

**PUBLIC TREE INVENTORY REPORT
AND
MANAGEMENT PLAN
FOR THE
CITY OF REEDSBURG, WI**



**PREPARED BY:
WACHTEL TREE SCIENCE, INC.
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**Public Tree Inventory Report & Management Plan
For the City of Reedsburg, WI**

By: Wachtel Tree Science (262)538-1900 (October, 2014)

EXECUTIVE SUMMARY

The City of Reedsburg recognizes the benefits a properly maintained urban forest provides to the quality of life of its citizens, through air pollution reduction, energy conservation, increased property values and aesthetics. To develop a system to increase these benefits through effective management, the City contracted with Wachtel Tree Science to conduct an urban forest inventory update and from that data, develop a management plan.

This document reports the findings of the street and park tree inventory that was conducted between June 16th and July 11th of 2014 by Wachtel Tree Science staff. The results include:

STREET TREES

- A total of 3,877 planted sites, 107 stumps and 1187 potential planting sites were inventoried along City of Reedsburg street right-of-ways.
- The current street tree population is 77.05% of full stocking (existing trees/identified planting sites)
- 69 different species and 33 genera make up the street tree population, with the species Norway Maple (32.1%), Green Ash (19.3%), and Honeylocust (6.5%) occurring most often. The top two *Genera* include: *Acer* (maples) 57.5% and *Fraxinus* (ashes) 21.8%.

PARK TREES

- 434 planted sites and 3 stumps were inventoried at various City parks.
- 41 different species and 20 genera make up the park tree population, with Green Ash (28.8%), Honeylocust (10.1%), and Norway Maple (8.8%) occurring most often. The top three *Genera* include: *Fraxinus* (ashes) 29.5%, *Acer* (maples) 23.3% and *Gleditsia* (honeylocusts) 10.1%.

ALL PUBLIC TREES

- The City of Reedsburg's public tree inventory shows a slightly older aged tree population. 62.1% of the trees are in the 7-12" or 13-18" diameter classes, 16.9% of the trees are in the smallest diameter classes (0.25-3" and 4-6"), while the largest diameter classes make up the remaining 21% of the population.
- The distribution of size classes is close to the desired "bell-shaped" curve for an urban tree population but is somewhat heavy on the larger sized class of trees. 70 to 80% of the public trees are contained in the 7-12", 13-18", and 19-24" classes respectively.

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- Of the younger trees (1-12” in diameter), 37% of the population in this diameter range are in one of the top three condition classes (70% or above). With the larger trees (13"+ in diameter) 13% are in one of the top three condition classes (70% or above). 87% are below these condition classes. Many of these larger diameter trees that fall below 70% condition class are Green Ash and Norway Maples that have co-dominant stems and included bark resulting in poor structure. Many of the Norway Maples have girdling root issues resulting from being planted deeply. This also contributes to poor structure.

GENERAL OBSERVATIONS

- Total public tree value is estimated at \$4,294,745.77, with an average individual tree value of \$909.38.
- The City is over-planted with the Maple species, Genus (*Acer*). This Genus alone accounts for 54.7% of the entire public tree population. Ashes (*Fraxinus*) are at 22.6%. This percentage will change with enactment of the “5-year Emerald Ash Borer Implementation Plan” (separate document).
- It is imperative that new species continue to be introduced to increase diversity and a moratorium be placed on the planting of any more Maple or Ash species.
- Being a moderately-aged urban forest, a resource of this magnitude justifies increased expenditures for providing properly managed care.
- The City should adopt a more proactive role in maintaining the urban tree population with regular, scheduled pruning rotations. Regular pruning will promote better structure of the overall tree population and will identify and address serious tree defects before failure occurs.
- The current level of local funding is not sufficient to manage the existing public trees for the foreseeable future, especially as the City implements more components of their Emerald Ash Borer (EAB) management strategy.
- The City should consider having within the budget process in the next 2 to 3 years at least a ½- time forestry position in place to coordinate the various public forestry functions within the City. This position should be filled by someone having International Society of Arboriculture Certified Arborist credentials.
- The City needs to retain local nursery stock suppliers and installers that practice proper structural pruning techniques in the nursery, so the City receives high quality planting stock thereby reducing the amount of staff time devoted to *Training Pruning* early in the trees’ development growth phase. This is extremely critical if an ash removal/replanting plan are implemented.

- The City should take a more active role in working with their citizens to promote better planting practices. Emphasis should be placed on proper planting techniques following current industry standards, proper care of trees after planting, and proper training pruning to promote better tree structure in the future. The City needs to also take a more proactive role in demanding greater species diversity when developers submit their planting plans for approval.

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

INTRODUCTION

Trees give some of the first impressions of the City of Reedsburg to visitors and add intangibles to the everyday lives of its citizens. Trees add beauty to the City of Reedsburg through the softening and complementing of building's 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.

A well maintained and managed urban forest has a lot to offer the citizens of the City of Reedsburg. Trees improve the environment and the quality of citizen's lives every day.

Energy savings 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. Our comfort is greatly affected by trees. Proper tree placement can reduce solar radiation (creating shaded areas), focus air movement, and lessen air temperature (offsetting the urban "heat island" effect).

The quality of the air around us is improved by trees. 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 great variety of harmful gases. The proper placement of trees can reduce noise and pollution to more tolerable levels.

Trees play an important role in 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.

Trees improve recreation opportunities by providing comfortable, inviting parks for a variety of activities. They create wildlife diversity in the City of Reedsburg 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 USDA – 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 City of Reedsburg's 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 City of Reedsburg 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 City of Reedsburg 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.

I. INVENTORY METHODOLOGY

A. Inventory System

A street/park tree inventory was conducted along all City streets and within City parks.

Field data was collected utilizing a handheld pocket computer, loaded with ESRI's **ArcPad 10.0** software. Digitized orthophoto and planimetric mapping data were supplied by the City of Reedsburg through their consulting engineer Ruckert & Mielke, Inc. Detailed site information was collected using a custom data entry interface **PinPoint 2.0**. A tree inventory database of all inventoried public trees was created in Microsoft **Access 2003** utilizing reports, tables and queries customized by Wachtel Tree Science. All trees and potential planting sites in the public R-O-W of the City were inventoried per street mapping supplied by the City.

The following information was collected between June 16th and July 11th of 2014 in a detailed walking inventory.

B. Public Tree Site Information

- 1.) Tree/Vacant Grow Space Unique ID number
- 2.) Inspection Date (date record was created or updated)
- 3.) Address (House Number)
- 4.) Street Name (the street that corresponds to the Address)
- 5.) Park/Public Property Name
- 6.) Growth Space (treelawn/terrace width)
 - 1 = Open/Unrestricted
 - 2 = Terrace w/ Sidewalk 0 – 3'
 - 3 = Terrace w/ Sidewalk 3 – 5'
 - 4 = Terrace w/ Sidewalk 5'+
 - 5 = Boxout/Cutout
 - 6 = Ditch
 - 7 = Median

C. Public Tree Data Collected

- 1.) Species: see **Appendix A** for listing of species inventoried.
- 2.) Year Planted: i.e. 2010, 2011, etc. (Data to be inputted by City personnel)

3.) DBH: tree diameter measured at 4.5 feet above ground, rounded to nearest inch. With multi-stemmed trees, the largest stem was used as the basis for measurement.

