fir, Baldcypress, Yellow and Ohio Buckeye, Catalpa, Ironwood, and Amur Corktree should be used as species of choice.

C. Public Tree Size, Condition and Value Discussion

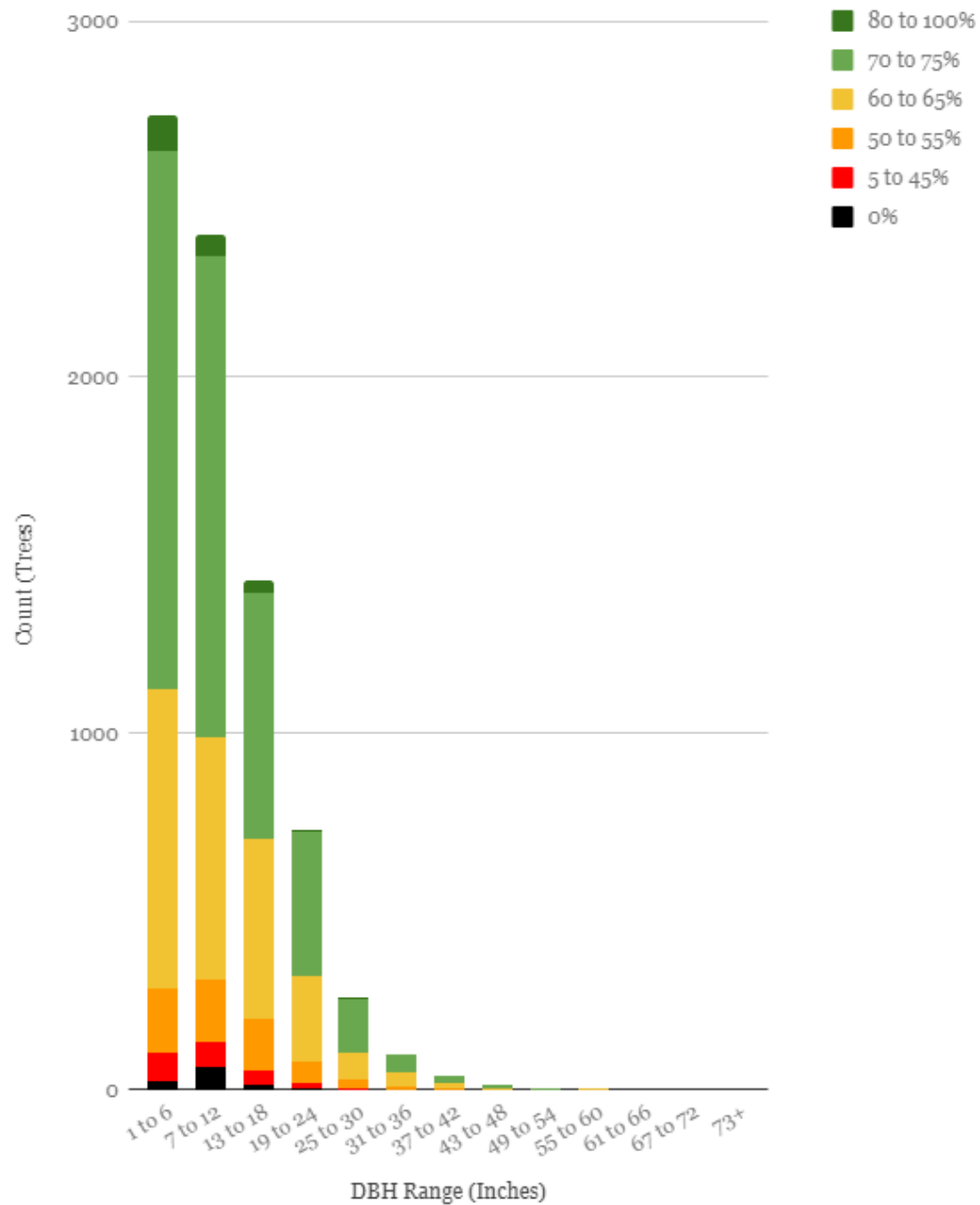
Ash trees were removed for this portion of the analysis. See the Village's 5-Year EAB Implementation Plan for an analysis and management recommendations of Ash trees.

i. Size Class Distribution

The Village's urban tree population is a very young forest with 66.52% in the 1 to 6 (35.45%, 2,737 trees) and 7 to 12 (31.07%, 2,399 trees) inch diameter classes (see **Figure 1. Condition Ratings and Size Distribution.**). Trees in the 13 to 18 range make up 18.55% (1,432 trees) of the population. The rest of the trees are greater than 18 inches comprising of 14.93% of the forest. The size class distribution curve is ideal. An ideal distribution is an uneven aged tree population heavy with younger trees and light with old trees. As the older age tree classes succumb to mortality and removal, there are numerous young healthy trees that will continue to grow and preserve benefits provided by the overall urban forest.

Focus on planting should be continued in order to maintain this size class distribution. Future maintenance should address structural issues in younger trees. As the tree becomes larger, trying to correct these issues becomes costlier and less effective. Many of the problems with form and structure can be corrected with regular maintenance while the trees are young or moderately young. This also extends tree life and reduces future maintenance costs. The overall condition of younger trees can be improved for less expense than with larger trees where poor structure and form have gotten to the point that they are no longer correctable.

Figure 1. Condition Ratings and Size Distribution, Non-Ash Trees.



See **Appendix E - Chart and Graph Data** for table containing this chart's data.

ii. Condition Rating

The overall condition of the Village's street trees is good with only 4.18% (323 trees) within the 0 to 45% condition classes. Trees in this range are very poor quality and typically warrant removal. The rest of the trees are distributed between the 50 to 55% range (7.75%), the 60 to 65% range (31.19%), the 70 to 75% range (54.16%) and trees rated 80% and greater (2.72%). Trees in the 50 to 55% range are usually in poor health and condition and could be considered for removal in the future. The 60 to 65% range has trees that are less than average condition. The 70 to 75% range encompasses trees that are good and average in terms of overall health for a street tree of that species. Trees rated 80% and greater are in great health and have excellent structure. The majority of the Village's trees are in condition classes of 70% and greater which is good for an urban forest.

Co-dominant branching was noted on 57.43% (5,045 trees) of the trees. Co-dominant stems are an undesirable tree structure that will fail as stems rip apart in severe storm events. Trees that have been properly pruned throughout their life have better structure and have a better chance of weathering severe storm events. Not all storm damage can be prevented, but a routine pruning program used to promote better tree structure can minimize the amount of storm damage in severe weather.

Younger trees (1 to 6 inches diameter) made up 31.16% of the tree population and 56.97% (1,597 trees) of those trees have co-dominant branching. Maintenance should be focused on some of the larger diameter trees in this group before structural problems become worse. Younger trees that are having difficulty becoming established may need to be removed and replaced. Older trees (greater than 6 inches diameter) have similar percentage of trees with co-dominant branching (57.64% or 3,448 trees) to younger trees.

There is opportunity to improve these condition ratings because younger trees tend to be more vigorous. They require more frequent pruning visits, once every two to three years versus every five to seven years for routine prune (trees greater than 6 inches in diameter). Supplemental watering for at least two years after transplanting is also a critical component of early tree maintenance. It is imperative to keep on top of the pruning and moisture requirements of younger trees so their condition rating improves as they grow in size and they don't become liabilities later in life. The key is to strive to maintain a high condition as the trees become older.

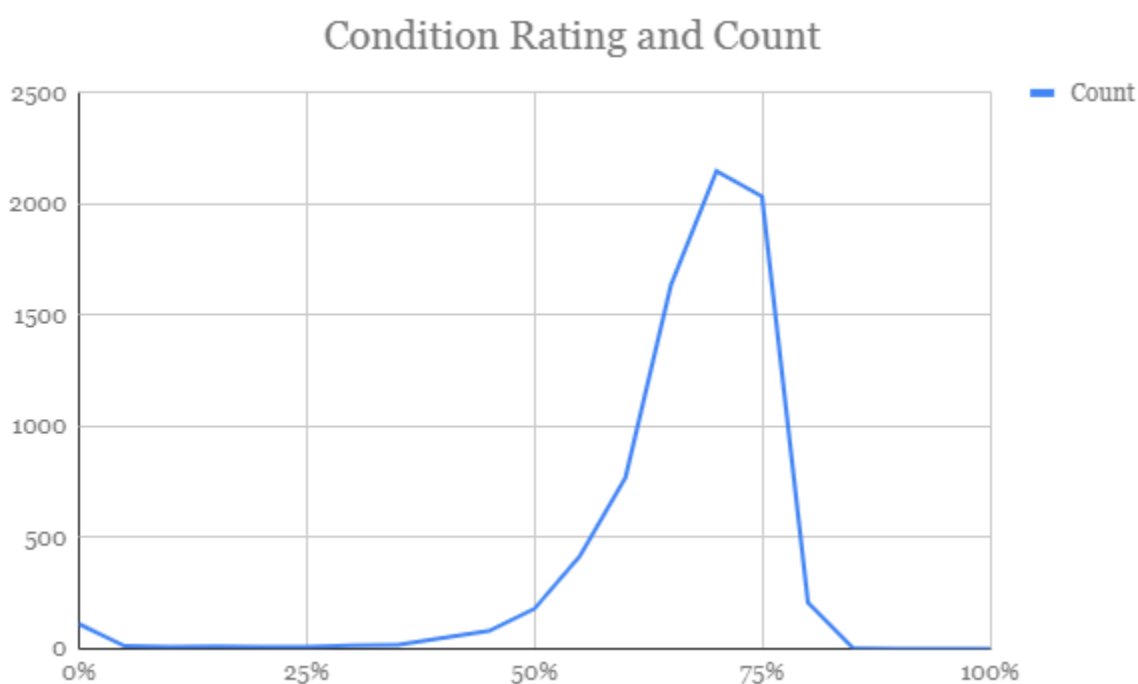
In the larger trees ranges (greater than 6 inches in diameter), 64.44% (4,768 trees) are in the condition classes greater than 45%. The rest of these trees (2.92% or 216 trees) were rated 45% or less. The focus of routine pruning in these larger diameter size classes should be with trees that are currently in the 60 to 65% condition classes. There is a good chance for a number of these trees to move into higher condition classes, if a five to seven year routine pruning schedule can be sustained.

Trees within the 60 to 65% have the potential to increase in condition and value given the appropriate maintenance. Spruce (37.18%, 499 trees), Maples (33.94%, 667 trees), Crab Apples Spp. (36.35%, 209 trees) and genera have a large number of trees with condition ratings between 60 and 65%. Colorado (295 trees) and White Spruce (112 trees) are the main species in

the Spruce genera in this condition. Within the Maple genus, Norway (266 trees) and Silver Maples (144 trees) make up a large portion of trees in this condition class. The Norway Maples, Silver Maples and Crab Apples Spp. given pruning could increase in condition and provide greater value to the community.

The condition of the urban forest is good with the majority of the trees in condition classes 70% and greater. There is the potential to improve the condition of some of the trees in the lower condition classes. Focus should be given to younger trees that can be Training Pruned to improve structure. Structural issues are easier to address when the trees are smaller. Larger trees can also benefit from Safety and Routine Pruning. Targeted pruning of large trees in the 60 to 65% condition classes, specifically Norway Maples, Silver Maples and Crab Apples Spp.

Figure 2. Condition Rating Distribution, Non-Ash Trees.



See **Appendix E - Chart and Graph Data** for table containing this chart's data.

iii. Maintenance

Overall the Village of Menomonee Falls' urban forest is in good shape. A continued focus on maintenance; primarily planting, structural pruning and young tree aftercare will improve these condition ratings and help guarantee the presence of healthy trees that add value to the community for many generations to come. Ash trees are being managed separately as outlined in the Village's 5-Year EAB Implementation Plan.

Figure 3. Maintenance Needs, Non-Ash Trees.

		Maintenance Need								
		Cable and Prune	Remove	Remove Stakes	Routine Prune	Safety Prune	Training Prune	Treat	Tree Heaving Walk/Curb	Watch
Diameter Range (inches)	Total	2	327	235	2,367	1,234	1,456	1	1	2,098
	1 to 6	0	112	233	0	79	1,456	0	0	855
	7 to 12	0	133	2	1,274	353	0	0	0	639
	13 to 18	1	57	0	582	358	0	0	1	433
	19 to 24	0	19	0	314	246	0	0	0	153
	25 to 30	1	4	0	124	113	0	0	0	17
	31 to 36	0	2	0	47	47	0	1	0	1
	37 to 42	0	0	0	17	23	0	0	0	0
	43 to 48	0	0	0	5	8	0	0	0	0
	49 to 54	0	0	0	1	2	0	0	0	0
	55 to 60	0	0	0	1	3	0	0	0	0
	61 to 66	0	0	0	1	0	0	0	0	0
	67 to 72	0	0	0	0	2	0	0	0	0
	73+	0	0	0	1	0	0	0	0	0

Stumps (181) should be removed. Stump removals should focus on parks and municipal property locations (36) due to the limited number of vacant planting sites at these areas. Opening up these sites for new planting will help increase the age and species diversity in the parks and municipal properties. The street population has plenty of vacant planting sites (2,349 sites) available for new plantings without having to remove any current stumps.

Trees in the 0 to 45% condition classes, with notable cracks or decay and severe pest problems such as DED were classified as a removal. These trees are a high risk and pose a hazard and threat to the community. They should be removed within the next year.

The Village should continue to focus on planting a diverse selection of trees ensuring their streets, parks and public properties are populated with a primarily young and varied urban forest. Proper planting techniques should be utilized to prevent things such as girdling roots that increase maintenance costs, damage the tree's overall health and value. Watering is essential for new plantings, especially during periods of drought or low rainfall. If stakes are utilized, they should be removed as trees become established so the tree can establish their own root flare and don't become reliant on stakes to stay up right. Currently, there are 235 trees with stakes. They should be removed within the year. Taking the time to properly maintain trees within their first several years of life can increase the overall health and value of these new trees for years to come.

Structural pruning is another important component of tree maintenance and care. Pruning trees when they are young, to improve structure, can reduce future maintenance costs and increase tree health and condition. Trees should undergo structural pruning when they are less than 7 inches in diameter. Trees that are closer to the end of this range should be a priority for structural pruning before they get too large and structural issues become harder or impossible to resolve. Structural

pruning should take place at two to three year intervals to spread out pruning sessions so any structural issues don't have to be solved with major pruning cuts.

The focus of routine pruning in trees greater than 6 inches in diameter should be with trees that are currently in the fair to excellent condition classes. There is a good chance for a number of these trees to move into higher condition classes, if a five to seven year routine pruning schedule can be sustained.

Conifers, such as Spruce and Pines, are not suitable street trees. These trees should be watched and reassessed every five years to ensure that don't become clearance and sight-line issues for sidewalks and streets. When they become hazardous, these trees should be removed. Overall, abutting property owners should be discouraged from planting trees within the ROW, especially conifers.

Safety pruning is pruning to reduce a tree's risk to the community. It is needed when a tree's canopy is made of 15% or more deadwood 2 inches or larger or there is a clearance issue. Clearance issues can include height of branches over sidewalks and streets, conflicts with lights and signs and visually block views, especially near intersections. There are 1,234 trees that require safety pruning to eliminate the hazard. The young trees should be raised as they become established to prevent these problems (part of training pruning). Be sure not to elevate the existing canopy too much at one time, or the tree's health can be severely affected.

Continued tree maintenance is essential for maintaining and potentially increasing the value of the Village's urban forest.

iv. Public Tree Value

Appendix D - Public Tree Valuation Report breaks down the value of the trees by species. This *trunk formula method* was developed and approved by the International Society of Arboriculture and Council of Tree and Landscape Appraisers, 7th edition. This is not the newest version, because the newest version does not lend itself to this format (it is more for individual landscape tree use). A figure of \$31.00/sq. inch of diameter area (**average value of a 3" B&B nursery purchased tree in the Milwaukee metro area**) is multiplied by a species (%) value (determined by species rating guides published by various upper Midwestern states), a location value (70% for street trees in primarily residential areas with moderate to heavy stocking) and the condition (%) value determined by field observations and data.

This trunk formula method is limited in assigning proper values to trees in the 1" to 2" DBH ranges due to the low square inch diameter product produced. An example of a 1" DBH tree calculation would be: 1" times 1" equals 1 sq. in. of diameter area, multiplied by \$31.00 giving a basic tree value of \$31.00 before species, location, and condition deductions are factored in. Whereas a 3" DBH tree 3" times 3" equals 9 sq. in. of diameter area, multiplied by \$31.00 gives a basic tree value of \$279.00. A 2" DBH tree would have a basic value of \$124.00.

Total public tree value for the inventory of the Village of Menomonee Falls is **\$10,179,523.01**. This equates to an average value of **\$899.73** for each inventoried tree along the Village's streets

and in parks/public facilities. Given slightly higher condition classes, and five to ten more years of growth to boost diameter and height, it becomes obvious that the value of the Village of Menomonee Falls' urban forest would be even higher.

IV. REVIEW AND CONCLUSION

The Village of Menomonee Falls has a healthy urban forest with good species diversity, size class distributions and tree conditions. Species diversity almost meets old guidelines, but a goal of reaching newer recommendations with greater diversity should be made. The size class distribution of the forest is ideal and should be maintained by continuing planting efforts. Tree conditions were mostly good, but these ratings could improve by increasing training pruning in younger trees.

A tree inventory is a dynamic, powerful management tool. The inventory should be updated to reflect work performed such as new planting and when trees are removed. The entire urban tree inventory should be re-inventoried and updated in 2024.

URBAN FOREST MANAGEMENT PLAN

I. INTRODUCTION

The purpose of this management plan is to review the data collected in the street, park and municipal property tree inventories and through analysis, develop management scenarios for both tree populations. These management strategies will build upon current practices and provide cost effective suggestions that will improve the health, safety, diversity of the Village's urban forest.

This management plan will focus on the inventoried public tree population excluding the public ash population. A "5-Year Emerald Ash Borer Implementation Plan" has been prepared for the Village as a separate document. That document contains pertinent ash tree data as well as costing over a five year period for implementation of the plan. The previous section of this document includes discussions on all public trees and gives an overview of diameters, condition and species mix for the entire population.

The Village of Menomonee Falls' urban forest (combined street and park trees) is in good shape. The overall condition is better than most medium-sized communities we see. In the 1 to 6 inch diameter classes 58.93% of the trees in this group are exceptionally healthy (70% condition class or greater). In the diameter classes greater than 6 inches, 55.76% are exceptionally healthy. It is important to improve upon the 50 to 65% condition classes as trees grow older. Focused maintenance (i.e. training pruning, proper mulching and young tree watering) early in a tree's life will be easier than trying to correct a lot of problems later. As it is, there will be continued work in the future due to changing maintenance needs as the trees grow older. This maintenance is imperative for the quality of life, property values and especially the safety of the Village of Menomonee Falls' citizens.

The priorities in the Management plan are:

1. Removals, including stump removal
2. Safety and Clearance pruning
3. Structural pruning (34.06% of the inventoried trees need this service)
4. Yearly inspections of lower condition class trees
5. Identify any additional training needs for Village crews to acquire proper tree skills (planting, pruning, hazard tree recognition, insect and disease identification, etc.)
6. Regular maintenance pruning is needed to keep trees healthy

Removals and safety pruning have to be given priority to eliminate hazards. Structural pruning, performed early in a tree's growth cycle, establishes proper branching structure and reduces long term maintenance costs. Focus must be maintained, so that low priority items that are easy to do, are not moved up. It is imperative to deal with the most important problems first. As these are dealt with, maintenance costs will decrease, safety will be greatly improved and the value of the Village of Menomonee Falls' urban forest will increase.

II. STATEMENT OF PURPOSE AND SCOPE

A. Purpose

Build upon the foundation of the comprehensive urban forestry street and park/municipal property tree inventory updated in the summer of 2018 by re-prioritizing field operations along with policies and procedures as needed to enhance the management of the urban forest resource.

B. Scope

This plan provides an outline of the community's urban forestry goals. It gives citizens, community decision makers and the staff of the Village of Menomonee Falls a clear set of strategies to achieve these goals. These goals and strategies, together with the accompanying management plan, propose a timetable of implementation and where possible, provide estimated costs to achieve the goals set forth.

III. MISSION STATEMENT

Where appropriate planting sites are present, create an aesthetic atmosphere in the Village through maintaining a diversity of high quality healthy young, intermediate and mature trees. By providing quality tree care on a low cost and regular basis, public trees will continue to be a significant asset to the Village. Quality care of public trees will also inspire and educate residents to properly care for trees on private property.

IV. GOALS & STRATEGIES

A. GOAL 1: Maintain the Village of Menomonee Falls' urban forest in a cost effective, healthy and safe condition through proper care and maintenance of trees.

Strategies:

- Use the 2018 street, park and municipal property tree inventories results to establish a maintenance action plan (part of the management plan).
 - Perform comprehensive updated inventory in 2024
- Implement maintenance goals from the management plan.
- Review yearly work plan with the Village Board in the summer of each year prior to budget submission to the Board.
- Ensure safety with regular inspections of street, park, and municipal property trees.
- Promote homeowners to assume a sense of ownership in public trees by encouraging them to perform seasonal maintenance (i.e. mulching and watering).
 - Village crews and contractors set an example by doing proper tree care
 - Collect information from (National Arbor Day Foundation, DNR, etc.) to be shared with citizens. Set up public events to distribute information
 - Create tree related articles for Village website

- Establish a “best management practices” manual that contains standards and specifications for performing tree work.
 - Continue Village employee training in proper tree care
 - Hold at least one membership in International Society of Arboriculture (ISA) and Wisconsin Arborist Association (WAA) and have multiple employees attend WAA meetings
 - Strive to get at least two people on staff to become an ISA Certified Arborist
 - Consider hiring only private contractors that agree to adhere to proper American National Standards Institute (ANSI) standards and who employ Certified Arborists
 - Enforce tree protection standards to be part of Public Works contract specifications
 - Educate others of the importance of trees, along with the current condition and goals for Village of Menomonee Falls’ urban forest
 - Make sure the importance of the role other Village departments have in maintenance and development of the Village’s Urban Forest is made clear.
- On a regular basis, update 2018 inventory to insure maintenance records are kept current.

B. GOAL 2: Establish and maintain maximum tree cover, age and species diversity, with proper site and species selection to minimize hazards and maintenance costs.

Strategies:

- Implement planting goals from the management plan.
 - Review and update recommended species list
 - Increase budget dollars for street and park tree planting
 - Increase plantings in areas that were identified in the GIS inventory as currently lacking street trees
- Seek out additional ways to provide funding for planting.
 - State grants (DOT and DNR)
 - Community groups
 - Businesses (homeowner discounts from nurseries where the Village is purchasing planting stock)
 - Strengthen Developers agreements to reflect the Village ’s management plan where they are utilized

C. GOAL 3: To have an educated public that knows what proper tree care is.

Strategies:

- Promote public awareness through publications and appearances at civic groups and schools.
- Continue the growing annual Arbor Day event including all Village departments and encourage continuing public participation.
- Communicate the importance of tree care to Village departments, construction contractors and residents.

V. CURRENT SITUATION

A. Ordinances

The Village of Menomonee Falls ordinances as they relate to trees are contained within Chapter 114 Article II: Trees and Shrubs. The ordinance is comprehensive, though outdated, and demonstrates a mindful approach to proactive management of the community's public urban forest. Care has been taken to identify potential threats to the future health of the urban forest as a whole, including public and private properties, and to lay out management strategies to address potential threats before they become an unmanageable problem.

In discussion with Village Staff, it was determined that some of the ordinances as they relate to trees have been overlooked and not followed within the community. There are also ordinances relating to trees scattered throughout the Village Code, which can be difficult to follow. It is our recommendation that the following changes be made to address some outdated language, and to bring the ordinance in line with advanced urban forest management strategies.

Division 2. Dutch Elm Disease

This section identifies Elm trees Dutch Elm disease as a public nuisance. There are many threats, biotic and abiotic, that threaten the health of the urban forest and it would be unnecessary to list each within an ordinance.

It is our recommendation that this division be revised to include any pest or disease that threatens the health of the overall urban forest. By keeping the definition of a pest or disease as a public nuisance broad, the municipality will be empowered to be flexible over time, and to respond quickly and efficiently to any potential new pest/disease that has been identified as a threat to the overall health of the urban forest.

This division includes further outdated language referring to spray trees as an effective treatment for Dutch Elm Disease. This language should be updated to include trunk injections as this treatment method is the current accepted practice for managing Dutch Elm Disease.

112-22. Permits

We recommend this ordinance remove the wording "do surgery" to avoid confusion as to what we as arborists can accomplish. ISA Certified Arborists are professionals that specialize in the study and care for individual trees in an urban setting. We employ management techniques that

favor the health of a tree and the ability of the tree to outgrow any harm that has been inflicted upon it. Trees cannot “heal” themselves, and as arborists we employ management techniques with that fact in mind. Surgeons employ techniques that save lives and allow the patient to eventually heal. These are two radically different concepts, and we should avoid confusing public perception of what we do as arboricultural professionals.

Sec. 90-68. Defective sidewalk adjacent to trees.

We recommend language in this section be updated to reflect current industry accepted practices for preservation of trees during construction activities found in ANSI A300 (Part 5): Management of Trees and Shrubs during Site Planning, Site Development, and Construction.

SPECIAL NOTE:

Inserting large amounts of detailed arboricultural information in an ordinance makes it cumbersome and difficult to change. One of the advantages of having management standards and specifications separate from the ordinance is the ease of making changes. A change made by the Village Superintendent of Public Works or a board is done more quickly and doesn't involve the politics of changing the Village Code. Another advantage to separate standards and specifications is that exceptions can be authorized by the Village Superintendent of Public Works whereas ordinances tend to be absolute. Greater detail can be written into standards and specifications when they are separate, without fear of not being able to change it in the future.

Through these processes, the Village of Menomonee Falls' trees will receive the protection and consideration they warrant.

B. Tree Administration

The responsibility for all street, park and municipal property trees lies with the Public Works Superintendent and shall be overseen by the Public Works Director. This management plan should help establish priorities and commitment in the Village system for nurturing the public tree population. A few problems need to be dealt with now, but in the long term, training and maintenance pruning along with new tree planting are the main priorities for future safety, health and benefits of the urban forest. Time needs to be set aside and taken for maintenance of street and park/municipal property trees.

The Village is not large enough to justify a full time urban forester position. However, the Village could consider plans to create at least a 1/2 time Village forester's position at some point in the foreseeable future. It is important to have a “go to” person for forestry issues. The public, elected officials, other Village staff and state staff need to know who the primary contact is. Also, this person would be the focus of training and support and reduce having multiple people answer questions differently and leading to conflict (i.e.. one person asks a parks staffer about pruning along a drive, then asks a public works employee - you can get opposing answers). It can also help in pulling workload from staff (for calls, emergencies, staff questions, etc.) that are not trained or equipped to deal with tree issues.

It is encouraging to see that the administration realizes the role that trees play in the Village's infrastructure. Having this support from the managers is vital in giving consistency and focus to the field work that is required in maintaining a safe and healthy public tree population. It will be critically important to have the financial and administrative support of the Village Administrator and the Village Board to help in moving the urban forestry program forward with an overall focus on the goals and objectives.

An internal assessment of Public Works Department has highlighted a need for an additional Certified Arborist as the Village does not have an ISA Certified Arborist on staff. Employees should be kept current with the latest techniques and procedures with staff training days. Appropriate training modules include tree biology, training pruning practices, chain saw safety, and felling techniques. Continued training will promote safe and efficient work practices.

Currently the Department is thoroughly stocked with forestry equipment such as chainsaws, various assorted small equipment, and various large loading, lifts, and chipping equipment. It is positive to see the Village has put a high priority on the safety of their work crews by supplying a wide variety of PPE and that they are including recent innovations such as "in-helmet" communication systems that allow for constant contact between crew members during forestry operations.

By utilizing the evolving GIS tree inventory, the Department should attempt to establish a rotational pruning cycle within the Village. The goal would be to set up a tree pruning cycle based on a 5 to 7-year rotation. The challenge the Village is currently presented with is the implementation of a data asset management program that will fit the needs of their forestry operations. The data collected within this tree inventory has built a tree layer for the Village's existing GIS program; however it will not aid in future management of the data such as querying out needed maintenance records or performing updates of the inventory information. It is our recommendation the Village pursue the implementation of a forestry data asset management program, whether that be in house or through a private contractor.

It is important that the work strategies are well thought-out so that they can fit correctly into the existing system of overall departmental responsibilities. A critical factor is to stay current with arboricultural practices. Opportunities for appropriate training for the staff are a priority of management. It is easier to train someone to run a lawn mower than it is to train a person to perform proper pruning. Improper pruning can have long term negative impacts on tree health and Village budgets.

One goal that should be reasonable to attain within the next year or two is the creation of a procedures manual for forestry activities. A sample manual prepared by the Village of Howard can be found at the link: <https://www.villageofhoward.com/DocumentCenter/View/362/Arboricultural-Specifications-Manual-2011>

Also consider, *Best Management Practices for Tree Care Operations* published by the International Society of Arboriculture and various *ANSI Standards for Tree Care Operations* published by the American National Standards Institute. These are excellent supplements to include in a procedures manual.

An area that is not seen as a problem is wood residue utilization. Currently brush/wood chips and logs generated by Village forestry operations are utilized by the Village for their own purposes and are available to Village residents.

C. Inventory Summary – All Public Trees

The Village of Menomonee Falls has a healthy forest with good species diversity, size distribution and condition ratings. These positive assessments are a testament to the Village's commitment to new diverse tree plantings and continued tree maintenance.

The distribution of size classes is ideal showing an uneven aged forest with predominantly young trees with 66.52% within the 1 to 6 and 7 to 12 inch diameter classes. An uneven aged forest is ideal because as the older age tree classes succumb to mortality and removal, there are numerous young healthy trees that will continue to grow and preserve benefits provided by the overall urban forest.

The 56.88% of the condition ratings are 70% and greater which is healthy but could be improved upon to get more trees in these condition classes. This can be accomplished using training, routine and safety pruning. Focus should be placed on safety pruning which can eliminate hazards and training pruning which can correct structural issues improving the health of the tree and reducing future maintenance costs.

Overall, the Village has good species diversity that meets older recommendations, but work should be done towards achieving newer guidelines that promote even higher standards of diversity. This would involve limiting the planting of all species such as Green Ash, Norway Maple, Colorado Spruce and Honeylocust (Thornless). There should be no or extremely limited planting of *Acer* (Maples) or *Picea* (Spruce) species.

Ash trees should be treated and removed in accordance to the Village's 2018 "5-Year EAB Implementation Plan." Maple trees make up large portions of the overall forest, 25.88% of species on streets and 12.95% in parks and public properties. Norway Maple is the main Maple species in the Village. It is prone to girdling roots and tends to have poor structure. Spruce are 12.52% of the street trees, Colorado Spruce being the main species. These are not good street trees because they cause street and sidewalk obstructions.

Plant species that are not currently represented in the inventory or have very low numbers but have unique attributes and necessary hardiness include: Swamp White x Bur Oak hybrid, Bitternut Hickory, Ohio Buckeye, Baldcypress, Ironwood and Amur Corktree.

VI. REVIEW OF RESOURCE & DISCUSSION

A. Introduction

Priorities in the Goals section for the public trees were set with safety being the most important criteria. Therefore, the first items dealt with were removals (incl. stumps) and safety pruning. A routine pruning program should be implemented on a limited basis, while focusing on taking care of newly installed trees. Ongoing street tree planting is a high priority. The Village should strive to meet a minimum of 250 trees planted annually, and emphasis should be placed on facilitating other funding means to increase this number. Based on vacant planting sites (2,349 sites), by planting 250 trees per year the Village will reach full stocking in ten years. This number does not factor in replanting sites where trees were removed. Training pruning needs to be ramped up in 2020 (2019 if the budget allows) as an important means of directing future growth and reducing costs for the Village's urban forest. After these programs are up and running, the focus can be spread out to include more routine pruning.