4.) Height Class: 0-15', 15-30', 30-60', 60'+

5.) Deadwood Present: 0 – 100% (5% increments)

6.) Condition Rating: 0 – 100% (5% increments)

This is an overall rating of factors covering tree health and structure including: branching, condition of trunk and roots, decay, vigor, insect and disease problems, growth rate, crown development, life expectancy, etc. (Council of Tree and Landscape Appraisers, 7th Edition, basic formula method)

0%	Dead tree or vacant planting site.
<30%	Trees in poor condition, death likely within three to five years. Trees with this rating usually have some major defect or are at the end of their life cycle.
31-50%	Trees with major structural problems and/or in poor health. The trees could live five to ten years but are likely to decline further and be damaged in storms.
51-70%	Trees with minor structural defects and little signs of poor health. These trees will benefit the most from proper care (pruning, mulching etc.) especially young trees. Most trees in this class can be expected to live ten or more years.
71-90%	Trees with good form and health. They may have some minor problems but they would be easily corrected with proper maintenance. These trees are established in their site and could be expected to live 20 or more years.
90%+	Trees in excellent health with no structural defects.

7.) Maintenance Needs:

- 1 = PLANT: plant vacant space.
- 2 = REMOVE: tree needs to be removed.
- 3 = SAFETY PRUNE: tree needs to be pruned for safety reasons (deadwood \geq 2").
- 4 = ROUTINE PRUNE: no immediate needs, tree should be on regular pruning schedule.
- 5 = TRAINING PRUNE: generally a young tree (up to 8" DBH) that needs pruning to direct scaffold branch structure and future form.
- 6 = WATCH: trees needs to be checked yearly due to structural or health problems. Conifers should be checked every 5 years to ensure they are not outgrowing their spaces and causing sight obstruction or clearance problems.
- 7 = CABLE & PRUNE: tree needs bolt and/or cable and pruning to correct a structural defect.
- 8 = GIRDLING ROOT: tree has girdling root(s) that need to be removed.
- 9 = REMOVE STUMP: stump that needs or may need to be removed.

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- 10 = REMOVE STAKES: planting or support stakes that need to be removed.
- 11 = HEAVING WALK/CURB: tree roots or root flare is damaging pavement.

8.) Work Priority:

A numbering system to assist in prioritizing work that needs to be completed

- 1 = OK: No problems. Also designation for vacant planting sites.
- 2 = PRIORITY 1: Work that needs to be completed in the next year for safety reasons (removals, cabling, safety pruning) or tree health.
- 3 = PRIORITY 2: Work to be completed over the next 2 - 3 years that is currently not presenting a major hazard but will prevent future problems (clearance, deadwood or training pruning).
- 4 = PRIORITY 3: Work to be completed over the next 5 - 7 years so the problem does not become a hazard. Or monitor the tree to be sure the condition does not become worse (crown restoration, crown cleaning or rejuvenation pruning).

10.) Clearance for Street Trees:

- 1 = OK: no clearance problems.
- 2 = Traffic: tree branches are or soon will be struck by passing vehicles.
- 3 = Signs/Lights: tree is interfering with street lights or street signs.
- 4 = Walks: tree limbs/branches are interfering with pedestrian traffic.
- 5 = Potential View Obstruction: tree may be obstructing the view of traffic.

11.) Utilities Present Overhead:

- 1 = none
- 2 = electric
- 3 = telephone/cable
- 4 = both

12.) Special Conditions: (see **Appendix G**)

Any specific information about a particular tree that was inventoried (i.e. disease or insect problems, multi-stemmed, included bark, wounding, v-crotch, etc.).

13.) General Notes/Comments

II. INVENTORY RESULTS AND DISCUSSION

A. Street Tree Inventory

The City of Reedsburg’s street tree population consists of 3,877 street trees, 107 stumps, and 1,187 potential planting sites for a total of **5,171** sites inventoried.

1. Data Summary

Total stocked sites (includes stumps)	3,984	(77.05% stocking)
Potential planting sites (vacant).....	1,187	
Removals	168	
Safety prune	978	
Routine prune	1,474	
Training prune	617	
Tree Heaving walk/curb.....	2	
Watch.....	40	
Cable/prune.....	13	
Girdling root	587	
Remove stakes	0	
Remove stumps	105	
Prune for street clearance	4	
Prune for sign/light clearance	7	
Prune for walk clearance	195	
Potential view obstruction	1	
Maintenance Priority		
OK	1,187	
Within Next Year	1,853	
Within Two to Three Years.....	617	
Within Next Five Years.....	1,514	

2. Planting Site Summary

There are 1,187 potential planting sites within the street tree inventory area that meet the criteria for being a suitable planting site. Some of these sites may be impacted by underground utility conflicts which may prohibit planting within the public R-O-W. The vacant planting sites are open/unrestricted, have growing space greater than 5’, or are boxouts (downtown area):

Open/Unrestricted.....	370	(31.2%)
Terrace w/ Sidewalk 5’+.....	815	(68.7%)
Boxout.....	2	(≤0.01%)

This larger width creates many options when selecting species to plant and is a feature that many municipalities do not have. The larger planting areas in these sites will allow a

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wider variety of trees to be planted and will help the City of Reedsburg to have healthier trees.

There are multiple vacant planting sites in the downtown area. High importance should be placed on keeping these sites filled and the trees within them looking beautiful. Many visitors to a City spend the majority of their time in the central marketplace and a well-kept appearance is a positive impression to be left with. Studies have shown that more greenspace in market areas improves the mood of shoppers and they stay for longer periods of time.

In all, 3,984 (77.05%) of the 5,171 street tree sites in the inventoried areas have trees or stumps (stocking level). This is a much higher stocking level than for most of the communities we have surveyed. The norm is in the 50 to 60% stocking level.

Emphasis should continue to be placed on new tree plantings, continuing to use greater species diversity in the planting site selection process. Since stocking is at a higher than average level, an opportunity presents itself in allowing superior species to be planted as planting monies become available and undesirable species are removed from the street tree population.

3. 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 should have taught us this lesson, but we weren't listening. The current rule of thumb is “**no more than 30% of one family, 20% of one genus and 10% of one species.**” The 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** × *freemantii* (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 the benefits a healthy,

sustainable urban forest provides.

The 3,877 existing street trees include 33 genera and 69 different species. The top 9 Species break down as follows:

<i>Acer platanoides</i>	Norway Maple	955 trees	24.6%
<i>Fraxinus pennsylvanica</i>	Green Ash	761 trees	19.6%
<i>Acer saccharinum</i>	Silver Maple	442 trees	11.4%
<i>Acer platanoides var.</i>	Norway Maple Var.	290 trees	7.5%
<i>Gleditsia triacanthos</i>	Honeylocust(Thornless)	250 trees	6.4%
<i>Acer rubrum</i>	Red Maple	197 trees	5.1%
<i>Acer saccharum</i>	Sugar Maple	168 trees	4.3%
<i>Acer x. freemannii</i>	Freeman Maple	135 trees	3.5%
<i>Fraxinus Americana</i>	White Ash	<u>85 trees</u>	<u>2.2%</u>
	Total	3,262 trees	84.6%

See **Appendix B**, Species Frequency-All Public Trees, for the entire break down.

It is unfortunate to see that eight of these nine species break the most recent recommendation of the “10% Rule for **Genus**”. Six species are the genus *Acer* (Maples) and two are *Fraxinus* (Ashes). It is imperative that more species on the recommended street tree species list be planted (see **Appendix C**). With the two genera *Acer* 56.4% (Maples) and *Fraxinus* 21.8% (Ashes) making up such a large portion (78.2%) of the population, any problems with one of the species within its respective genus will have a big impact on the City of Reedsburg’s urban forest and budgets. No one genus should make up more than 10% of the population.

All future planting projects need to focus on adding more diversity and quantities to the species mix. Several additional species to consider adding to the planting list include: Amur Corktree, Yellow Buckeye, Turkish Filbert, Ironwood, Ginkgo, Kentucky Coffeetree, and Swamp White x Bur Oak hybrid. Species that could be increased in numbers planted annually include: hybrid Elm species and Serviceberry.

A concern with Ash species (Green and White), combined total 846 trees or 21.8% of the street tree population, is the number of disease and insect problems they can contract 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 Emerald Ash Borer (EAB). This is an exotic woodborer 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 Connecticut, Colorado, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Maryland, Minnesota, Missouri, New Hampshire, New York, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin and the Quebec and Ontario provinces of Canada. EAB is easily spread through the movement of firewood,

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logs and nursery stock.

Now that EAB has arrived and is expanding in Wisconsin, the DATCP is determining the extent of infestations as they are discovered, quarantining the affected areas, and assisting with developing plans of action based on the size of the infestation; available support resources are limited. Removal will most likely be the responsibility of municipalities and private residents per their local ordinances.

It is recommended that a minimum five year moratorium be placed on future Ash plantings until the full impact of this pest is better understood. Reedsburg's EAB strategy is outlined in their recently completed "5-Year EAB Implementation Plan".

With Norway Maple having an extremely high frequency (32.1%), the concern of their tendency to develop girdling roots is a major maintenance issue currently. 685 of the 1245 existing street Norway Maples (55%) have identified girdling root issues. 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 30 - 35 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 by not performing timely training pruning when the trees are young, serious structural issues can develop. 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.

Conifers account for (42 trees) 1.1% of the population. A majority of these trees are located on streets where there is no sidewalk and have been planted by the abutting property owner in the right-of-way. Conifers should not be used for street trees because of view and clearance obstructions in most street settings. None of these trees are currently creating obstructed view potentials or clearance issues.

Another concern is Silver Maple, which make up (442 trees) 11.4% of the total population with 246 being 20" DBH or larger. This is a poor street tree because it is very weak wooded, grows with a poor form and has surface roots. There is a higher probability of storm damage due to their very poor form. This is not a recommended species and extra focus will be needed on these trees (**Appendix C** lists undesirable as well as desirable trees).

It is important to continue the planting of trees with mature heights of 30 feet or less. Currently there are 174 trees or 4.5% of the current population in this grouping. Some smaller scale trees to add to mix include: Korean Mountain Ash and more Turkish Filbert, Ironwood, Serviceberry, American Hornbeam and crabapple. These are important to use in areas with power lines where shorter trees are preferred or in smaller growspaces (< 5' between the back of curb and sidewalk). Disease resistant varieties of crabapples with persistent fruit should be specified for any new plantings.

4. Street Tree Planting

The minimum criteria for potential planting sites was where there was existing curb and gutter and sidewalk with a minimum terrace width of 6 feet. Vacant box-outs in the downtown areas were also considered for planting. A vast majority of sites in the City had terrace widths of six feet or greater or were unrestricted, meaning there was no sidewalk on the back side of the planting site. Given the moderate number of qualifying potential planting sites (1,187) within the City, 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** contains a list of recommended trees and ones to avoid. With all of the open growspace (planting) areas being *Greater than 5'* in width or *Unrestricted* allows 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 or when feasible entire blocks, the desired effect of the plants will be achieved. Also, when possible, plant in the back half of the R-O-W 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 City is also trying to determine locations in the City where new trees can be planted behind the sidewalk.

The following modifications are recommended to be incorporated into the “Trees, Standards Related to Planting and Care Policy”.

- continue the moratorium on the planting of Ash species for at least another 5 years (due to insect threat being present - Emerald Ash Borer - and being too high a percentage of the population)
- eliminate the planting of Norway Maple as well as all other *Acer* species since the *Acer* genus already is 56.4% of the street tree population
- where Crabapples are planted, select disease resistant and smaller persistent fruiting varieties, add more varieties to the mix.
- under power lines, plant only trees that are small at maturity
- where possible, (especially in new areas or where there can be a lot of mortality) add groups of new species that are currently not being used to any great extent, more variety in species is needed
- discourage planting of Spruce and Pine varieties in the R-O-W 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 (*Training Pruning*) is also very important. Try to visit newly planted trees every three years up until they are 8” in diameter. 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 15. 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

A total of (16) established parks were inventoried in the City of Reedsburg. The named parks include: Anna Stone Memorial, City, Ernstmeyer, Huntington, Monument, Nishan, North, Oak, Ramsey, the Skate Park, South, Webb, Willow, Roloff, Eastridge, and the Dog Park.

A total of **437** sites were inventoried which includes **3** stumps.

1. Data Summary

Total trees (includes stumps)	437
Removals	25
Safety prune	133
Routine prune	142
Training prune	79
Watch.....	34
Cable/prune.....	1
Girdling root	19
Remove stakes	1
Remove stumps	3
Maintenance Priority	
Within Next Year	184
Within Two to Three Years	77
Within Next Five Years.....	176

2. Species Frequency

The 437 existing park trees are made up of 41 different species and 20 genera. The top five break down as follows:

<i>Fraxinus pennsylvanica</i>	Green Ash	125 trees	28.8%
<i>Gleditsia triacanthos</i>	Honey Locust	44 trees	10.1%
<i>Acer plattanoides</i>	Norway Maple	38 trees	8.8%
<i>Acer saccharinum</i>	Silver Maple	33 trees	7.6%
<i>Quercus rubra</i>	Northern Red Oak	<u>19 trees</u>	<u>4.4%</u>
	Total	259 trees	59.7%

See **Appendix B- All Public Trees Species Frequency**, for the entire break down.

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For the City of Reedsburg, WI**

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It should be noted that combining all the species in their respective genus puts the *Fraxinus* (Ashes) genus at 29.5%, *Acer* (Maple) at 23.3%, and *Gleditsia* (Honeylocusts) at 10.4%. This means that three genera are breaking the currently recommended “10% Rule for **Genus**” where no one species should make up more than 10% of a public tree population. More of other genera, species and varieties on the recommended street and park tree species list need to be planted (see **Appendix C**). With only three genera making up such a large portion (63.2%) of the park tree population, any problems with one of these genera will have a big impact on the City of Reedsburg's park/public property landscapes.

More of other species such as hybrid Elm, Kentucky Coffeetree, Serviceberry, Ginkgo, White Fir, Baldcypress, Yellow and Ohio Buckeye, Catalpa, Ironwood, and Amur Corktree should be used as species of choice. Also more Crabapple varieties should be included to add variability and resistance to apple scab.