It is important to stay focused on the priorities. **Table 5 – Estimated Costs for a Five Year Implementation Schedule Public Trees (Non-Ash) – In House** summarizes the expenses by area and function per year. This table was compiled using the priorities from the Goals section and data from all the trees included in the inventory. As problems are corrected, there may be a reduction in cost over time. The yearly budgets are only suggestions and depend on overall funding levels available.

B. Estimated Costs

All projected costs in **Table 5** are made with the assumptions that work will be performed by Village crews with an average cost of \$60.43 per hour (including payroll taxes and benefits) for full-time staff. Some of the larger pruning, tree and stump removals, may need to be performed by tree contractors with more specialized skills and equipment. It is estimated that contractor costs (\$85.00 per hour estimate) will be approximately 1.4 times higher than the hourly rate used in the illustrations. Costs have been calculated managing street and park trees together as an urban forest. Actual costs could vary and no factor for inflation has been included.

Table 3. Estimated Costs for a Five Year Urban Forest Implementation Schedule Public Trees (Non-Ash) – In House.

In-House Cost w/Fringe Benefits			60.43										
Estimated costs for each activity			2019		2020		2021		2022		2023		Five Year Cost
Activity	Diameter Class	Cost/Tree (\$)	# of trees	Total Cost	# of trees	Total Cost	# of trees	Total Cost	# of trees	Total Cost	# of trees	Total Cost	
TREE REMOVALS	1-6"	\$64.06	112	\$7,174.25									
	7-12"	\$123.28	133	\$16,395.87									
	13-18"	\$234.47	57	\$13,364.70									
	19-24"	\$418.18	19	\$7,945.34									
	24"+	\$729.99	6	\$4,379.97									
Activity Totals			317	\$49,260.12	(M)	\$3,000.00	(M)	\$3,000.00	(M)	\$3,000.00	(M)	\$3,000.00	\$61,260.12
PRIORITY PRUNING (SAFETY, CLEARANCE, DEADWOOD)	1-6"	\$24.17	0	\$0.00	0	\$0.00	79	\$1,909.59					
	7-12"	\$76.14	0	\$0.00	0	\$0.00	353	\$26,878.06					
	13-18"	\$123.28	60	\$7,396.63	190	\$23,422.67	108	\$13,313.94					
	19-24"	\$186.12	185	\$34,433.01	60	\$11,167.46	0	\$0.00					
	24"+	\$263.47	198	\$52,168.01	0	\$0.00	0	\$0.00					
Activity Totals			443	\$93,997.66	250	\$34,590.13	540	\$42,101.58	(M)	\$2,500.00	(M)	\$2,500.00	\$175,689.37
TRAINING PRUNING	1-6"	\$41.09	0	\$0.00	125	\$5,136.55	225	\$9,245.79	506	\$20,792.75	600	\$24,655.44	
	7-12"	\$87.02	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	
	13-18"	\$152.28	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	
Activity Totals			0	\$0.00	125	\$5,136.55	225	\$9,245.79	506	\$20,792.75	600	\$24,655.44	\$59,830.53
ROUTINE PRUNING (MAINTENANCE)	7-12"	\$111.19	0	\$0.00	0	\$0.00	0	\$0.00	674	\$74,942.87	600	\$66,714.72	
	13-18"	\$111.19	0	\$0.00	0	\$0.00	120	\$13,342.94	212	\$23,572.53	250	\$27,797.80	
	19-24"	\$282.81	0	\$0.00	195	\$55,148.42	119	\$33,654.68	0	\$0.00	0	\$0.00	
	24"+	\$398.84	0	\$0.00	100	\$39,883.80	97	\$38,687.29	0	\$0.00	0	\$0.00	
Activity Totals			0	\$0.00	295	\$95,032.22	336	\$85,684.91	886	\$98,515.40	850	\$94,512.52	\$373,745.05
TREE PLANTING	Site Prep	\$15.71	250	\$3,927.95	250	\$3,927.95	250	\$3,927.95	250	\$3,927.95	250	\$3,927.95	
	Tree Cost	\$110.00	250	\$27,500.00	250	\$27,500.00	250	\$27,500.00	250	\$27,500.00	250	\$27,500.00	
	Planting	\$53.18	250	\$13,294.60	250	\$13,294.60	250	\$13,294.60	250	\$13,294.60	250	\$13,294.60	
Activity Totals			250	\$44,722.55	250	\$44,722.55	250	\$44,722.55	250	\$44,722.55	250	\$44,722.55	\$223,612.75
OTHER MAINTENANCE	Stake Removal	\$15.71	235	\$3,692.27	250	\$3,927.95	250	\$3,927.95	250	\$3,927.95	250	\$3,927.95	
	Watering (2x)	\$42.30	250	\$10,575.25	500	\$21,150.50	500	\$21,150.50	500	\$21,150.50	500	\$21,150.50	
	Mulching	\$21.75	0	\$0.00	250	\$5,438.70	250	\$5,438.70	250	\$5,438.70	250	\$5,438.70	
	Watch	\$15.71	0	\$0.00	0	\$0.00	0	\$0.00	998	\$15,680.38	1100	\$17,282.98	
	Stump Removal	3.00/inch	3,398	\$10,194.00	(M)	\$750.00	(M)	\$750.00	(M)	\$750.00	(M)	\$750.00	
	Cable&Prune	\$150.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	
	Girdling Root	\$115.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	0	\$0.00	
Activity Totals			485	\$24,461.52	1000	\$31,267.15	1000	\$31,267.15	1998	\$46,947.53	2100	\$48,550.13	\$182,493.48
Totals per Year				\$212,441.85		\$213,748.60		\$216,021.98		\$216,478.23		\$217,940.64	\$1,076,631.30
(M) = REGULAR MAINTENANCE ITEM REOCCURRING YEARLY OR ON A CYCLE													
In House cost based on \$60.43 per hour													

C. Summary

The data projected in **Table 5** was extrapolated directly from the database created from the public tree inventory update that was conducted during the summer of 2018. The budget provides a starting point for Village staff to see what the current needs are with respect to the public tree population (non-Ash). Obviously staff will have to make some priority choices in order to keep cost within each annual budget allocation.

Overall costs (including streets and parks) projections for the first five-year period of the Implementation Schedule for all public trees averages about \$215,326.26 per year over the projected five years. Following review of the 2017 Village Tree City USA application, the estimated 2019 starting budget of \$212,441.85 is approximately double the estimated forestry budget spent by the Village in 2017.

It is strongly recommended that the Village of Menomonee Falls continue to implement additional street tree plantings to infuse more species diversity into the population and lessen the impact of the Emerald Ash Borer infestation. There are around 2,349 identified vacant planting sites along the streets where species diversity planting can take place.

Supplementary funding might be secured through additional Urban Forestry Assistance Grants for implementation of this management plan. There are also other possible funding sources such as American Transmission Company's Pollinator Planting and Community Planting Programs. Additional funding sources include fundraising events in conjunction with the business community or possibly homeowners paying for the wholesale cost of the trees selected for street plantings and the Village paying for the planting labor.

Realize that the costs in the Implementation Schedule are only projections. As stated before, removals and safety issues are of first priority. Years two, three, four, and five are when most routine pruning would expand in activity level.

D. Implementation Detail (All Non-Ash Trees)

i. Tree and Stump Removal (see Table 3)

Tree removals (327 total) are taken care of during the first year of the budget. All removals are addressed within the first year. Larger trees within the 13 to 18 inch, 19 to 24 inch and greater than 24 inch diameter classes are likely the most hazardous. After 2019 this activity becomes a regular maintenance item with \$3,000.00 budgeted annual for this expense. All stump removals are completed in the first year. This becomes another regular maintenance expense with an annual budget of \$750.00. Since some time has passed from when the inventory was concluded to when this management plan is completed, several of the trees in this category may have already been removed.

ii. Safety and Clearance Pruning (see Table 3)

Safety pruning (deadwood, broken limbs hanging in trees and clearance issues) involves 1,234

trees in total with 443 trees in 2019, 250 trees in 2020, and 540 trees in 2021. After work on these trees is completed, \$2,500.00 is budgeted every year as a regular maintenance item. Having the trees on a routine pruning cycle of every five to seven years will prevent most of the problems that are now being corrected in the safety category.

There are 668 trees with noted clearance issues. Clearance Pruning is needed to eliminate these hazards that interfere with foot and vehicle traffic and view obstructions. When raising trees, they do not have to be raised evenly. The street side can be raised to allow for truck clearance and the walk side can be left lower to keep more crown surface. View obstructions at intersections and clearance for lights and signage need to be resolved and maintained.

iii. Training Pruning (see Table 3)

The corrective training pruning is spread out over the five-year rotational pruning schedule. Some trees, because of diameter increase, will move into the routine prune category. Others, because of their species or habit of growth, may be able to be skipped for a rotation. This category involves 1,456 trees, all in the 1 to 6 inch diameter categories. As new trees are planted, they will need to be added to the training pruning rotation.

Young trees, depending on the growth habit of the species, should be pruned every two to three years for the first ten years of the establishment period. This is very critical for maintaining street and sidewalk clearances. At the same time, a young tree cannot be raised up (removing lower limbs) too fast or it will not have enough crown area (leaf surface) and will become susceptible to other stresses.

Even more important than clearance pruning, training pruning creates proper structure in the trees. This not only makes the trees safer but will also greatly reduce future pruning expenses. The amount of time and money it takes to remove a one-inch branch with a hand pruner in year five as opposed to using a chainsaw at age 30 is obvious. This can greatly reduce future pruning expense and reduce tree decay along with stress.

iv. Routine Tree Pruning (see Table 3)

This is regular maintenance pruning for all trees (including mature tree pruning). It is crown cleaning pruning that includes training and clearance pruning as needed. It holds the largest number of trees of any of the maintenance categories, with 2,367 trees. As the trees grow older, this category will become even more important.

All trees should be on a five to seven year pruning cycle to keep the trees at maximum health and to prevent most problems from developing. The number of trees requiring routine pruning increases over the course of the budget as resources previously allocated towards removals and safety pruning become available for regular maintenance such as routine pruning. In fifteen years the number of trees requiring routine pruning could double and will increase even more over time as the trees mature.

Once the problems are corrected, not budgeting to this area may save money for a year or two.

However, problems will reappear needing more money to correct and compromising the safety of citizens. The most cost effective and safe way to manage trees is with routine maintenance pruning. You don't wait for trucks to breakdown before changing the oil because usually it is too late by then! Tree maintenance prevents problems, extends the life of the tree and reduces costs.

v. Tree Planting (see Table 3)

The Village currently plants approximately 100 trees per year. This number should be increased to at least 250 trees planted annually based on the number of vacant planting sites (2,349) being available. These sites have been identified in the street tree inventory. Using the visual mapping information in GIS, management can readily discern where the greatest need for future plantings should take place. It is important to continue introducing new tree species into the street tree population to keep and improve the diversity of the population.

If the Village uses outside contractors for planting, a primary focus should be to establish planting and aftercare specifications (see **Appendix H – Standards and Guidelines**) that will be adhered to by all private contractors planting in the public ROW. Inspection and enforcement of the specifications is critical at planting time.

When possible, where the terrace is particularly wide, trees should be planted in the back portion of the right-of-way away from the street. Unless they are small scale trees, they should be at an approximate 45' to 50' spacing. This gives enough room for the mature crown to grow (reducing pruning) and can lessen the potential spread of a future pathogen through root grafts. Also, in many areas a larger vision corner should be left by staying farther away from the corner with plantings.

It is recommended that a community wide planting plan be developed after the majority of the existing tree problems are corrected (2019 or 2020). Do not use conifers for street side planting, scale way back or eliminate *Acer* (Maples), eliminate *Fraxinus* (Ash) for the time being and continue to add more variety in species planted. There are many options to help fund planting; from involving community groups, grants for planting, partnerships with businesses, projects tied to highway work, etc.

The planting that does take place should only be trees from the list of Recommended Tree Planting List (**Appendix C - Planting Recommendations**). This is set up to ensure that the proper size tree is used under utility wires or in a narrower tree terrace situation.

Better quality (single leader) planting stock should be specified and required when ordering nursery stock. The Village should expect to receive quality nursery stock from its suppliers that do not exhibit poor structural problems. By using quality nursery stock, the Village will be able to reduce the amount of training pruning time spent correcting problems created in the nursery. This is best accomplished by purchasing plant material from nursery firms that are members of the Wisconsin Nursery Association (WNA).

vi. Tree Stake Removal (see Table 3)

There are 235 sites where tree stakes were still in place supporting younger trees. Stake removal is important to prevent potential damage to the trunks of these trees. If the stakes are left on too long and are extremely taut, there is a risk of girdling taking place and causing restriction of water and nutrient flow between the roots and crown, potentially leading to dieback in the crown.

Tree stakes should not be left on for more than two growing seasons. Beginning in 2019, hours are budgeted to remove stakes systematically from trees that were planted one year previously.

vii. Young Tree Watering (see Table 3)

A most critical phase of new tree establishment is young tree watering. Through public awareness and education most newly planted street trees can be watered by the adjoining property owner. This saves the Village substantial employee-hours that can be redirected towards other tree maintenance activities including new park/municipal property tree watering. Supplemental watering of newly planted trees during the first two to three years after planting is crucial to their survival, becoming established and beginning vigorous growth. This initial care sets the course for getting trees started on the right path and reduces their chances of succumbing to insects, diseases or environmental stresses in the future. Minimal dollars have been budgeted to provide two visits to newly established trees during the course of a summer.

It is important to realize that more plants are lost to over-watering than to under watering. Roots need air just as much as they need water. Always check the moisture level under the mulch before watering.

viii. Mulching (see Table 3)

Creating mulched beds around street trees is important to reduce damage to the base of the trees from mowing and string trimmer equipment. It also creates a superior rooting area for improved tree vigor and better aesthetics. When trees are being mulched, care should be taken to avoid piling mulch against the trunk (see **Appendix H - Standards and Guidelines**). This work needs to be ongoing project of the department. Maintenance funds need to be budgeted every year beginning in 2020 to maintain the mulch at a two to three-inch thickness. This mulch can be wood chips from Village tree care operations (free) or shredded hardwood mulch (will stay in place better, last longer and look nicer, but must be purchased).

Educating homeowners on the importance of installing mulch rings is vital. Numerous instances were observed when conducting the street tree portion of the inventory field work where basal damage had occurred as the result of mower or string trimmer damage.

ix. Watch (see Table 3)

There is also a projected budget amount that includes watch trees as identified in the inventory. The inspection of these 2,098 trees are distributed relatively evenly throughout each budgeted year, they are all conifers. They rarely require any maintenance; however, they need to be

checked periodically for sight clearance issues where they are planted in the street terrace and general overall health and vigor.

x. Girdling Roots (see Table 3)

Girdling roots is a situation where a root(s) grows around the base of the tree cutting off the flow of materials through the cambium up into the tree. This will slowly kill the tree over several years. It is a very common problem with Norway Maples and the reason why planting Norway Maples is discouraged. Given that there are 768 Norway Maples (6.79% of population) this may become a problem over time. Instead of the trees living eighty plus years, they may only live thirty to forty years. Identifying girdling roots during an inventory provide the Village with the option of performing root collar exams. A root collar exam utilizes an air spade. During this procedure roots in the root crown area are exposed and the problem roots can be cut away to correct the problem. However, it is not possible to see all problem roots because they are below the surface. These types of maintenance could reduce the removal and planting costs of leaving a tree with girdling roots. Better species selection for new plantings is the long term answer.

E. Disease & Insect Problems

i. Dutch Elm Disease

There are 267 Elm Spp. (2.36%) in the entire inventory for the Village. This includes a variety of species including American and Red Elm which are susceptible to DED. 18 Elms showed signs of having DED. These trees range in size from 7 to 32 inches in diameter. Fortunately, this is a small percentage of the overall public tree population. Regular inspections and removal of infected elm trees should be programmed into the maintenance schedule to help break the disease cycle and to keep dead or dying trees from endangering the public.