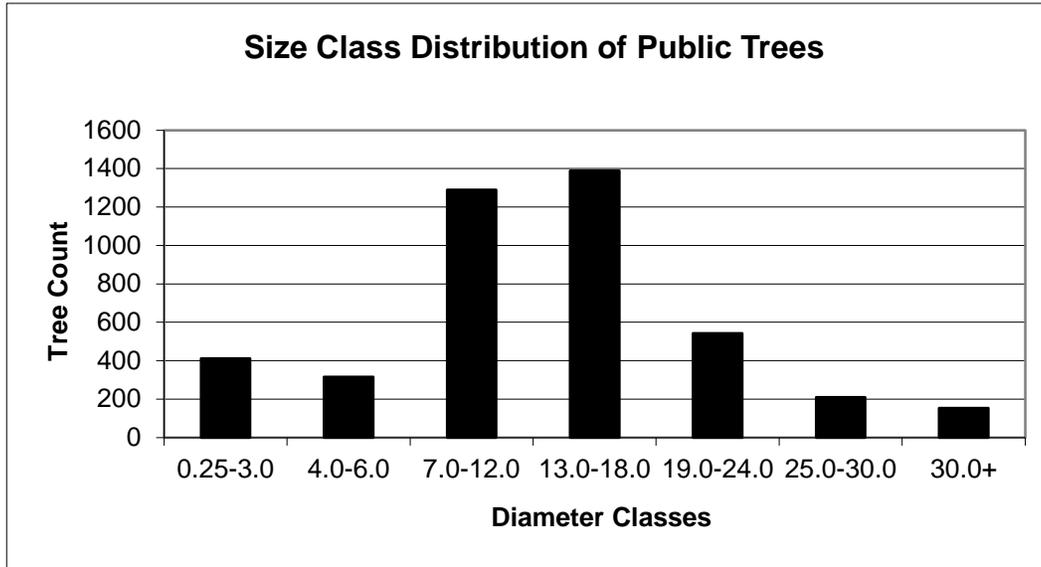
C. Public Tree Size/Condition/Value Discussion

1. Size Class Distribution

The City of Reedsburg's public tree inventory shows a moderate aged tree population, 62.1% of the trees are in the 7-12” or 13-18” diameter classes. 16.9% of the trees are in the smallest diameter classes (1-3” and 4-6”), while the largest diameter classes make up the remaining 21% of the population. (See **Figure 1**) Future maintenance should focus on immediate concerns first but also address structural issues in the younger trees. Many of the trees in the moderate to older age classes have poor structure. As the tree becomes larger, trying to correct these issues becomes more costly 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. *Training Pruning* is the second most recommended maintenance procedure over the next 5 years with **22.6%** of the trees needing it.

The distribution of size classes is close to the desired “bell-shaped” curve with 60 to 70% of the trees falling in the 7-12”, 13-18”, and 19-24” classes respectively. The 4-6” class should be somewhat higher than the present situation. This will change with time as trees from the 1-3” class move up into this class from additional plantings taking place.

Figure 1.



2. Condition Rating

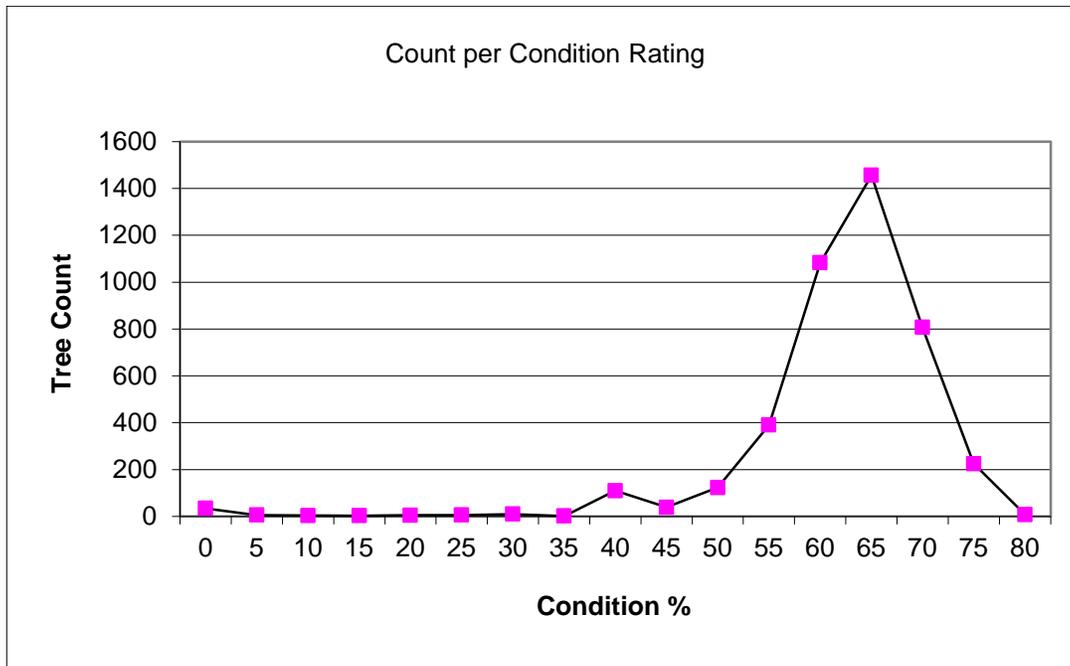
This area is in need of improvement. **76%** of all public trees fall below the top three condition classes. (see **Figure 2.**) Many trees in the community have been allowed to grow without any regular maintenance. Poor structure resulting from larger co-dominant stems and included bark is prevalent throughout the community. A large portion of the storm damage in mid-June 2014 was a result of these stems ripping 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.

Of the younger trees (1-12” in diameter) **37%** of the population in these three diameter classes are in one of the top three condition classes (70% or above). Immediate maintenance should be focused on some of the larger diameter trees in this group before their structural problems become worse while other younger trees that are having difficulty becoming established may need to be removed and replaced.

There is opportunity to improve these condition ratings because younger trees do 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 >8” 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.

Figure 2.



3. Maintenance

In the larger trees (13"+ in diameter) 12.5% are in a condition class above 70% and 87.5% are below the 70% condition class. Many of these larger diameter trees that fall below the 70% condition class are Green Ash and Norway Maples that have co-dominant stems and included bark. The vast majority of these two tree species with these structural issues received a condition class rating of 60 to 65%. (See **Table 1**)

Table 1

PUBLIC TREES PER CONDITION CLASS AND DIAMETER CLASS								
CONDITION CLASS %	DIAMETER CLASS (Inches DBH)							TOTAL
	<u>1 - 3</u>	<u>4 - 6</u>	<u>7 - 12</u>	<u>13 - 18</u>	<u>19 -24</u>	<u>25-30</u>	<u>30+</u>	
90 - 100	0	0	0	0	0	0	0	0
80 - 89	4	2	2	0	0	0	0	8
70 - 79	277	149	319	182	82	15	8	1032
60 - 69	91	141	738	962	359	147	101	2539
50 - 59	10	14	157	181	76	38	37	513
40 - 49	11	6	50	51	17	8	6	149
30 - 39	0	1	7	1	3	0	0	12
20 - 29	1	0	3	3	4	0	0	11
10 - 19	2	0	2	2	1	0	0	7
0 - 9	15	3	12	7	0	2	1	40
	411	316	1290	1389	542	210	153	4311

The focus of routine pruning in these larger diameter size classes should be with trees that are currently in the 60 to 70% condition classes. There is a good chance for a number of these trees to move into higher condition classes, if a 5 to 7-year routine pruning schedule can be sustained. Due to the varied tasks required of the employees in the Department and current budget restraints both routine and training pruning activities do not receive the priority level that public trees require. A goal should be set to attain placing at least 75% of the trees into condition classes above 70% within the next 15 years. Currently 24% of all existing trees have a condition rating of 70% or higher.