The Village has planted several varieties of disease resistant hybrid elms. This is a great way to keep the *Ulmus* genus part of the species diversity mix.

ii. Oak Wilt

There was no active oak wilt detected in either the street or park inventoried areas. Oak wilt is a fungal disease that invades the water conducting vessels of the sapwood and causes blockage of these vessels. This disrupts sap flow, causing leaves to wilt and eventual death of the tree. The Red Oak group is more susceptible to the disease than White, Swamp White or Bur Oak. The breakdown of oak species inventoried includes: 94 Bur Oak, 65 Northern Red Oak, 65 White Oak, 53 Swamp White Oak, 3 Oak Spp., 1 Pin Oak and 1 Shingle Oak. The Oak family accounts for 2.50% (283 trees) of all the public trees that were inventoried in the Village. Discretion should be used when planting trees in the *Quercus* genus such as the Swamp White x Bur Oak hybrid.

Proper understanding of oak wilt management is critical to properly managing this disease. An excellent publication giving an overview of this disease and its management has been produced by the University of Wisconsin-Extension titled “*Oak Wilt Management – What are the Options*”

(publication #G3590).

iii. Gypsy Moth

There has been no DNR-organized aerial spraying in the Village of Menomonee Falls for the gypsy moth suppression program in recent years.

iv. Emerald Ash Borer

The EAB is an exotic wood borer that was found attacking and killing ash trees in Michigan during 2002. Since its detection, EAB has killed millions of ash trees and is now found in Arkansas, Connecticut, Colorado, Delaware, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Maryland, Minnesota, Missouri, Nebraska, New Hampshire, New York, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Texas, Virginia, West Virginia, Wisconsin and the Quebec and Ontario provinces of Canada. EAB is easily spread through the movement of firewood, logs and nursery stock and is why people have been the greatest cause for the rapid spread of EAB over the past decade.

EAB is a very destructive pest. This insect attacks and kills white, green, blue, black and all horticultural varieties of ash. This insect attacks not only stressed ash trees but healthy and vigorous ash trees as well. The larvae of this insect feed under the bark undetected, disrupting the flow of nutrients and water between the roots and crown of ash trees. The first visible signs are usually crown dieback. By this time it is usually too late to save trees.

This pest has been confirmed and is well established in Southeast Wisconsin. The entire state is under quarantine. Using the recent ash population data from the recent inventory a “5-Year EAB Implementation Plan,” was created to address how the will handle the ash tree population. Adherence to this plan will help the Village proactively deal with EAB without drastically impacting the urban forest.

Additionally, listed below are three websites with current information on EAB:

1. <http://emeraldashborer.wi.gov/>
 - a. EAB internet portal for Wisconsin sponsored by Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources and the University of Wisconsin – Madison
 - b. Contains information from a Wisconsin perspective on EAB biology, management, survey activities, publications and provides related links
2. <http://www.emeraldashborer.info/>
 - a. Official emerald ash borer web page administered by Michigan State University
 - b. Contains information on EAB biology, distribution, control measures, current research and links to various EAB infested state’s web sites
3. <http://dnr.wi.gov/topic/UrbanForests/EABToolBox.html>
 - a. Wisconsin DNR EAB Toolbox for Wisconsin Communities

- b. Designed for the planning and response needs of municipal governments, including such topics as: “Is Your Community Ready for EAB (video), “EAB: The Opportunity of a Lifetime”, “Readiness Checklist”, “What Will Happen if EAB is Found in Your Community?” and “EAB University”

v. Other Pest Problems (by tree species):

Honeylocust

Leafhoppers and plant bugs (leaf sucking insects that defoliates the tree)

- Relatively easy to control, but the public is often not comfortable with spraying. Can be controlled with a soil injected material for individual high value trees (like park trees or business district area).

Nectria canker

- A fungus that causes a dead area in the bark, usually at a branch crotch area. Important to keep the tree growing vigorously and out of drought stress. Proper pruning cuts and dormant pruning during dry, lower humidity conditions are important.

Linden

Boring insects

- Can be very serious on individual trees. Usually attack branch crotch areas. Buying good planting stock and good training pruning can do a lot to limit this problem. Keeping existing plants healthy and out of stress is very important. Can trunk inject specimen trees, but is expensive.

Spruce

Spruce needle casts (*Rhizosphaera*)

- Rows of black dots (fruiting bodies) on needles. Loss of innermost needles. Shade and irrigation compound the problem.

Cytospora canker

- Dieback and eventual death of lower branches. Disease progresses upward in tree over time. Prune out infected branches during dry conditions. Mulching, supplemental watering and fertilization reduce disease incidence.

Crabapple

Apple scab

- A fungus causing leaf spots, which causes premature leaf drop, and disfigured fruits. Can be treated with two to three foliar sprays annually. Plant disease-resistant varieties.

F. Crew Training

Village employees should regularly be sent through training experiences that involve the safe use of chainsaws and proper felling techniques such as FISTA Chainsaw Safety Training, the UW Extension Horticulture Short Course seminar and Proper Pruning and Felling Techniques Workshop, and the MATC Arboriculture 101 class.

Serious consideration should be given to hold at least one membership with the Wisconsin Arborist Association. Attending the various meetings produced by the WAA and/or the DNR's Urban Forestry working group can provide additional avenues to secure technical training. A goal should be to have at least one International Society of Arboriculture Certified Arborist on staff.

VII. KEY NEEDS OF THE URBAN FOREST

The main needs of the Village of Menomonee Falls' urban forest, as brought out in the inventory and discussions, fall into three categories:

Administrative Needs:

- implementation of the Management Plan
- recommendations for additions to the Municipal Tree Ordinance
- supplemental training of crews
- coordinate efforts of all departments currently working with tree issues
- all Village departments understand importance of trees
- revenue generating opportunities

Resource Needs:

- street tree removals
- safety and clearance pruning
- training pruning
- ongoing inspection program for EAB and Dutch elm disease
- increase stocking on streets (planting)
- proper species selection to improve diversity
- improve tree condition/health through timely watering and mulching practices
- proper regular maintenance

Community Needs:

- public awareness on policies of trees in the ROW and other public property
- education, especially major disease and insect threats
- involvement of civic groups in funding projects, particularly tree planting

VIII. REVIEW OF PLAN

It is vital to the success of the urban forestry program that this Plan be evaluated to see that desired results are being attained. It has to be remembered that a Management Plan is a dynamic document. There will certainly be a need to change or add goals, strategies and priorities as time goes on. It will be the responsibility of the appropriate Village departments to review all of the goals, strategies, actions, tasks, and priorities in the Plan in the summer of every year, prior to budget submission, to see that they are achieving the overall Mission and Purpose. Any additions and/or adjustments to the Plan will be made at the time of the review. The Village Board should be informed of these accomplishments. A major review and updating should take place in **2024** by an outside urban forestry consulting firm.

IX. CONCLUSION

It has been the pleasure of Wachtel Tree Science to assess and analyze the Menomonee Falls' Public Urban Forest. The Village's Urban Forest has good species diversity, tree health conditions and an ideal size distribution. This is a testament to the commitment to Menomonee Falls' Urban Forest on behalf the Village's residents, administration, and motivated individuals within the Village's staff. The Village should be commended on a job well done.

The Village of Menomonee Falls has a wonderful living, growing resource. The urban forest needs to be managed to avoid serious problems and to achieve its full potential. When managed properly, it will increase in value, giving many benefits to the citizens from cleaner air, cooler homes, increased property values and making the Village of Menomonee Falls a more beautiful community to visit, work and live in.

APPENDICES

Appendix A: Inventory Criteria

Menomonee Falls Tree Inventory - Pinpoint 3.0

GENERAL NOTES:

TREES

Inventory all trees in the Right-Of-Way (R.O.W.), selected parks and public properties that are 1.0" diameter at breast height (DBH, 4.5 feet above ground) or greater.

- Data fields not applicable to the site being inventoried do not have to be edited
- Notify Nate of immediate hazards such as truck splits - TS or significant deadwood - DW or hangers - HG

RANDOM NOTE: save neighborhoods with a large number of vacant planting sites or very small trees for the end of the inventory or rain days

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Inspection Date - use check box to automatically select the current date or drop down menu to select required date from a calendar

Species - select the species group (common, uncommon or rare) that contains the site description or tree species to being inventoried > select the site description or species from the second drop down menu

- DO NOT use varieties designated for Green Ash, White Ash, Norway Maple or Honeylocust
- Oddball Linden (Boulevard, Sentry, etc.) are Basswood Spp.
- For Norway Maple and other species with purple leaves, write 'purple leaved' in **NOTES**, these trees have slightly different growth characteristics
- For species with variegated leaves, write 'variegated' in **NOTES**, these trees have slightly different growth characteristics
- See sections on VACANT PLANTING SITES or STUMPS for more information how to fill out those site types

COMMON	UNCOMMON	RARE
Vacant	Ailanthus	American Hornbeam
Stump	American Mountain-Ash	Amur Corktree
Alder Spp.	Amur Chokecherry	Balsam Poplar
American Basswood	Amur Maple	Bigtooth Aspen
American Elm	Apple Spp.	Bitternut Hickory
Ash Spp.	Baldcypress	Black Ash
Austrian Pine	Balsam Fir	Black Maple
Birch Spp.	Basswood Spp.	Black Oak

Black Cherry	Black Hills Spruce	Black Spruce
Black Locust	Cockspur Hawthorn	Black Willow
Black Walnut	Cornelian Cherry Dogwood	Blackgum
Boxelder	Dogwood Spp.	Blue Ash
Bur Oak	Douglas-Fir	Bristlecone Pine
Callery Pear Spp.	Eastern Cottonwood	Butternut
Cherry and Plum	Eastern Hemlock	Canada Plum
Colorado Spruce	Eastern Redcedar	Catalpa Spp.
Crab Apple Spp.	Eastern White Pine	Chestnut Oak
Crab Apple Var.	European Alder	Chestnut Spp.
Elm Spp. (Hybrid)	European Hornbeam	Chinese Elm
Freeman Maple	European Larch	Chinkapin Oak
Green Ash	European Mountain-Ash	Common Hoptree
Green Ash Var.	Fir Spp.	Common Persimmon
Hackberry	Ginkgo	Crack Willow
Hawthorn Spp.	Glossy Buckthorn	Cucumbertree
Honeylocust (Thornless)	Honeylocust (Native)	Dawn Redwood
Honeylocust Var.	Hornbeam Spp.	Downy Hawthorn
Horsechestnut	Jack Pine	Eastern Redbud
Ironwood	Juniper Spp.	European Ash
Japanese Tree Lilac	Kentucky Coffeetree	European Beech
Littleleaf Linden	Larch (Introduced)	False Cypress Spp.
Mountain-Ash Spp.	Lilac Spp.	Fraser Fir
Northern Red Oak	Lombardy Poplar	Golden Raintree
Norway Maple	Magnolia Spp.	Japanese Larch
Norway Maple Var.	Maple Spp.	Katsura Tree
Oak Spp.	Northern Catalpa	Korean Mountain-Ash
Other, Unknown	Northern Pin Oak	Mockernut Hickory
Paper Birch	Northern White-Cedar	Ohio Buckeye
Pine Spp.	Norway Spruce	Pagoda Dogwood
Poplar Spp.	Osage-Orange	Pear Spp.
Red Maple	Pin Oak	Pecan
Redmond Linden	Red Elm	Pignut Hickory
Russian-Olive	River Birch	Pin Cherry
Scotch Pine	Rock Elm	Ponderosa Pine
Siberian Elm	Sargent Cherry	Port-Orford-Cedar
Silver Maple	Serviceberry	Quaking Aspen
Spruce Spp.	Shagbark Hickory	Red Mulberry
Sugar Maple	Shubert Cherry	Red Pine

White Ash	Silver Linden	Sassafras
White Ash Var.	Swamp White Oak	Saucer Magnolia
Willow	Sweetgum	Scarlet Oak
	Sycamore	Shingle Oak
	Tamarack (Native)	Silverbell
	Turkish Filbert	Smoketree
	Walnut Spp.	Sourwood
	Washington Hawthorn	Southern Catalpa
	Weeping Willow	Tartian Maple
	White Fir	White Mulberry
	White Oak	White Poplar
	White Spruce	White Willow
	Yew Spp.	Wild Plum
		Yellow Birch
		Yellow BUCKeye
		Yellow-Poplar
		Yellowwood

Address - N/A (automatically filled post process by Rueke-Mielke)

Street - N/A (automatically filled post process by Rueke-Mielke)

Side Street - N/A

- Only collect data for communities we plan on actively managing
- For corner properties with trees located on the adjacent side street, fill **Side Street** with the name of the adjacent side street.
- Also fill in **Side** information

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Side

- Only collect data for communities we plan on actively managing
- N/A
- Front
- Right
- Left
- Back
- Median

Location

- Street
- Park
- Parking Lot
- Building Site
- Natural Area
 - Under **Special Conditions** check wooded area - **WA**

- Only inventory trees that are 8 inches DBH or greater
- Other

Year Planted - N/A.

Growth Space

- Open
- 0 - 3 ft - distance between street and sidewalk
- 3 - 5 ft - distance between street and sidewalk
- 5 ft + - distance between street and sidewalk
- Ditch - drainage ditch
- Median - strip of land between lanes of opposing traffic
- Island - strip of land between traffic lanes used for control of traffic movement
- Boxout - space located within downtown sidewalks designated for tree
- Grate - boxout with grate surrounding tree
- Behind Walk - site located behind sidewalk, rather than between the street/curb and sidewalk (usually the R.O.W. ends at the sidewalk, occasionally it can extend beyond the sidewalk and trees may be planted there)
- Other

Diameter -

- Measure DBH in inches
 - Round up for trees over the 0.5 inch mark and round down for trees below the 0.5 inch mark
 - For ash trees round up for trees over the 0.3 inch mark
- For multi-stemmed trees measure the largest stem DBH
 - Under **NOTES** designate the number of stems, ex. '2-stemmed', '3-stemmed', 'clump' (stems less than 2 inches DBH), etc. and the DBH of all the individual stems above 2 inches in diameter
 - For multiple stem trees where stems originate from ground level, under **Special Conditions** check multi-stemmed - **MS** and possibly codominant trunks/stems - **CT** or included bark - **IB** (stems might have fused together)
 - For single stem tree with codominant stems below 6', measure/record DBH of single stem, under **Special Conditions** check low crotched - **LC** and possibly codominant trunks/stems - **CT**, included bark - **IB** or poor structure - **PS**

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Height Class

- N/A
- 0-15'
- 15-30'
- 30-60'
- 60'+

Deadwood Present (%) - estimated the percent of deadwood in the crown, range of 0-100% with 5% increments

- For trees with 15% and greater deadwood normally 2 inches in diameter and greater check deadwood - **DW** under **Special Conditions** and 'safety prune' under **Needs**

Priority

Condition Rating (%) - range of 0-100% with 5% increments

- No tree should have a 100% rating for liability purposes

Planting Depth

- N/A
- OK
- Deep, Vigor Good
- Deep, Declining
- For both 'Deep' planting depths, under **Special Conditions** mark deep planting - **DP**

Primary Maintenance Needs - list most pressing maintenance need

- Hierarchy: removal, safety, structure, health
- Plant - vacant site suitable for planting
 - **Work Priority** should be OK by default
- Remove - tree requires removal
 - Tree usually has **Condition Rating** between 0 and 45%, may be adjusted based on pest problems, etc.
 - **Work Priority** should occur 'Within One Year' and 'Within Three Years', depends on severity
- Safety Prune - tree require immediate pruning to remove potential hazards,
 - Trees usually has **Condition Rating** between 50 and 65%, might not apply to clearance pruning
 - For trees with 15% and greater deadwood normally 2 inches in diameter and greater, under **Special Conditions** check deadwood - **DW**
 - Trees with hangers - **HG** require a 'safety prune'
 - Trees that require clearance should be marked low branched - **LB** in **Special Conditions** and require a safety prune
 - **Work Priority** should occur 'Within One Year'
- Routine Prune - normal maintenance for trees with no immediate hazards
 - Trees usually has **Condition Rating** 65% and above
 - For trees 7 inches and greater DBH
 - **Work Priority** should occur 'Within Five Years'
- Training Prune - pruning for small trees to encourage good structure
 - Trees usually has **Condition Rating** 65% and above
 - For trees 6 inches and less DBH
 - **Work Priority** should occur 'Within Three Years'
- Watch - regularly inspect trees that are not actively managed (pruning, etc.), but still fall within the R.O.W. and inventoried properties
 - All evergreen species are NOT actively managed, **Work Priority** should occur 'Within Five Years'
 - Trees that 6 inches or less that are establishing poorly
 - We don't want to continue to stress the tree with training pruning
 - **Primary Maintenance Needs** should be 'Watch' with **Work Priority** should occur 'Within Three Years'
- Cable & Prune - not applicable to all communities
 - **Work Priority** should occur 'Within Three Years'
- Girdling Root -
 - Pay attention to Norway Maples
 - Usually **Secondary Maintenance Need**