Improving the condition of some of the older trees that are less desirable species (Boxelder, Silver Maple, Siberian Elm and Eastern Cottonwood in particular - 432 trees, 13"+ DBH) may not be possible. It has to be accepted that these trees will not live as long and the main goal will be to make sure hazards are reduced as much as possible. The City will see a service life of 30 - 40 years from most of these trees, yet it should be 80+

years if they were proper species. Poor species selection not only increases maintenance costs but also requires replanting sooner.

Overall the City of Reedsburg's urban forest is in poor to fair shape. An increased focus on maintenance; primarily training pruning, proper planting techniques and aftercare will improve this condition and help guarantee healthy trees that add value to the community for many generations to come.

Clearance Pruning is also important. There are 207 trees (5% of the total) in the terrace tree inventory that are in need of some type of clearance pruning. These 207 trees comprise: trees having branches interfering with vehicular (2%) and pedestrian (95%) traffic, limbs blocking signs/ lights (3%), or limbs obstructing traffic view (<1%).

Vehicular and walk clearance account for 97% of the clearance issues. Of the trees that fall in these two groupings, 56% are in the 2" to 12" DBH class. Time should be taken over the next several years to visit these trees and perform "crown raising". With some of the larger diameter trees this may require two visits spaced out over a two or three year period so that too much crown is not removed at one time.

For other clearance issues low limbs need to be removed now before they get too large. This prevents a large wound being created at a later time. Trees do not have to be raised evenly; they can be left lower away from the street. Even though the public frequently objects to this pruning appearance, it is important to educate them of the benefits to the health of the tree by leaving as much foliage on the tree as possible, while meeting the necessary street side clearance requirements. The young trees should be raised as they become established to prevent these problems (part of training pruning). Be sure not to elevate too much at one time, or the tree's health can be severely affected. Preventative maintenance is performed on equipment (trucks, etc.) even though they are losing value. What better investment than maintenance on trees which increase in value!

4. Public Tree Value

Table 2 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 Racine/Kenosha 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

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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 City of Reedsburg is \$4,294,745.77. This equates to an average value of \$909.38 for each inventoried tree along the City’s streets and in parks. Given slightly higher condition classes, and 5 to 10 more years of growth to boost diameter and height, then it becomes obvious that the value of the City of Reedsburg’s urban forest would be even higher.

Table 2 City of Reedsburg Public Tree Valuation Report

Common Name	Species Count	Species Value	Average Species Value
American Basswood	38	\$66,431.17	\$1,748.19
American Elm	14	\$13,122.47	\$937.32
Amur Maple	26	\$4,113.30	\$158.20
Apple Spp.	5	\$438.11	\$87.62
Austrian Pine	8	\$10,047.55	\$1,255.94
Birch Spp.	35	\$14,885.61	\$425.30
Black Cherry	7	\$4,139.45	\$591.35
Black Locust	32	\$21,382.29	\$668.20
Black Walnut	36	\$34,377.88	\$954.94
Boxelder	11	\$1,525.05	\$138.64
Bur Oak	19	\$99,591.74	\$5,241.67
Callery Pear Spp.	20	\$3,499.99	\$175.00
Catalpa Spp.	11	\$12,517.79	\$1,137.98
Cherry and Plum Spp.	20	\$2,218.59	\$110.93
Chinkapin Oak	2	\$58.72	\$29.36
Colorado Spruce	8	\$2,139.78	\$267.47
Crab Apple Spp.	78	\$15,264.90	\$195.70
Douglas-Fir	3	\$4,663.85	\$1,554.62
Eastern Cottonwood	5	\$8,005.49	\$1,601.10
Eastern Redbud	1	\$140.49	\$140.49
Eastern Redcedar	9	\$9,652.97	\$1,072.55
Eastern White Pine	34	\$75,796.60	\$2,229.31
Elm Spp. (Hybrid)	26	\$27,639.20	\$1,063.05
European Alder	1	\$60.56	\$60.56
European Beech Var.	1	\$60.38	\$60.38
Freeman Maple	140	\$31,328.81	\$223.78
Ginkgo	3	\$3,325.74	\$1,108.58
Green Ash	874	\$1,070,209.97	\$1,224.50
Green Ash Var.	12	\$10,474.27	\$872.86
Hackberry	23	\$55,216.32	\$2,400.71
Hawthorn Spp.	2	\$132.12	\$66.06
Hickory Spp.	1	\$755.91	\$755.91
Honeylocust (Thornless)	294	\$360,214.41	\$1,225.22

Honeylocust Var.	2	\$6,103.03	\$3,051.52
Japanese Tree Lilac	16	\$1,585.45	\$99.09
Lilac Spp.	5	\$73.86	\$14.77
Littleleaf Linden	28	\$24,940.93	\$890.75
Maple Spp	12	\$590.88	\$49.24
Mountain-Ash Spp.	17	\$2,087.73	\$122.81
Mulberry Spp.	6	\$6,875.35	\$1,145.89
Northern Pin Oak	7	\$18,714.12	\$2,673.45
Northern Red Oak	35	\$58,129.48	\$1,660.84
Northern White-Cedar	9	\$2,830.21	\$314.47
Norway Maple	993	\$729,848.86	\$734.99
Norway Maple Var.	293	\$217,841.79	\$743.49
Norway Spruce	3	\$6,858.89	\$2,286.30
Ohio Buckeye	15	\$15,838.37	\$1,055.89
Other, Unknown	7	\$0.00	\$0.00
Pear Spp.	5	\$365.68	\$73.14
Pin Oak	1	\$36.13	\$36.13
Poplar Spp.	1	\$165.15	\$165.15
Quaking Aspen	3	\$734.92	\$244.97
Red Maple	205	\$144,696.44	\$705.84
Red Pine	1	\$1,449.20	\$1,449.20
Redmond Linden	18	\$4,253.64	\$236.31
River Birch	7	\$6,321.17	\$903.02
Russian-Olive	1	\$994.35	\$994.35
Scotch Pine	1	\$487.71	\$487.71
Serviceberry	8	\$252.89	\$31.61
Shagbark Hickory	1	\$37.16	\$37.16
Siberian Elm	36	\$14,381.52	\$399.49
Silver Linden	1	\$1,145.05	\$1,145.05
Silver Maple	475	\$624,013.10	\$1,313.71
Sugar Maple	174	\$265,091.92	\$1,523.52
Swamp White Oak	1	\$7.74	\$7.74
Sycamore	3	\$2,641.05	\$880.35
Tartian Maple	2	\$59.94	\$29.97
White Ash	79	\$111,555.25	\$1,412.09
White Ash Var.	9	\$7,244.64	\$804.96
White Fir	2	\$5,249.37	\$2,624.68
White Oak	2	\$8,631.92	\$4,315.96
White Poplar	6	\$3,727.43	\$621.24
White Spruce	18	\$34,145.89	\$1,896.99
Willow	4	\$1,306.07	\$326.52
Totals:	4311	\$4,294,745.77	Average/tree=\$909.38

III. REVIEW AND CONCLUSION

This GIS tree inventory is a dynamic, powerful management tool. It is imperative that it constantly be updated as work is performed and new trees are planted and others removed. It is recommended that a review and City wide updating of the inventory be performed in **2019** by an outside urban forestry consulting firm.

Now that the inventory has been conducted, the collected data will be analyzed and an action plan will be developed. The City should strive to have one of its employees become an International Society of Arboriculture Certified Arborist. Even though this position might not be able to focus entirely on forestry related activities, having a Certified Arborist on staff will ensure that proper tree care procedures will be part of the City's best management practices. The City could also consider retaining a consulting Arborist on an as needed basis. With an **asset of over \$4.2 million**, the City of Reedsburg's public trees deserve the best knowledgeable care the City can provide.

City of Reedsburg

URBAN FOREST MANAGEMENT PLAN

I. INTRODUCTION

The purpose of this Management Plan is to review the data collected in the street and park tree inventories and through analysis, develop management scenarios for both tree populations. From this, build upon or as necessary redirect efforts to maintain in a cost effective manner, a healthy, safe, diverse and growing 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 City 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 City of Reedsburg’s community forest (combined street and park trees) is in poor to fair shape. The overall condition is below most moderate-sized communities we see. In the 1 - 12" diameter classes 37% of the trees in this group are healthy (70% or greater condition rating). In the diameter classes >12", 13% are healthy. It is important to improve upon these condition classes as the 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 City of Reedsburg’s citizens.

To that end, the priorities in the Management plan are:

- 1.) Removals, including stump removal
- 2.) Safety and Clearance pruning
- 3.) Training pruning (22.6% of the combined inventoried trees need this)
- 4.) Yearly inspections of lower condition class trees with special focus on the “*Consider Removal*” trees
- 5.) Identify any additional training needs for City crews to acquire proper tree skills (planting, pruning, hazard tree recognition, insect and disease identification, etc.)
- 6.) Prepare a recommended species list for new tree plantings for the City
 - proper species selection and diversity are key to reduced future costs and a healthy urban forest
 - larger planting sites will help make it easier to grow healthy trees
- 7.) Regular maintenance pruning is needed to keep trees healthy

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Removals, safety and clearance pruning have to be given priority to eliminate hazards. Training 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 City of Reedsburg's 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 conducted between mid-June and mid-July 2014 by reprioritizing 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 City of Reedsburg a clear set of strategies to achieve these goals. The 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 street terrace widths are present and suitable planting sites exist in parks/municipal properties, create an aesthetic atmosphere in the City through maintaining a diversity of high quality healthy young, intermediate and mature trees. By providing quality tree care on a low cost regular basis, public trees will continue to be a significant asset to the City. Quality care of public trees will also inspire and educate residents to properly care for trees on private property.

IV. GOALS & STRATEGIES

GOAL 1:

Maintain the City of Reedsburg's urban forest in a cost effective, healthy and safe condition through proper care and maintenance of trees.

Strategies:

- Use the 2014 street and park/municipal property tree inventories and field survey results to establish a maintenance action plan (part of the management plan)
 - Perform comprehensive updated inventory in 2019
- Implement maintenance goals from the management plan
 - Review yearly work plan with the City Council in the summer of each year prior to budget submission to the Council
- Insure 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)
 - City 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 City newsletter
- Establish a “best management practices” manual that contains standards and specifications for performing tree work
 - Increase City employee training in proper tree care
 - Hold at least one membership in ISA and WAA and have a person attend WAA meetings
 - Strive to get at least one person on staff to become an ISA Certified Arborist
 - Consider hiring only private contractors that agree to adhere to proper ANSI standards and who employ Certified Arborists
 - Develop and enforce tree protection standards to be part of Public Works and Parks contract specifications
 - Update ordinance to make the standards enforceable
- Educate others of the importance of trees, along with the current condition and goals for City of Reedsburg’ urban forest
 - Make sure the importance of the role other city departments have in maintenance and development of the City’s Urban Forest is made clear.
- On a regular basis, update 2014 inventory to insure maintenance records are kept current

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
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- 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 City is purchasing planting stock)
 - Strengthen Developers agreements to reflect the City’s management plan where they are utilized

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
- City Board sign an annual Arbor Day proclamation and host an Arbor Day program, presentation or award
- Communicate the importance of tree care to City departments, construction contractors and residents
- Maintain Tree City U. S. A. status

V. CURRENT SITUATION

A. Ordinances

Current ordinance language with respect to care and protection of public trees covers a variety of management activities and is currently located throughout various chapters. See below:

2.03 Parks and Recreation Committee

This chapter assigns responsibility of governing city forestry functions to the Parks and Recreation Committee.

8.09 Trees

Purpose is to promote and protect the public, health, safety, and general welfare by providing for the regulation of the planting, maintenance, and removal of trees, shrubs, and other plants within public areas of the City of Reedsburg.

8.09(02) Administration

The Parks and Recreation Committee governs the City’s Forestry Program. They appoint the Parks Director and Public Works Director to oversee all forestry functions of the City. This chapter also provides full power over all public trees, plants, and shrubs; and to trees, plants, and shrubs on private property that constitute a public hazard.

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8.09(03) Planting, Maintenance and Removal

Requires approval from the Parks Director or Public Works Director before a person shall perform any tree work within public areas of the City. Designates the planting space of trees within public areas and prohibits the planting of non-desirable tree species as listed by the Parks and Rec Committee.

8.09(04) Landscaping

The Plan Commission is to review landscaping plans and possibly require the planting of street trees in newly developed subdivisions and commercial property.

8.09(05) Injury

Prohibits the injury to any tree in a public space by any person. Pruning is permitted, but proper pruning techniques must be followed as set forth in the most recent version of the ANSI-A300 standards. Requires approval from the Parks Director or Director of Public works before tapping trees for maple syrup.

8.09(06) Advertisements

Prohibits the attachment of any sign, notice, or advertisement to trees in public spaces.

8.09(07) Dangerous Trees

Permits the Utility to prune any tree that impedes or interferes with traffic or travel or obstructs any street lamp or fire alarm wires. Permits the Utility or tree owner to remove a tree limb that has become likely to fall on or across any public space.

8.09(08) Wires

Prohibits the attachment of any wire or rope to any tree without the permission of the Park Committee. Requires the any poles or wires be kept away from trees and shrubs as possible and that such trees and shrubs should be properly trimmed to avoid damage from contact of trees, poles, and wires.

8.09(09) Tree Banks to be Kept Clear of Man-Made Objects

Prohibits the placement of any man-made objects on tree banks within the City, with the exception of utilities, traffic signs and installations provided by governmental services.

8.09(10) Removal of Trees

Requires any infected, infested, or dangerous tree found in the City on private property to be removed within 30 days of identification.