- Under **Special Conditions** mark deep planting - **DP**
 - **Work Priority** should occur 'Within Five Years'
- Remove Stump
 - **Work Priority** should occur 'Within One Year'
- Remove Stakes - new planting occasionally require stakes to stabilize the tree as it gets established
 - Trees should not be staked for more than one year after planting, otherwise the tree might become dependent on the stakes
 - **Work Priority** should occur 'Within One Year'
- Tree Heaving walk/curb - sidewalk or curb next to tree heaving creating uneven separation that affects the safe use of the sidewalk or uplifting 2 inches and greater
 - Where sidewalk is purposely altered to go around a root flare, list 'sidewalk radius' under **NOTES**
 - **Work Priority** should occur 'Within One Year'
 - If the tree is marked for 'Removal' heaving sidewalks don't have to be noted
- Treat

Page 4

Secondary Maintenance Needs - list second most pressing maintenance need for tree

- N/A
- Routine Prune
- Training Prune
- Watch
- Cable & Prune
- Girdling Root
- Remove Stakes
- Tree Heaving walk/curb
- For trees that require treatment and a safety prune mark 'Treat' in **Primary Maintenance Needs** and 'safety prune' in **Notes**

Work Priority

- OK
- Within One Year
- Within Two Years
- Within Three Years
- Within Four Years
- Within Five Years

Clearance

- Trees that require clearance should be marked low branched - **LB** in **Special Conditions** and require a safety prune
- OK
- Traffic - tree branches hang below 14 feet over street
 - These branches typically have damage from passing trucks
- Signs/Lights - where trees are in direct conflict (touching or obstructing the view)
 - Under **NOTES** list 'street light' or 'stop sign', these types of signs have priority for safety pruning
- Walk - tree branches hang below 8 feet over sidewalk

- Potential View Obstruction

Utility

- For trees that have been utility pruning in the past, mark utility pruned - **UP** in **Special Conditions**
 - Condition ratings will normally be 70% or less
- None
- Electric - 10 ft clearance
- Telephone/Cable - 10 ft clearance
- Both
- Underground - 5 ft clearance
- DO NOT include service drops

Notes

- Make note of 'old storm damage', 'upright/columnar' forms, 'multi-stemmed' trees, 'purple' or 'variegated' varieties, 'street lights', 'stop signs' or pest problems

Special Conditions - ways to note atypical/abnormal growth patterns/problems based on a street tree species

Abbreviation	Special Condition	Description
BS	Basal Suckers	suckers growing around base of trunk, any number
BW	Basal Wound	visible/open wound at ground level, actively sealing
CC	Concreted Cavity	concrete in tree
C/D	Cavity/Decay	visible/open cavity
CD	Crown Dieback	deadwood present at the tips of the canopy, crown retreating
CR	Consider Removal	condition rating between 50 and 55%
CT	Codominant Trunks/Stems	no central leader
DFF	Decay Fungi Present	fruiting bodies of decay
DL	Dead Leader	dead codominant stem still present in the tree
DP	Deep Planting	deep planting
DW	Deadwood (15%, 2"+)	trees with 15% and greater deadwood normally 2 inches in diameter
HG	Hanger	hanger
IA	Invasives Around	unintended sprouts (buckthorn, ect.) conflicting with growth space, found in WA and or around conifers
IB	Included Bark	included bark
IM	Improperly Mulched	excessive mulch against trunk of tree
IP	Improperly Pruned	stubs, flush cuts, tears, etc.
LB	Low Branched	branches that impede safe use of area around tree (streets, sidewalks, mower clearance etc.)
LC	Low Crotched	single stem tree with codominant stems below 6',

		measure/record DBH of single stem
LLD	Large Leader Decay	significant dieback on one significant limb/leader
LML	Lost Main Limb/Leader	stumb/wound from damaged large main limb/leader ripped/broken out of tree, usually during a storm event
LN	Leaning	significant abnormal growth pattern, tree may potentially fail
LS	Lightning Struck	lightning struck
MD	Mechanical Damage	trunk wound from mechanical damage (mower damage, struck by cars, construction damage, etc.), BW and/or TW
MS	Multi-stemmed	stems originate from ground level
ND	Nutrient Deficiency	mostly chlorosis
OG	Overgrowing Growthspace	usually large tree in narrow terrace, roots over growing sidewalk/curb
OS	Overshadowed	street trees where private tree dominates public tree's canopy
PL	Poor Location	poor location
PP	Pest Problem	list pest problem under NOTES (apple scab, target canker, etc.)
PS	Poor Structure	IB, LC, significant CT
RD	Root Damage	visible root damage and assumed damage from new construction
RP	Raised Planter	raised planter
RR	Root Rot	visible root decay or fruiting bodies
SP	Sucker Present	canopy water sprouts/suckers, note when vigorous for species
TP	Topped	topped
TS	Trunk Split	unsealed wound/split in trunk, usually remove Within One Year, call client contact to notify
TW	Trunk Wound	visible/open wound on trunk, actively sealing, don't have to include typical frost cracks (for species such as Norway Maples)
UP	Utility Pruned	tree was pruned for utility clearance
WA	Wooded Area	should already be noted in tree location
WG	Weak Growth	recent growth is less than expected for species profile

VACANT PLANTING SITES

Locate vacant planting sites within the following parameters:

terrace width of 5 feet (1.5 meters) or greater that have curb, sidewalk and grass.

- Street tree **Growth Spaces** with terrace widths that are open, greater than 5 feet, boxout/grate or behind walk that have a curb, sidewalk and grass
- In medians and **Growth Spaces** not listed above only inventory existing trees, no vacant planting sites will be located
- Vacant planting sites must be spaced 40 feet (12.2 meters) on center

- No overhead restrictions
- Minimum of 5 feet (1.5 meters) from water/gas laterals
- Minimum of 10 feet (3.0 meters) from driveways
- Minimum of 10 feet (3.0 meters) from utility poles
- Minimum of 10 feet (3.0 meters) from hydrants
- Minimum of 10 feet (3.0 meters) from other miscellaneous obstacles (signage, flag poles, fencing etc.)
- Minimum of 50 feet (15.2 meters) from intersections (watch vision triangles!!)
- In the event of an inventory update, if an existing yard or private tree conflicts with a potential planting site, show as a “no plant site” and list reason in **Notes**
- For vacant planting sites, include the following information:
 - **Inspection Date**
 - **Species** - Common, Vacant
 - **Location** - Street
 - **Growth Space** - Open, 5 ft +, Boxout, Grate, Behind Walk
 - **Primary Maintenance Needs** - Plant
 - **Work Priority** - OK
 - **Work Priority** managed separately/differently from other maintenance needs

STUMPS

Inventory all stumps in the Right-Of-Way (R.O.W.), selected parks and public properties.

- For stumps, include the following information:
 - **Inspection Date**
 - **Species** - Common, Stump
 - **Location** -
 - **Growth Space** - Open, 5 ft +, Boxout, Grate, Behind Walk
 - **Diameter** - diameter of the stump
 - **Primary Maintenance Needs** - Remove Stump
 - **Work Priority** - Within One Year
 - Include other information as needed to identify whether or not it would make a suitable planting site

Appendix B: Tree Species Frequency

Table 4.

Genus	Common Name	Count
Abies	Balsam Fir	19
Abies	White Fir	7
Acer	Amur Maple	26
Acer	Black Maple	18
Acer	Boxelder	94
Acer	Freeman Maple	284
Acer	Maple Spp	37
Acer	Norway Maple	768
Acer	Norway Maple Var.	1
Acer	Red Maple	75
Acer	Silver Maple	445
Acer	Sugar Maple	217
Aesculus	Horsechestnut	5
Aesculus	Ohio Buckeye	3
Alnus	Alder Spp.	4
Amelanchier	Serviceberry	69
Betula	Birch Spp.	39
Betula	Paper Birch	17
Betula	River Birch	57
Carpinus	Hornbeam Spp.	12
Carya	Bitternut Hickory	17
Carya	Hickory Spp.	14
Carya	Shagbark Hickory	6
Catalpa	Northern Catalpa	3
Celtis	Hackberry	83
Cercidiphyllum	Katsura Tree	1

Genus	Common Name	Count
Cercis	Eastern Redbud	11
Cladrastis	Yellowwood	1
Cornus	Cornelian Cherry	2
Cornus	Dogwood Spp.	3
Corylus	Turkish Filbert	3
Crataegus	Cockspur Hawthorn	50
Crataegus	Downy Hawthorn	51
Crataegus	Hawthorn Spp.	65
Crataegus	Washington Hawthorn	14
Elaeagnus	Russian-Olive	1
Fraxinus	European Ash	3
Fraxinus	Green Ash	795
Fraxinus	Green Ash Var.	3
Fraxinus	White Ash	263
Ginkgo	Ginkgo	117
Gleditsia	Honeylocust (Native)	2
Gleditsia	Honeylocust (Thornless)	591
Gleditsia	Honeylocust Var.	3
Gymnocladus	Kentucky Coffeetree	56
Juglans	Black Walnut	89
Juniperus	Eastern Redcedar	79
Juniperus	Juniper Spp.	36
Larix	Tamarack (Native)	3
Magnolia	Magnolia Spp.	13
Malus	Apple Spp.	9
Malus	Crab Apple Spp.	564
Malus	Crab Apple Var.	2

Genus	Common Name	Count
Morus	Mulberry Spp.	21
Ostrya	Ironwood	29
Phellodendron	Amur Corktree	19
Picea	Black Hills Spruce	102
Picea	Colorado Spruce	679
Picea	Norway Spruce	189
Picea	Spruce Spp.	42
Picea	White Spruce	330
Pinus	Austrian Pine	167
Pinus	Eastern White Pine	118
Pinus	Jack Pine	1
Pinus	Pine Spp.	7
Pinus	Ponderosa Pine	10
Pinus	Red Pine	10
Pinus	Scotch Pine	53
Platanus	Sycamore	16
Populus	Bigtooth Aspen	2
Populus	Eastern Cottonwood	37
Populus	Poplar Spp.	6
Populus	Quaking Aspen	23
Populus	White Poplar	1
Prunus	Black Cherry	19
Prunus	Cherry and Plum Spp.	25
Pseudotsuga	Douglas-Fir	5
Pyrus	Callery Pear Spp.	225
Pyrus	Pear Spp.	6
Quercus	Bur Oak	94

Genus	Common Name	Count
Quercus	English Oak	1
Quercus	Northern Red Oak	65
Quercus	Oak Spp.	3
Quercus	Pin Oak	1
Quercus	Shingle Oak	1
Quercus	Swamp White Oak	53
Quercus	White Oak	65
Rhamnus	Glossy Buckthorn	10
Robinia	Black Locust	18
Salix	Weeping Willow	8
Salix	Willow	43
Sorbus	American Mountain-Ash	3
Sorbus	Mountain-Ash Spp.	1
Syringa	Japanese Tree Lilac	88
Syringa	Lilac Spp.	2
Taxodium	Baldcypress	8
Taxus	Yew Spp.	2
Thuja	Northern White-Cedar	293
Tilia	American Basswood	137
Tilia	Basswood Spp.	129
Tilia	Littleleaf Linden	149
Tilia	Redmond Linden	35
Tilia	Silver Linden	3
Tsuga	Eastern Hemlock	3
Ulmus	American Elm	117
Ulmus	Elm Spp. (Hybrid)	79
Ulmus	Red Elm	9

Genus	Common Name	Count
Ulmus	Rock Elm	7
Ulmus	Siberian Elm	55
UNKNOWN	Other, Unknown	11

Appendix C: Planting Recommendations

RECOMMENDED TREE PLANTING LIST

This list is provided as a guide to some of the most appropriate trees for urban settings in USDA Hardiness Zone 5b for the Village of Menomonee Falls. There is no single perfect tree. These species have been selected for use in our demanding street tree situations. There is a larger group of plants that would grow very well in the Village of Menomonee Falls and should be considered for other landscape uses (parks, etc.). Before selecting any particular species or variety, each site should be evaluated as to: rooting space, soil texture, soil pH, drainage, exposure, overhead wires, and surrounding buildings (crown space). The most important thing to remember is to plant the right tree in the right place.

SMALL TREES (Below 30' Maximum Height) – Acceptable trees for terraces with overhead power lines and/or if terrace is 3-5 feet wide. May be planted in wider terraces.

Scientific Name	Common Name	Cultivars
<i>Amelanchier arborea</i>	Downy Serviceberry	
<i>Amelanchier x grandiflora</i>	Apple Serviceberry	Autumn Brilliance', 'Robin Hill'
<i>Amelanchier laevis</i>	Allegheny Serviceberry	'Cumulus', 'Lustre'
<i>Carpinus caroliniana</i>	American Hornbeam	'Firespire'
<i>Crataegus crusgalli inermis</i>	Thornless Cockspur Hawthorn	
<i>Crataegus phaenopyrum</i>	Washington Hawthorn	
<i>Crataegus viridis</i>	Winter King Hawthorn	'Winter King'
<i>Maackia amurensis</i>	Amur Maackia	'Starburst'
<i>Malus spp.</i>	Flowering Crabapple	'Adirondack', 'Bob White', 'Harvest Gold', 'Jackii', 'Prairiefire', 'Professor Sprenger', 'Red Bud', 'Royal Raindrops', 'Sugar Tyme'
<i>Ostrya virginiana</i>	Ironwood	
<i>Syringa pekinensis</i>	Peking Lilac	China Snow'
<i>Syringa reticulata</i>	Japanese Tree Lilac	Ivory Silk', 'Summer Snow'

MEDIUM TREES (30'-45' Maximum Height) – Acceptable trees for terraces that are 5-8 feet wide. May be planted in wider terraces.

Scientific Name	Common Name	Cultivars
<i>Aesculus x carnea</i>	Red Horsechestnut	'Ft. McNair'
<i>Aesculus glabra</i>	Ohio Buckeye	'Sunset'
<i>Cladrastis kentuckea</i>	American Yellowwood	

<i>Phellodendron amurense</i>	Amur Corktree (male only)	Macho'
<i>Prunus sargentii</i>	Sargent Cherry	'Columnaris'
<i>Sorbus alnifolia</i>	Korean Mountain Ash	

LARGE TREES (Above 45' Maximum Height) – Acceptable trees for terraces 8 foot and wider.

Scientific Name	Common Name	Cultivars
<i>Aesculus octandra</i>	Yellow Buckeye	
<i>Carya cordiformis</i>	Bitternut Hickory	
<i>Celtis occidentalis</i>	Hackberry	Prairie Pride', 'Chicagoland'
<i>Cercidiphyllum japonicum</i>	Katsuratree	
<i>Corylus colurna</i>	Turkish Filbert	Autumn Gold'
<i>Eucommia ulmoides</i>	Hardy Rubber Tree	
<i>Ginkgo biloba</i>	Ginkgo (male only)	Autumn Gold', 'Magyar', 'Princeton Sentry'
<i>Gleditsia triacanthos inermis</i>	Thornless Honeylocust	Imperial', 'Shademaster', 'Skyline/Skycole', 'Sunburst', 'Street Keeper/Draves'
<i>Gymnocladus dioica</i>	Kentucky Coffeetree	Espresso', 'Prairie Titan'
<i>Liriodendron tulipifera</i>	Tuliptree	
<i>Platanus x acerifolia</i>	London Planetree	'Exclamation'
<i>Quercus bicolor</i>	Swamp White Oak	
<i>Quercus macrocarpa</i>	Bur Oak	
<i>Quercus robur</i>	English Oak	Skymaster', 'Regal Prince'
<i>Quercus rubra</i>	Red Oak	
<i>Quercus muehlenbergii</i>	Chinkapin Oak	
<i>Quercus x schuettei</i>	Swamp x Bur Oak	
<i>Taxodium distichum</i>	Baldcypress	'Shawnee Brave'
<i>Tilia americana</i>	American Linden	Redmond', 'Sentry'
<i>Tilia cordata</i>	Littleleaf Linden	Chancole'
<i>Tilia tomentosa</i>	Silver Linden	Wandell'
<i>Tilia x euchlora</i>	Crimean Linden	
<i>Ulmus x</i>	Hybrid Elm	Accolade', 'New Horizon', 'Regal', 'Triumph'
<i>Ulmus parvifolia</i>	Lacebark Elm	

EVERGREENS TREES – Do not plant on streets, evergreens obstruct visibility making them hazardous on street locations. Acceptable trees for parks and non-street tree locations.

Scientific Name	Common Name	Cultivars
<i>Abies concolor</i>	White Fir	
<i>Xanthocyparis nootkatensis</i>	Nootka Cypress	

<i>Juniperus chinensis</i>	Chinese Juniper	Iowa', 'Mounntbatten'
<i>Juniperus x</i>	Star Power Juniper	JN Select Blue'
<i>Picea glauca var. densata</i>	Black Hills Spruce	
<i>Picea omorika</i>	Serbian Spruce	
<i>Pinus bungeana</i>	Lacebark Pine	
<i>Pinus flexilis</i>	Limber Pine	Vanderwolf's Pyramid'
<i>Pinus strobus</i>	Eastern White Pine	Fastigiata'
<i>Pinus sylvestris</i>	Scotch Pine	
<i>Pseudotsuga menziesii</i>	Douglasfir	
<i>Thuja occidentalis</i>	Arborvitae	Smaragd', 'Hetz Wintergreen', 'Sunkist', 'Techny'
<i>Thuja plicata</i>	Western White Cedar	
<i>Tsuga canadensis</i>	Canadian Hemlock	

UNACCEPTABLE TREE PLANTING LIST

The following is a list of trees that are considered unacceptable for planting in the road right of way. Species on this list may be planted in park or open space settings in the right location and situation. This list should be evaluated periodically and species may be added or removed as seen fit.

Scientific Name	Common Name	Reason
<i>Acer negundo</i>	Boxelder	Weak wooded, attracts boxelder bug
<i>Acer platanoides</i>	Norway Maple	Over-planted, invasive, girdling roots
<i>Acer rubrum</i>	Red Maple	Intolerant of alkaline soils
<i>Acer saccharinum</i>	Silver Maple	Weak wooded, aggressive roots, heavy seed crop
<i>Ailanthus altissima</i>	Tree-of-Heaven	Weak wooded
<i>Betula spp.</i>	Birch	Susceptible to insects and disease, intolerant of disturbed sites
<i>Catalpa spp.</i>	Catalpa	Littering fruit
<i>Elaeagnus angustifolia</i>	Russian Olive	Disease problems, weak wood
<i>Fraxinus spp.</i>	Ash	Emerald Ash Borer
<i>Ginkgo biloba (female)</i>	Ginkgo (female)	Messy and smelly fruit
<i>Juglans spp.</i>	Walnut	Littering fruit
<i>Malus sylvestris</i>	Common Apple	Fruit tree
<i>Morus spp.</i>	Mulberry	Littering fruit
<i>Populus spp.</i>	Poplar, Cottonwood	Weak wooded, aggressive roots, heavy seed crop
<i>Prunus serotina</i>	Black Cherry	Fruit tree

<i>Prunus domestica</i>	Garden Plum	Fruit tree
<i>Pyrus calleryana</i>	Callery Pear	Exhibits invasive traits
<i>Pyrus communis</i>	Common Pear	Fruit tree
<i>Quercus palustris</i>	Pin Oak	Intolerant of alkaline soils
<i>Robinia pseudoacacia</i>	Black Locust	Weak wooded, thorns, invasive
<i>Salix spp.</i>	Willow	Weak wooded, aggressive roots
<i>Sorbus americana</i>	American Mountainash	Susceptible to insects and disease
<i>Sorbus aucuparia</i>	European Mountainash	Susceptible to insects and disease
<i>Ulmus pumila</i>	Siberian Elm	Weak wooded, aggressive roots

Appendix D: Public Tree Valuation Report

Common Name	Total Value of Species	Average Value of Species
	\$10,179,523.01	\$899.73
Alder Spp.	\$142.07	\$35.52
American Basswood	\$299,346.30	\$2,185.01
American Elm	\$98,638.28	\$843.06
American Mountain-Ash	\$1,315.23	\$438.41
Amur Corktree	\$43,750.76	\$2,302.67
Amur Maple	\$19,014.36	\$731.32
Apple Spp.	\$3,896.12	\$432.90
Austrian Pine	\$233,205.00	\$1,396.44
Baldcypress	\$4,958.06	\$619.76
Balsam Fir	\$6,148.08	\$323.58
Basswood Spp.	\$72,861.33	\$564.82
Bigtooth Aspen	\$570.66	\$285.33
Birch Spp.	\$12,411.81	\$318.25
Bitternut Hickory	\$33,511.13	\$1,971.24
Black Cherry	\$20,550.08	\$1,081.58
Black Hills Spruce	\$13,714.58	\$134.46
Black Locust	\$12,973.14	\$720.73
Black Maple	\$22,411.29	\$1,245.07
Black Walnut	\$149,948.40	\$1,684.81
Boxelder	\$35,089.94	\$373.30
Bur Oak	\$499,299.30	\$5,311.70
Callery Pear Spp.	\$147,136.50	\$653.94
Cherry and Plum Spp.	\$5,396.50	\$215.86
Cockspur Hawthorn	\$8,045.79	\$160.92
Colorado Spruce	\$1,014,723.00	\$1,494.44
Cornelian Cherry	\$231.93	\$115.97
Crab Apple Spp.	\$237,248.90	\$420.65
Crab Apple Var.	\$351.76	\$175.88

Common Name	Total Value of Species	Average Value of Species
Dogwood Spp.	\$361.90	\$120.63
Douglas-Fir	\$8,573.80	\$1,714.76
Downy Hawthorn	\$43,631.67	\$855.52
Eastern Cottonwood	\$136,483.80	\$3,688.75
Eastern Hemlock	\$312.42	\$104.14
Eastern Redbud	\$979.59	\$89.05
Eastern Redcedar	\$33,841.29	\$428.37
Eastern White Pine	\$75,317.11	\$638.28
Elm Spp. (Hybrid)	\$35,425.46	\$448.42
English Oak	\$1,201.95	\$1,201.95
European Ash	\$2,240.38	\$746.79
Freeman Maple	\$168,867.00	\$594.60
Ginkgo	\$103,001.00	\$880.35
Glossy Buckthorn	\$798.06	\$79.81
Green Ash	\$967,571.60	\$1,217.07
Green Ash Var.	\$4,422.84	\$1,474.28
Hackberry	\$79,635.60	\$959.47
Hawthorn Spp.	\$63,080.38	\$970.47
Hickory Spp.	\$10,029.06	\$716.36
Honeylocust (Native)	\$1,255.87	\$627.94
Honeylocust (Thornless)	\$965,151.60	\$1,633.08
Honeylocust Var.	\$11,382.54	\$3,794.18
Hornbeam Spp.	\$400.63	\$33.39
Horsechestnut	\$4,683.64	\$936.73
Ironwood	\$7,384.16	\$254.63
Jack Pine	\$250.41	\$250.41
Japanese Tree Lilac	\$19,663.30	\$223.45
Juniper Spp.	\$4,225.33	\$117.37
Katsura Tree	\$7.50	\$7.50
Kentucky Coffeetree	\$100,296.40	\$1,791.01
Lilac Spp.	\$571.16	\$285.58

Common Name	Total Value of Species	Average Value of Species
Littleleaf Linden	\$166,219.10	\$1,115.56
Magnolia Spp.	\$1,732.58	\$133.28
Maple Spp	\$5,380.18	\$145.41
Mountain-Ash Spp.	\$409.00	\$409.00
Mulberry Spp.	\$18,416.68	\$876.98
Northern Catalpa	\$590.24	\$196.75
Northern Red Oak	\$218,077.70	\$3,355.04
Northern White-Cedar	\$68,315.13	\$233.16
Norway Maple	\$903,500.00	\$1,176.43
Norway Maple Var.	\$676.10	\$676.10
Norway Spruce	\$405,286.40	\$2,144.37
Oak Spp.	\$48.29	\$16.10
Ohio Buckeye	\$3,035.55	\$1,011.85
Other, Unknown	\$612.90	\$55.72
Paper Birch	\$11,725.27	\$689.72
Pear Spp.	\$2,891.00	\$481.83
Pin Oak	\$768.68	\$768.68
Pine Spp.	\$1,329.54	\$189.93
Ponderosa Pine	\$15,128.18	\$1,512.82
Poplar Spp.	\$7,518.87	\$1,253.15
Quaking Aspen	\$5,255.75	\$228.51
Red Elm	\$27,954.90	\$3,106.10
Red Maple	\$25,584.46	\$341.13
Red Pine	\$9,355.00	\$935.50
Redmond Linden	\$17,090.41	\$488.30
River Birch	\$17,354.10	\$304.46
Rock Elm	\$18,000.36	\$2,571.48
Russian-Olive	\$272.55	\$272.55
Scotch Pine	\$55,504.54	\$1,047.26
Serviceberry	\$3,903.22	\$56.57
Shagbark Hickory	\$5,191.09	\$865.18

Common Name	Total Value of Species	Average Value of Species
Shingle Oak	\$31.00	\$31.00
Siberian Elm	\$23,224.99	\$422.27
Silver Linden	\$57.23	\$19.08
Silver Maple	\$928,697.90	\$2,086.96
Spruce Spp.	\$10,743.07	\$255.79
Stump	\$0.00	\$0.00
Sugar Maple	\$356,470.10	\$1,642.72
Swamp White Oak	\$36,955.50	\$697.27
Sycamore	\$21,354.61	\$1,334.66
Tamarack (Native)	\$100.16	\$33.39
Turkish Filbert	\$741.09	\$247.03
Vacant	\$0.00	\$0.00
Washington Hawthorn	\$12,784.57	\$913.18
Weeping Willow	\$58,678.39	\$7,334.80
White Ash	\$266,367.60	\$1,012.81
White Fir	\$2,564.72	\$366.39
White Oak	\$181,918.20	\$2,798.74
White Poplar	\$747.39	\$747.39
White Spruce	\$322,321.10	\$976.73
Willow	\$87,740.97	\$2,040.49
Yellowwood	\$2,067.65	\$2,067.65
Yew Spp.	\$891.25	\$445.63

Appendix E: Chart and Graph Data

		Condition Rating							
		0%	5 to 45%	50 to 55%	60 to 65%	70 to 75%	80 to 100%	Count	Percent
DBH Range (Inches)	1 to 6	26	81	177	840	1,509	104	2,737	35.45%
	7 to 12	65	68	175	683	1,349	59	2,399	31.07%
	13 to 18	13	44	142	507	691	35	1,432	18.55%
	19 to 24	6	13	59	241	404	9	732	9.48%
	25 to 30	2	3	25	75	152	2	259	3.35%
	31 to 36	0	2	10	37	49	0	98	1.27%
	37 to 42	0	0	4	17	19	0	40	0.52%
	43 to 48	0	0	2	5	6	0	13	0.17%
	49 to 54	0	0	0	2	1	0	3	0.04%
	55 to 60	0	0	2	1	0	1	4	0.05%
	61 to 66		0	0	0	1	0	1	0.01%
	67 to 72	0	0	2	0	0	0	2	0.03%
	73+		0	0	0	1	0	1	0.01%
	Count	112	211	598	2,408	4,182	210		
	Percent	1.45%	2.73%	7.75%	31.19%	54.16%	2.72%		

Condition Rating	Count
0%	112
5%	12
10%	8
15%	10
20%	9
25%	9
30%	15
35%	18
40%	50
45%	80
50%	181
55%	417
60%	771
65%	1637
70%	2148
75%	2034
80%	209
85%	1
90%	0
95%	0
100%	0

Appendix F: Definitions

American National Standards Institute (ANSI)	Non-profit organization that develops national consensus standards for various industries.
ANSI A3100 Standards	Industry-developed, national consensus standards of practice for tree care.
ANSI Z133.1 Standards	Industry-developed, national consensus safety standards of practice for tree care.
Arborist	Professional who possesses the technical competence gained through experience and related training to provide for or supervise the management of trees and other woody plants in residential, commercial, and public landscapes.
Best Management Practices (BMP)	Best-available, industry-recognized courses of action, in consideration of the benefits and limitations, based on scientific research and current knowledge.
Canopy	Collective branches and foliage of a tree or group of trees.
Superintendent Public Works	Individual in charge of enforcing the provisions of these specifications
Chlorosis	A whitish or yellowish leaf discoloration caused by a lack of chlorophyll, often caused by nutrient deficiency.
Co-dominant Branches or Co-dominant Stems	Forked branches nearly the same size in diameter, arising from a common junction and lacking normal branch union.
Construction Damage	Damage to a tree (branches, trunk or roots) usually from excavating, filling, grade changes, compaction, etc. It can take up to five years for visible signs of this damage to show up in a tree and ten years for a tree to die.
Crown	Upper part of a tree, measured from the lowest branch, including all the branches and foliage.
Crown Cleaning	Removing dead, dying, diseased, and/or broken branches from the tree crown.
Crown Rot	Disease or other decay at the base of a tree or root crown.
Cultivar	Cultivated variety of a plant; cannot be reproduced without human assistance; usually propagated asexually (cloned); compare to variety.
Deadwooding	Removing dead and dying branches from a tree.
Diameter-at-Breast-Height (DBH)	A standard measure of tree trunk size measured at 4.5' above ground level, on the uphill side.
Dieback	Condition in which the branches in the tree crown die from the tips toward the center.
Directional Pruning	A pruning technique that is used to "train" trees to grow in a certain direction (usually away from utility lines or buildings). The most important aspect involves always pruning back to a lateral branch to try and reestablish a leader in that area of the tree.
Flagging	Symptom in which leaves on a branch wilt and may ultimately turn brown without falling from the shoot.
Genus	Taxonomic group of species having similar fundamental traits: botanical classification under the family level and above the species level.
Girdling Roots	Roots located above or below ground whose circular growth around the base of the trunk or over individual roots applies pressure to the bark area, ultimately restricting sap flow and trunk/root growth, frequently resulting in reduced vitality and/or death of the plant.
Hanger	Broken or cut branch that is hanging in a tree.