8.09(11) Penalty

Subjects anyone who violates any provision of **Sec. 8.09** to a penalty provided in **Sec. 25.04**.

10.03(11) Box Elder Trees

Identifies Box Elder Trees infected with box elder bugs as a public nuisance affecting health.

10.05(04) Obstruction of Intersections

Identifies trees that obstruct clear views of traffic as a public nuisance affecting peace and safety.

10.05(05) Tree Limbs

Identifies tree limbs pruned to 7 feet high instead of 9 feet high as a public nuisance affecting peace and safety.

10.05(06) Dangerous Trees

Identifies trees that are a menace to public safety or the cause of substantial annoyance as a public nuisance affecting peace and safety.

10.06 Dutch Elm Disease and Elm Bark Beetles Declared Public Nuisances

Identifies Dutch Elm Disease and Elm Bark Beetles as a public nuisance. Outlines a management plan to control and prevent the spread of such disease and insect pests. Identifies the Board of Public Works to carry out the provisions of this ordinance. Spells out penalties for non-compliance.

17.32(7)J General Restrictions-Landscaping

Requires developments in the Reedsburg Business Center to have street tree plantings spaced 50 feet apart, screened plantings along property lines that abut residential properties, and a minimum 5% landscaped cover for parking lots serving 20 or more vehicles.

17.37(3) Height Limitation Zones

Restricts the height of trees in the vicinity of the Reedsburg Airport.

Ordinance Recommendations

- It is recommended that a public tree ordinance be drafted that pulls all the existing provisions into one chapter. It needs to be comprehensive and should primarily cover the planting and removal of trees within public rights-of-way. It should also contain provisions governing maintenance or removal of private trees which pose a hazard to the traveling public. Once a tree ordinance is enacted, many of the existing sections can be repealed. Below is a sample table of contents.

CHAPTER XX – URBAN FORESTRY

XX.20 Purpose and Intent

XX.21 Definitions

XX.22 Tree Advisory Board

XX.23 Nuisance Trees Prohibited

XX.24 Standards and Specifications

XX.25 Public Nuisances, Declaration and Abatement

XX.26 Planting, Maintenance and Removal of Public Trees and Shrubs

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For the City of Reedsburg, WI**

By: Wachtel Tree Science (262)538-1900 (October, 2014)

- XX.27 Tree Protection During Construction
- XX.28 Private Tree Maintenance
- XX.29 Penalty
- XX.30 Appeals

This chapter would be the overarching section in the Reedsburg Municipal Code that establishes policies, regulations and standards necessary to insure that the community will continue to realize the benefits provided by its urban forest.

- Include in the nuisance section, provisions for oak wilt (*Ceratocystis fagacearum*), Asian Longhorned beetle (*Anoplophora glabripennis*) and Emerald ash borer (*Agrilus planipennis*).
- Creation of a Public Tree Care Manual. A good example for the Village of Howard (Arboricultural Specifications Manual) can be found at the following website:
<http://www.villageofhoward.com/cm/pdfs/recreation/Arb%20Specs%202011.pdf>
- **Appendix H** is intended to provide resource information regarding sample Tree Protection Provisions.

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 City Forester or a board is done more quickly and doesn't involve the politics of changing the City Code. Another advantage to separate standards and specifications is that exceptions can be authorized by the City Forester whereas ordinances tend to 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 City of Reedsburg's trees will receive the protection and consideration they warrant.

B. Tree Administration

The responsibility for all public trees lies with the Reedsburg Parks and Recreation Committee and is delegated to the Parks Director and Public Works Director. This management plan should help establish priorities and commitment in the City 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/public property trees.

The City is not large enough to justify a full time urban forester position. However, the

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City could consider plans to create at least a 1/2 time City 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 City 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 City'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 City Administrator and the Common Council to help in moving the urban forestry program forward with an overall focus on the goals and objectives.

By and large, the Department seems to be understaffed for managing the current tree population. If new tree planting continues to expand and as the existing population matures, additional staff or more outside contracting will be needed to meet the demand. Current arboricultural skill levels are average to below average within the 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.

In the past, the Department has spent approximately \$10,000-\$12,000 on trimming and removal activities. An average of 10-15 trees per year have been planted with a budget of about \$5000. No data was provided for contracting, equipment rental and supplies. The average hourly rate (incl. fringe benefits) for employees performing tree work is \$25 per hour. There will need to be a considerable increase in budget to achieve the \$59,148 figure (both Streets and Parks) that is used as the starting point for the "Estimated Costs for a Five Year Urban Forest Implementation Schedule". This may seem significant but it is necessary. The current state of the urban forest is a direct result of under-management activities in the past. If the City is to take the threat of EAB seriously it will need to jumpstart a new forestry management initiative. More aggressive management activities include addressing immediate hazards, implementing a larger planting routine, and implementing regular maintenance of all publicly owned trees. With a current net valuation over \$4.2 million dollars, your urban forest is worth the investment.

Currently the Department is moderately stocked with forestry equipment such as chainsaws, various assorted small equipment, and various large loading equipment. It is positive to see the City has put a high priority on the safety of their work crews by supplying a wide variety of PPE. We recommend that more equipment be purchased to supply work crews for broad scale forestry operations. These include but are not limited to: hand saws, hand pruners, pole saws and pruners, planting equipment, a variety of differently sized chainsaws for different applications, tree rigging equipment. Also

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consider the purchase of larger equipment such as a chip truck that could be paired with the chipper the city already has. This large equipment requires more investment from the city but allows tree care operations to be completed more efficiently.

The Department might want to consider renting a stump grinder once or twice per year. Not only could this unit be used for grinding stumps that are generated from tree removal operations, but it is an excellent piece of equipment to dig planting holes for new tree planting. A soil auger has the potential to glaze the sides of the planting hole, making it difficult for new tree roots to penetrate into undisturbed soil areas beyond the planting hole. This increases the establishment period for newly planted tree.

By utilizing the evolving GIS tree inventory, the Department should attempt to establish a rotational pruning cycle within the City. The goal would be to set up a tree pruning cycle based on an 8-10 year rotation.

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. It is good to see that part time seasonal help is hired annually to handle some of the operations (like mowing, mulching and watering). This can free up crew hours for tree work. 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 City budgets.

One goal that should be relatively easy 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:

<http://www.villageofhoward.com/cm/pdfs/recreation/Arb%20Specs%202011.pdf>

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 generated by City crews are utilized as mulch by City residents.

C. Inventory Summary – All Public Trees (Non-Ash)

While the distribution of age and size classes is not ideal, it is fairly typical of smaller sized communities having a minimal growth phase in new housing stock in the last decade. Also, until recently, there has not been a strong commitment towards maintaining the public tree population. This is confirmed by the lower condition rating of many of the larger diameter trees.

A large number (71.5%) of trees fall into the lower condition classes, below 70%. Most

of these lower rated trees fall in the 60 to 69% condition class and are heaviest in the larger diameter classes (13"+). This indicates that overall the City's public trees are in poor to fair condition. Current maintenance practices have not been keeping up with most of the pruning needs of this medium to older aged urban forest.