Hardiness	Genetically determined ability of a plant to survive low temperatures.
Hazard Tree	Any tree or tree part that has a major structural fault that could lead to catastrophic loss and it has an identifiable target (people or property).
Included Bark	Bark that becomes embedded in a crotch (union) between branch and trunk or between codominant stems; causes a weak union.
ISA Certified Arborist	An individual who is trained in the art and science of planting, caring for and maintaining individual trees. And one who has passed the certification examination sponsored by the International Society of Arboriculture and who maintains a current certification.
Leader	Primary terminal shoot or trunk of a tree; large, usually upright stem; a stem that dominates a portion of the crown by suppressing lateral branches.
Live Crown Ratio	Ratio of the height of the crown containing live foliage to the overall height of the tree.
Mature Height	Maximum height that a plant is likely to reach if the conditions of the planting site are favorable.
Pruning Cycle	In municipal arboriculture, the length of time between each maintenance (routine) pruning for a given geographic area.
Qualified Arborist	A worker who, through related training and on-the-job experience, is familiar with the hazards of pruning, trimming, repairing, maintaining, or removing trees, and with the equipment used in such operations, and has demonstrated his/her ability in the performance of the special techniques involved.
Raising or Lifting	Selective removal of lower limbs from a tree to provide clearance.
Root Crown or Collar	Area where the main roots join the plant stem, usually flared at the tree trunk base.
Routine Pruning	Pruning done on a regular basis (usually every five to seven years) that is done mostly for sanitation, therapeutic or maintenance reasons to keep trees healthy. Usually involves a combination of crown cleaning, raising and training pruning.
Safety Pruning	Pruning to remove a potential hazard such as large deadwood, broken branches, or branches impeding traffic or pedestrian travel. This type of pruning also includes branches obstructing street signs and light or obstructing vision at intersections and drive approaches.
Significant Trees	Trees that provide significant aesthetic and environmental benefits such as reduction of storm water runoff, preservation of wildlife habitat, enhancement of air quality, and contributes to overall forest health by providing species and size class diversity.
Species	Taxonomic group of organisms composed of individuals of the same genus that can reproduce among themselves and have similar offspring.
Speciman Tree(s) or Stand	Any tree or group of trees which has been determined to be of high value because of its species, size, age, historic significance or other criteria as designated by the Village of Menomonee Falls.
Structural Defects	Any naturally occurring or secondary conditions such as cavities, poor branch attachments, cracks, or decayed wood in the trunk, crown, or roots of a tree that may contribute to structural failure.
Training Pruning	Pruning done to young trees (or sometimes neglected older trees) to establish proper branching structure, critical for long term health and safety of trees. Best if performed on a two to four year cycle.
Tree Protection Zone (TPZ)	A fenced area around a tree or group of trees that will not be disturbed by construction activities.
Trunk Formula Method	Method to appraise the monetary value of trees considered too large to be replaced with nursery or field-grown stock, or a method to produce a fairly accurate monetary value of a large grouping of public trees.

Watch Tree	These are trees that need to be checked yearly due to problems such as poor structure or decay. These are marginal trees that are not bad enough to make the safety prune or removal list, but due to their condition, they may need work in the next few years. They have a higher potential for problems and should be checked regularly due to this.
Utility Prune	Pruning around or near utility facilities with the objective of maintaining safe and reliable utility service.
Variety	Naturally occurring subdivision of a species having a distinct difference and breeding true to that difference; compare to cultivar.

Appendix G: References

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The WI EAB Resource is brought to you by:

-WI Department of Agriculture, Trade and Consumer Protection

-Wisconsin Department of Natural Resources

-University of Wisconsin - Madison

Visit their EAB Web pages for additional information on EAB.

Wisconsin's Gypsy Moth Resource <http://www.gypsymoth.wi.gov/>

Insect Diagnostic Lab, UW-Madison <http://labs.russell.wisc.edu/insectlab/>

Plant Disease Diagnostic Clinic, UW-Madison <https://pddc.wisc.edu/>

UW-Extension Wisconsin Horticulture <https://hort.uwex.edu/>

Most complete source of horticulture information for Wisconsin on the Internet including Garden Fact Sheets

Tree Care Information <http://www.treesaregood.org/>

Sponsored by the International Society of Arboriculture

Benefits of Trees

Value of Trees

New Tree Planting

Why should I hire an arborist?

Find a Tree Care Service

Frequently Asked Questions

Quick Facts about Trees

Resources

Wisconsin Arborist Association <http://www.waa-isa.org/>

Search for Certified Arborists for Hire

Appendix H: Standards and Guidelines

These provisions are intended to provide standards and guidelines for the preservation of trees as part of the land development and/or building construction process. The Village of Menomonee Falls finds that such preservation is necessary to promote the general health and welfare of the community by making the Village a more attractive place to live, protect watercourses and ecology, provide a healthy living environment, and to better maintain control of flooding, noise, glare, and soil erosion. The Village further finds that trees provide beneficial oxygen while reducing the levels of harmful carbon dioxide and reduce air pollution, purify water, and stabilize soil. Trees also provide wildlife habitat and shade, cool the land, reduce noise, and provide an aesthetic value to the land.

Table 5. Sample Specimen Tree List

SPECIES	Min. DBH	SPECIES	Min. DBH
American Basswood	20"	Common Hackberry	16"
Sugar Maple	12"	American Beech	12"
All Serviceberries	6"	All Oaks	12"
SPECIES	Min. DBH	SPECIES	Min. DBH
Musclewood	6"	White Pine	12"
All Hickories	12"	Butternut	12"
Black Walnut	12"	Black Cherry	12"
Eastern Red Cedar	8"	Ironwood	6"
Tamarack or Larch	12"	White Cedar	12"
Kentucky Coffeetree	12"		

Calculating the Optimal Tree Protection Zone

1. Evaluate the species tolerance of the specimen tree: good, moderate, or poor (see Table 1).
2. Identify specimen tree age: young, mature, or overmature.
3. Using Table 2, find the distance (in feet) from the trunk that should be protected per inch of trunk diameter.

4. Multiply the distance by the trunk diameter to calculate the optimum radius (in feet) for the tree protection zone.

Examples

A healthy 50-year-old, 15" diameter Northern Red Oak (*Quercus rubra*) (good tolerance, mature age):

$$0.75' \times 15'' = 11.25' \text{ radius for Tree protection zone}$$

A declining 90-year-old, 26" diameter Shagbark hickory (*Carya ovata*) (intermediate tolerance, overmature age):

$$1.25' \times 26'' = 32.5' \text{ radius for Tree protection zone}$$

The tables and formulas are strictly guidelines, not an absolute rule, and may need to be adjusted in the field to meet local conditions and design criteria. It is best and least expensive to protect trees in groupings during construction. Groupings offer the best protection for soil, root systems and associated plants.

Table 6. Size and Tolerance of Tree Species to Construction Impacts.

This table represents information from three publications: Tree Characteristics, Protecting Trees from Construction Damage, Minnesota Extension Service, University of Minnesota; The Response of Ohio's Native and Naturalized Trees to Construction Activity, T. Davis Sydnor, School of Natural Resources, The Ohio State University; and Relative Tolerance of Tree Species to Construction Damage, Kim D. Coder, The University of Georgia Cooperative Extension Service, Forest Resources Unit.

Tolerance to construction impact can vary greatly according to site characteristics such as soil depth, individual tree characteristics such as rooting habit, prevailing weather conditions such as drought, and the degree of construction impact.

SPECIES	ROOT	SOIL COMPACTION AND	MATURE CROWN SPREAD	HAZARD POTENTIAL	COMMENTS
	SEVERANCE	FLOODING	(FEET)	RATING*	
Norway Spruce	tolerant	tolerant	20-30	medium	vulnerable to windthrow
Colorado Spruce	intermediate	tolerant	20-30	medium	vulnerable to windthrow
White Pine	tolerant	sensitive	40-60	medium	sensitive to drainage changes
Austrian Pine	tolerant	sensitive	30-50	medium	sensitive to poor drainage
Scotch Pine	tolerant	sensitive	30-50	medium	sensitive to poor drainage
Tamarack or Larch	tolerant	tolerant	15-25	medium	
Red Cedar	tolerant	sensitive	10-20	low	
White Cedar	tolerant	tolerant	10-20	low	
All Firs	tolerant	sensitive	10-20	medium	
Horsechestnut	sensitive	sensitive	30-40	medium	
Kentucky Coffeetree	intermediate	intermediate	40-50	medium	
Butternut	sensitive	sensitive	50-60	medium	
Redbud	intermediate	intermediate	25-35	low	sensitive to increased light and heat
All Mulberries	tolerant	tolerant	35-50	high	

Sycamore	tolerant	tolerant	60-80	low	
Pagoda Dogwood	intermediate	intermediate	15-20	low	sensitive to increased light and heat
Ironwood	sensitive	sensitive	20-30	low	
Musclewood	sensitive	sensitive	20-30	low	
All Hickories	intermediate	sensitive	30-40	medium	
Amur Corktree	intermediate	intermediate	30-40	medium	
Hackberry	tolerant	intermediate	40-50	low	
Ohio Buckeye	sensitive	sensitive	30-40	medium	
Catalpa	intermediate	tolerant	30-50	medium	
Bur Oak	tolerant	tolerant	40-80	low	
Red Oak	tolerant	sensitive	40-50	low	
White Oaks	sensitive	sensitive	50-90	low	
Sugar Maple	tolerant	sensitive	60-80	medium	sensitive to fill
Red Maple	tolerant	tolerant	40-60	medium	sensitive to wounding
Norway Maple	tolerant	tolerant	60-80	medium	
Black Cherry	intermediate	sensitive	40-50	low	
White Ash	tolerant	intermediate	40-70	medium	
All Serviceberries	intermediate	intermediate	15-20	low	
American Beech	sensitive	sensitive	30-50	medium	sensitive to fill
European Beech	sensitive	sensitive	40-60	medium	sensitive to fill
Honeylocust	tolerant	tolerant	50-75	medium	
Black Walnut	sensitive	intermediate	50-70	medium	

***Hazard Potential Rating** refers to the relative potential for a tree to become hazardous due to its large size and likelihood of breakage or decay. For a tree to be considered hazardous, a likely "target" (e.g., a person, a house, or car) must be present. A high rating does not imply that an individual tree is likely to fail.

TABLE 7. Guidelines for Tree Protection Zones

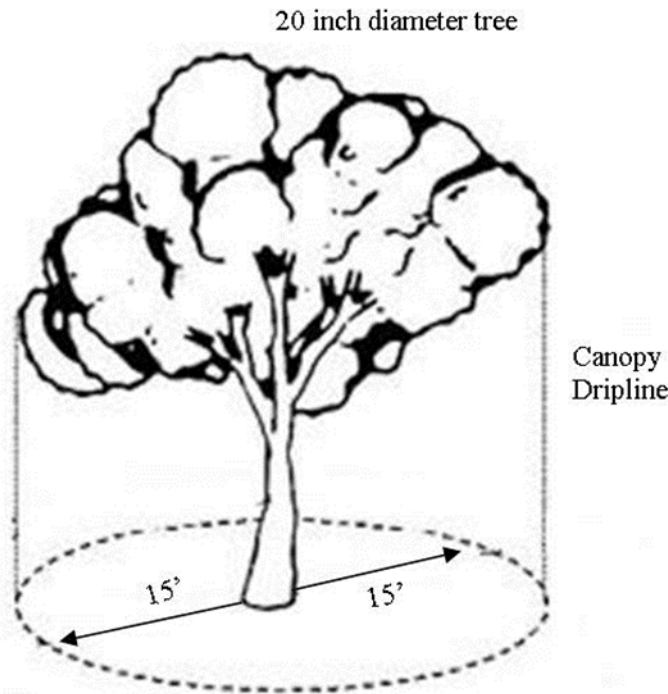
Distances to be increased for trees of poor vigor and to protect young and other trees with low branching from severe pruning of limbs. Table adapted from table provided courtesy of the International Society of Arboriculture

SPECIES TOLERANCE TO IMPACTS		DISTANCE FROM TRUNK* (feet per inch of DBH)
tolerant	young <1/4 life expectancy	0.5'
	middle aged 1/4 - 3/4 life expectancy	0.75'
	mature >3/4 life expectancy	1.0'
intermediate	young	0.75'
	middle aged	1.0'
	mature	1.25'
sensitive	young	1.0'
	middle aged	1.25'
	mature	1.5'

* These distances are based on a tree's tolerance to root pruning and soil disturbance and may not be adequate to protect branches of young trees or other trees with low branching. Because severe pruning would destroy the form of such trees, fencing at the dripline or beyond is required.

Site Clearing Specifications

Figure 4. Extent of Tree Protection Zone.



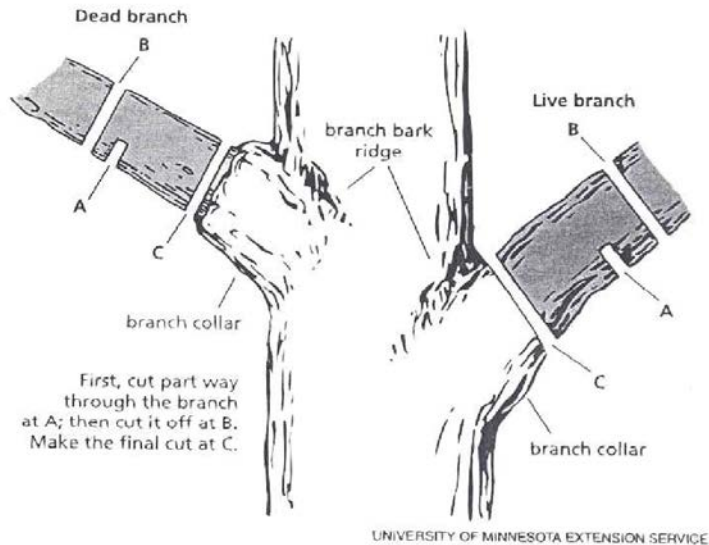
The following work must be accomplished before any demolition or site clearing activity occurs within 50 feet of specimen trees:

1. The site clearance/demolition contractor is required to meet with the Village Forester at the site prior to beginning work to review all work procedures, access and haul routes, and tree protection measures.
2. Limits of all TPZ(s) shall be staked by the contractor in the field. A 4-foot plastic, wood or chain link fence with posts sunk in the ground at no more than 10' on center shall be erected to enclose each TPZ. Weather resistant signs with the wording: KEEP OUT – TREE PROTECTION ZONE shall be erected by the contractor at each TPZ. Signs shall be placed a minimum of 30' on center on the TPZ fencing. Each TPZ shall have a minimum of one sign.
3. Tree(s) to be removed that have branches extending into the canopy of tree(s) to remain must be removed by a qualified arborist and not by demolition or construction contractors. The qualified arborist shall remove the tree in a manner that causes no damage to the tree(s) and understory to remain.

4. Any brush clearing required within the TPZ shall be accomplished by a qualified arborist using hand-operated equipment.
5. Trees to be removed shall be felled so as to fall away from TBZ(s) and to avoid pulling and breaking of roots to remain.
6. Trees to be removed within the tree protection zone shall be removed by a qualified arborist. The trees shall be cut near ground level and the stump ground out.
7. All downed brush and trees shall be removed from the TPZ either by hand or with equipment sitting outside the TPZ. Extraction shall occur by lifting the material out, not by skidding it across the ground.
8. Brush shall be chipped and hauled offsite or stored to be used as a buffer over root zones.
9. Structures and underground features to be removed within the TPZ shall use the smallest equipment possible and operate from outside the TPZ. The Village Forester shall be on site during all operations within the TPZ to monitor demolition activities.
10. All trees to be pruned in accordance with the provided Pruning Specifications.
11. Any damage to trees due to clearing or demolition activities shall be reported to the Village Forester within 6 hours so remedial action can be taken. Timeliness is critical to tree health.
12. If temporary haul or access roads must pass over the root areas of trees to be retained, a roadbed shall be constructed by laying appropriate geo-textile fabric on the surface and covering with 8 inches of mulch or gravel to protect the soil from compaction. The road bed material shall be replenished as necessary to maintain an 8-inch depth.

Pruning Specifications

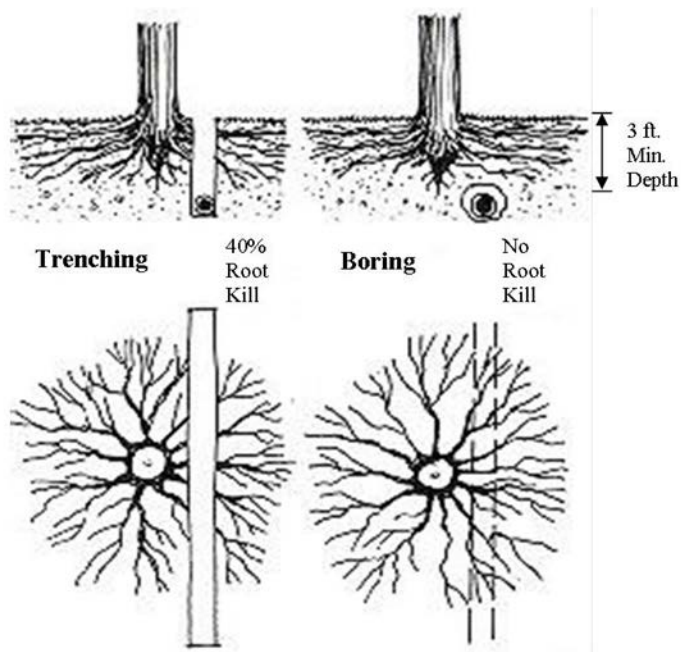
Figure 5. Proper Pruning Techniques.



1. All pruning shall be performed by a qualified arborist under the direct, on-site supervision of a Certified Arborist.
2. All pruning shall be in accordance with the ANSI A300 Pruning Standard (American National Standard for Tree Care Operations) and adhere to the most recent edition of ANSI Z133.1 Safety Requirements for Tree Care Operations.
3. Where temporary clearance is needed for access, branches shall be tied back to hold them out of the clearance zone.
4. Pruning shall not be performed on Oaks or Elms during the time period of April 15th thru September 1st due to the potential spread of Oak Wilt and Dutch Elm disease.
5. Interior branches shall not be stripped out.
6. Pruning cuts larger than 4 inches in diameter, except for deadwood, shall be avoided.
7. No more than 20 percent of live foliage shall be removed within the trees.
8. Brush shall be chipped and chips shall be spread underneath trees within the TPZ to a maximum depth of 6 inches, leaving the trunk clear of mulch.

Construction Specifications

Figure 6. How Boring Saves Trees.



1. Before beginning work, the contractor is required to meet with the Village Forester at the site to review all work procedures, access routes, utility corridors, storage areas, and tree protection measures.
2. Fences have been erected and sign have been posted to protect trees to be preserved. Fences define a specific protection zone for each tree or group of trees. Fences and signs are to remain until all site work has been completed. Fences or signs may not be relocated or removed without the permission of the Village Forester.
3. Construction trailers and traffic and storage areas must remain outside fenced areas at all times.
4. All underground utilities and drain or irrigation lines shall be routed outside the TPZ. If lines must traverse the protection area, they shall be tunneled or bored under the tree. (See Table 3) Utilities shall be placed in a common trench where practical. Soil removed from trenches shall be placed on the side away from trees and replaced as soon as possible. Trench walls shall be shored rather than sloped to reduce trench width.

Table 8. Trench Augering Distances

The distance from tree face for augering in each direction

if trench is located within a particular radius of a TPZ

(Morell 1984).

Tree Diameter (DBH)	Auger distance from face of tree
0-2"	1'
3-4"	2'
5-9"	5'
10-14"	10'
15-19"	12'
over 19"	15'

5. No materials, equipment, spoil, or waste or washout water may be deposited, stored, or parked within the TPZ.
6. Additional tree pruning required for clearance during construction must be performed by a qualified arborist and not by construction personnel.
7. Any herbicides placed under paving materials must be safe for use around trees and labeled for that use. Any pesticides used on site must be tree-safe and not easily transported by water.
8. If injury should occur to any tree during construction, it should be evaluated as soon as possible by the Village Forester so that appropriate treatments can be applied.
9. Any grading, construction, demolition, or other work that is expected to encounter tree roots must be monitored by the Village Forester. Specific locations or tree tag numbers shall be identified prior to work commencing.
10. Erosion control devices such as silt fencing, debris basins, and water diversion structures shall be installed to prevent siltation and/or erosion within the TPZ.
11. Before grading, pad preparation, or excavation for foundations, footings, walls, or trenching, specimen tag # trees, shall be root pruned 1 foot outside the TPZ by cutting all roots cleanly to a depth of 36 inches, normal depth of root penetration. Roots shall be cut manually

digging a trench and cutting exposed roots with a saw, vibrating knife, rock saw, a narrow trencher with sharp blades, or other approved root-pruning equipment.

12. Any roots damaged during grading or construction shall be exposed to sound tissue and cut cleanly with a saw or other appropriate sharp cutting instrument.

13. If temporary haul or access roads must pass over the root areas of trees to be retained, a roadbed shall be constructed by laying appropriate geo-textile fabric on the surface and covering with 8 inches of mulch or gravel to protect the soil from compaction. The road bed material shall be replenished as necessary to maintain an 8-inch depth.

14. Spoil from trenches, basements, or other excavations shall not be placed within the TPZ, either temporarily or permanently.

15. No burn piles or debris pits shall be placed within the TPZ. No ashes, debris, or garbage may be dumped or buried within the TPZ.

16. Maintain fire-safe areas around fenced areas. Also, no heat sources, flames, ignition sources, or smoking is allowed near mulch or trees.

Grading

1. Maintain the root flare at the bottom of trees. Do not bury the trunk flare.

2. For small grade changes (1 to 2 feet) slope to natural grade rather than construct a retaining wall. For larger grade changes, retaining walls can increase the distance of natural grade and therefore should be considered.

3. Within or in close proximity to a TPZ, adjust surrounding grades to match base trunk elevation as closely as possible.

4. Where grade must be raised, determine the location of the proposed structure on the fill area, plus required overbuild. If within a TPZ, a retaining wall may be required at that location.

5. If TPZ is in a low area that will collect water, a drain shall be installed as far from the tree as possible, near the retaining wall. Fine grade the area by hand to create flow to the drain.

6. Where required grade changes prohibit the establishment of an adequate TPZ, the tree/trees shall be removed and replanting of appropriate trees (per mitigation requirements). Planting for that location shall be performed after final grades are installed.

Mitigation Requirements for Specimen Trees

1. Report any damage or injury to specimen trees within 6 hours to the Village Forester so that mitigation can take place.

2. If inadvertent compaction occurs in the upper 12" of soil within the TPZ, the soil shall be loosened by a method approved by the Village Forester, such as vertical mulching or soil fracturing.
3. Irrigate to wet the soil within the TPZ during periods of drought as specified by the Village Forester.
4. Where roots 2" and larger are encountered in trenches, they must be cleanly cut back to a sound lateral root. All exposed root areas within the TPZ shall be backfilled or covered within one hour. If this cannot be accomplished, then the roots shall be covered with layered wet burlap until backfilling can occur to reduce evaporation from trench walls.
5. If bark or trunk wounding should occur, current bark tracing and treatment methods shall be performed by a qualified arborist within two days.
6. Where injury occurs to branches, within 5 days, the broken or torn branch shall be cut back to an appropriate branch capable of resuming terminal growth. Work shall be performed by a qualified arborist. If foliage is heat scorched from equipment exhaust pipes, the Village Forester shall be informed within 6 hours.
7. Where a specimen tree is removed by design or error, replacement shall be at a ratio of 1" of DBH of replacement for every 1" of DBH of removal. Replacement trees shall be of a size and species as determined by the Village of Menomonee Falls.
8. If a specimen tree incurs significant damage to its roots, bole or crown, the Village Forester will determine the Tree Appraisal value. This will be determined by adjusting the tree's basic value by its species, location and condition using the most recent edition of the *Guide for Plant Appraisal*, published by the Council of Tree and Landscape Appraisers. The formula and appraisal methods used shall be noted.

Alternative Construction Techniques

1. Where grades are to be raised, excavation towards trees is minimized with L-type footings, with the L of the footing extending towards the fill and away from the tree. In cuts, the footing shall extend towards the cut and away from the tree.
2. For grade changes over 5 feet, two or more smaller retaining walls shall be considered and stepped down the slope to reduce the mass of a larger single wall.
3. Where structures must be placed close to a TPZ, alternative footing designs shall be considered. These include: the use of custom footings in the vicinity of trees that bridge over tree roots; cantilevering the structure, so the building extends outward from the footing; and installing a raised foundation with discontinuous footings (piers).

Aftercare

1. Avoid putting trees in stress for several years after construction. Water during periods of drought and treat for insect and disease infestations when they arise.
2. Contact a Certified Arborist about whether fertilizing trees is appropriate. Be sure not to overdo it. Trees with damaged roots can't take up and utilize excessive amounts of fertilizer. Also consider mycorrhizae applications to assist with root regeneration and Cambistat (a plant growth regulator) to redirect the root to shoot ratio to producing more root growth.
3. Aerate compacted soils if there are large trees on the site where roots are growing in compacted areas of the site. Aeration can be done to shallow depth with standard core aerators or to deeper depths by vertical mulching with air spades or gas powered augers.
3. If root damage or loss should occur, estimate the percentage of damage or loss and thin out the top in direct proportion to root loss.
4. Protect root zones of both existing and newly planted trees with 3 to 4 inches of organic mulch. Keep mulch several inches away from the trunk base and mulch all the way to the dripline where feasible.
5. Keep competing vegetation especially grass away from trees. Consider alternative landscaping in the areas beneath trees. Use native plants and groundcovers that can provide a variety of sizes, colors and forms beneath preserved trees. These plantings preserve tree root systems, conserve water and reduce the reliance on fertilizers and pesticides.

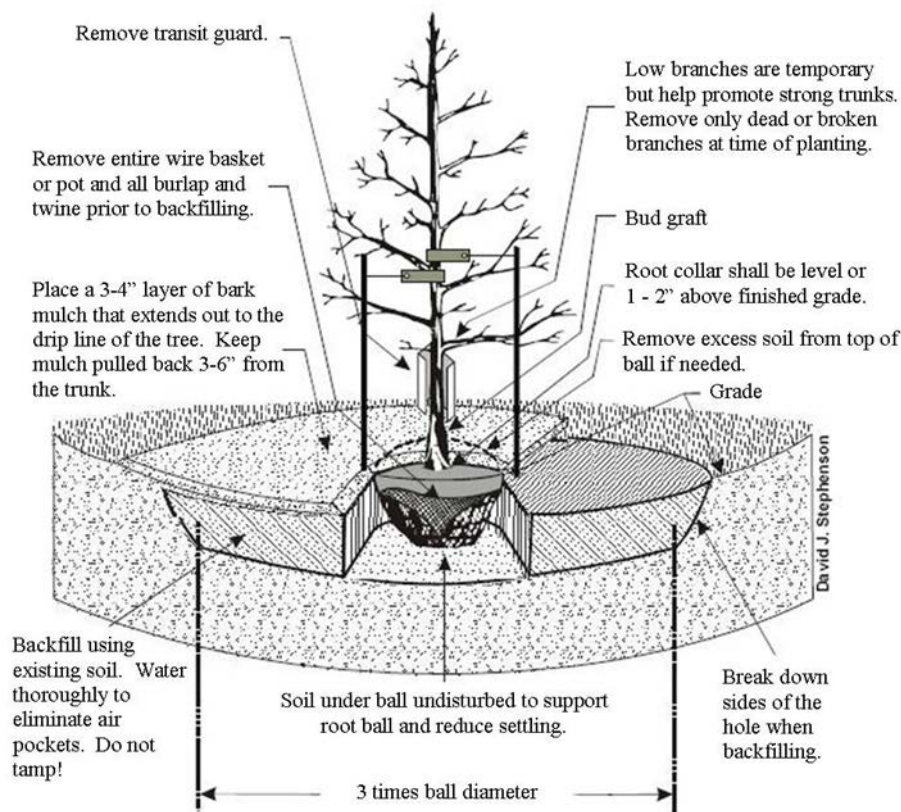
Standards and Guidelines References

- American National Standards Institute. 2000. ANSI Z133.1 Safety Requirements. *American National Standards for Arboricultural Operations – Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush – Safety Requirements*. New York, NY: American National Standards Institute. 32 pp.
- American National Standards Institute. 2017. ANSI A300 Pruning Standard. *American National Standards for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)*. Londonderry, NH: Tree Care Industry Assoc., Inc. 33 pp.
- Council of Tree and Landscape Appraisers (CTLA). 2000. *Guide for Plant Appraisal* (9th ed.). Champaign, IL: International Society of Arboriculture. 143 pp.
- Elmendorf, W., H. Gerhold, and L. Kuhns. 1999. *A Guide to Preserving Trees in Development Projects*. University Park, PA: The Pennsylvania State University. 27 pp.
- Harris, R.W. 1992. *Arboriculture: Integrated Management of Landscape Trees, Shrubs and Vines*. 2nd ed. Englewood Cliffs, NJ: Prentice Hall. 674 pp.

Matheny, N., and J. Clark. 1998. *Trees and Development: A Technical Guide to Preservation of Trees During Land Development*. Champaign, IL: International Society of Arboriculture. 183 pp.

Morell, J.D. 1984. Parkway tree augering specifications. *Journal of Arboriculture* 10(5):129 – 132.

Figure 7. Tree Planting Detail.



a) All plant material shall be true to name and type, and first-class representatives of their species or variety. They shall have normal, well-developed branches, be healthy, vigorous plants free from defects, plant disease, and all forms of infestation or objectionable disfigurements. Either bare root or balled and burlaped trees are acceptable. All plant material shall conform to American Standard for Nursery Stock (ANZI Z60.1-2004 or later).

b) Diggers Hotline will be contacted to mark all planting areas before any work is carried out.

c) Site Disturbances: Take precautions to insure that equipment and vehicles do not disturb or damage existing site grading, walks, drives utilities, plants, etc. Replace and/or return to original condition any damage caused by Contractor's negligence at no cost to Owner.

d) The trees shall be planted according to the planting plan. Unless otherwise approved, the trees shall also be located five (5) feet from all sewer and water laterals, and ten (10) feet from driveways, light poles and fire hydrants. No trees shall be planted within 25 feet of any street corner.

e) All trees planted shall be of minimum size of 1.5" to 2.5" in caliper. Said caliper reading shall be taken 6" above the ground surface.

f) Plants stored on site must be mulched and watered. The root balls can not dry out.

g) The size for the tree installation hole shall preferably be two to three times the root ball in diameter where feasible. Trees shall be planted with the root collar (root flare) exposed and at or slightly above the surface level. For balled trees, the hole shall be at least 18" larger than the largest diameter of the ball and no deeper than the ball. Place no soil on top of the root ball.

h) Care should be taken to remove as much planting material from the root ball as possible without compromising the structure of the root ball. At a minimum, all planting material must be removed from the top half of the root ball. Planting twine must be removed, especially twine that comes into contact with the tree trunk, to prevent any future trunk girdling issues. It is recommended that burlap and wire be removed during the plant installation process.

i) Soil for backfilling around roots and/or root balls shall be the existing soil from the excavation. Where existing soil is rocky and poor quality, the local brown topsoil may be used. Soil shall be pulverized and screened. All material dug from the plant holes and not used shall be removed from the site and disposed of. Immediately after planting, soil around roots and balls shall be thoroughly watered.

j) At the time of planting, trees shall be pruned to remove dead, broken, or diseased branches or cross branches that rub. As much of the leaf surface as possible shall be maintained to create food for the tree. Trees shall appear symmetrical in shape and appearance. Trees shall have a single, straight leader.

k) Persons installing street trees shall take all necessary precautions to minimize the damage to existing lawns. Any damage to existing lawns shall be repaired by placing topsoil and seed in the damaged area.

l) Plants shall be lifted and handled from the bottom of the ball only. Not dragged, lifted or pulled by the trunk or foliage parts in a manner that will loosen the roots in the ball.

m) All plants shall be mulched over the root system with a 3 - 4 inch layer of wood chips or bark immediately after planting. Mulching material shall be pulled back no less than 2 - 3" and no more than 6" from the trunk. Mulch between the plants may be deeper depending upon the individual plan.

n) Only those plants designated by the Purchaser shall be wrapped, staked and/or guyed. Staking shall consist of a minimum of two posts or stakes. The minimum length of the posts shall be the depth of the bore plus one-half the height of the tree. The posts shall be installed at least one foot outside the diameter of the tree planting hole. The tree shall be connected to the posts with a 2"x 1/16" strap of such design so as not to damage the tree. The tree shall be planted as plumb as possible and the contractor shall maintain tree plumb ness throughout the guarantee period. All stakes shall be removed within one year of planting.

- o) Trees planted between June 1 and September 15, shall be balled and burlaped.
- p) All installation must be inspected by the Village Forester, or a representative. If, in the sole opinion of the Village Forester, additional remedies are needed to assure the stocking and maintenance of healthy tree specimens, additional remedies may be required.