The most immediate work that needs to be performed includes tree removals (154), safety pruning (542) which is primarily deadwood, and crown raising for clearance (207). By focusing on these areas of work first, the City will be using the most cost effective approach. Training pruning (660) young trees (1 - 8" diameter) and routine pruning (1079) should be able to establish a 8 to 10 year rotational pruning program. Also, a yearly street tree planting program should target planting at least 25 trees per year. This will ensure new trees are being planted to expand the street tree population in selected areas and to replace those that are lost. Establishing a species list and planting plan and planting policy will also help to save a lot of mistakes by getting better species planted. More species diversity is strongly encouraged.

Currently the genera *Acer* (Maples and Boxelder) and *Gleditsia* (Honeylocust) make up 79% of the non-ash street tree population. This is way beyond the acceptable range. It is important to reduce this percentage over time by making sure no additional plantings or at the very most, limited plantings from these groupings occur. Better species selection has been implemented and needs to continue.

Non-ash species diversity is also poor within the park sites. *Acer* (Maples and Boxelder) account for 33% of the species mix. *Gleditsia* (Honeylocusts) and *Quercus* (Oaks) add another 26% to the total.

Plant species that are not currently represented in the inventory but have unique attributes and necessary hardiness could include: Swamp White x Bur Oak hybrid, several varieties of disease resistant Elm hybrids, Bitternut Hickory, Ohio Buckeye, Baldcypress, Ironwood, Amur Corktree, and Serbian Spruce. Parks and other public open spaces are wonderful areas where new introductions of trees can be planted and observed for several years to make sure their growth and feature characteristics meet the criteria for possible future street tree plantings.

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), clearance pruning (for streets) and safety pruning. Included early on were the beginning of a training pruning program, starting a routine pruning program on a limited basis, watering newly planted trees and addressing the priority bolt and prune trees. A new street tree planting program targeting planting at least 25 trees per year should begin in 2015. It is also recommended that an expanded park tree planting program be initiated in

2015 addressing species diversity. Training pruning needs to be ramped up in 2015 as an important means of directing future growth and reducing costs for the City'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 given the limited funding for tree maintenance activities. **Table 3**, "Estimated Costs for a Five Year Urban Forest Implementation Schedule" 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 3** are made with the assumptions that work will be performed by City crews with an average cost of \$25.00 per hour (including payroll taxes and benefits) for full-time staff and \$10.50 per hour for seasonal personnel. 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 3.5 times higher than the hourly rate used in the illustrations. Costs have been separated between street tree maintenance and park tree maintenance. Actual costs could vary and no factor for inflation has been included.

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

Estimated costs for each activity			2015		2016		2017		2018		2019		Five Year Cost
Activity	Diameter Class	Cost/Tree (\$)	# of trees	Total Cost									
TREE REMOVALS	1-5"	26.50	27	715.50									
	6-10"	51.00	47	2397.00									
	11-15"	97.00	35	3395.00									
	16-20"	173.00	14	2422.00									
	21"+	302.00	17	5134.00									
Activity Totals			140	14063.50	(M)	3000.00	(M)	3000.00	(M)	3000.00	(M)	3000.00	26063.50
PRIORITY PRUNING (SAFETY, CLEARANCE, DEADWOOD)	1-5"	10.00	17	170.00	5	50.00							
	6-10"	31.50	53	1669.50	44	1386.00							
	11-15"	51.00	54	2754.00	129	6579.00							
	16-20"	77.00	27	2079.00	132	10164.00							
	21"+	109.00	119	12971.00	108	11772.00							
Activity Totals			270	19643.50	418	29951.00	(M)	2500.00	(M)	2500.00	(M)	2500.00	57094.50
TRAINING PRUNING	1-5"	17.00	0	0.00	79	1343.00	79	1343.00	80	1360.00	80	1360.00	
	6-10"	36.00	41	1476.00	145	5220.00	45	1620.00	45	1620.00	45	1620.00	
	11-15"	63.00											
Activity Totals			41	1476.00	224	6563.00	124	2963.00	125	2980.00	125	2980.00	16962.00
ROUTINE PRUNING (MAINTENANCE)	6-10"	46.00	0	0.00	0	0.00	73	3358.00	73	3358.00	73	3358.00	
	11-15"	75.00	0	0.00	0	0.00	120	9000.00	121	9075.00	121	9075.00	
	16-20"	117.00	0	0.00	0	0.00	73	8541.00	72	8424.00	72	8424.00	
	21"+	165.00	0	0.00	0	0.00	46	7590.00	47	7755.00	47	7755.00	
Activity Totals			0	0.00	0	0.00	312	28489.00	313	28612.00	313	28612.00	85713.00
TREE PLANTING	Site Prep	13.00	25	325.00	25	325.00	25	325.00	25	325.00	25	325.00	
	Tree Cost	110.00	25	2750.00	25	2750.00	25	2750.00	25	2750.00	25	2750.00	
	Planting	44.00	25	1100.00	25	1100.00	25	1100.00	25	1100.00	25	1100.00	
Activity Totals			25	4175.00	20875.00								
OTHER MAINTENANCE	Stake Removal	6.50	0	0.00	25	162.50	25	162.50	25	162.50	25	162.50	
	Watering (3x)	17.50	50	875.00	50	875.00	50	875.00	50	875.00	50	875.00	
	Mulching	9.00	25	225.00	25	225.00	25	225.00	25	225.00	25	225.00	
	Watch	6.50									40	260.00	
	Stump Removal	3.00/inch	1671"	5013.00	(M)	1000.00	(M)	1000.00	(M)	1000.00	(M)	1000.00	
	Cable&Prune	150	0	0.00	13	1950.00	(M)	500.00	(M)	500.00	(M)	500.00	
Girdling Root	115	0	0.00	5	575.00	190	21850.00	196	22540.00	196	22540.00		
Activity Totals				6113.00		4787.50		24612.50		25302.50		25562.50	86378.00
Totals per Year				45471.00		48476.50		65739.50		66569.50		66829.50	293086.00

(M) = REGULAR MAINTENANCE ITEM REOCCURRING YEARLY OR ON A CYCLE

In House cost based on \$25.00 per hour

**Estimated Costs for a Five Year Urban Forest Implementation Schedule
(Table 4) Park Trees (Non-Ash) – In House**

Estimated costs for each activity			2015		2016		2017		2018		2019		Five Year Cost
Activity	Diameter Class	Cost/Tree (\$)	# of trees	Total Cost									
TREE REMOVALS	1-5"	26.50	4	106.00									
	6-10"	51.00	3	153.00									
	11-15"	97.00	2	194.00									
	16-20"	173.00	1	173.00									
	21"+	302.00	4	1208.00									
Activity Totals			14	1834.00	(M)	8000.00	(M)	8000.00	(M)	8000.00	(M)	8000.00	13834.00
PRIORITY PRUNING (SAFETY, CLEARANCE, DEADWOOD)	1-5"	10.00	0	0.00									
	6-10"	31.50	1	31.50									
	11-15"	51.00	14	714.00									
	16-20"	77.00	9	693.00									
	21"+	109.00	47	5123.00									
Activity Totals			71	6561.50	(M)	2500.00	(M)	2500.00	(M)	2500.00	(M)	2500.00	16561.50
TRAINING PRUNING	1-5"	17.00	0	0.00	50	850.00	10	170.00	25	425.00	25	425.00	
	6-10"	36.00	0	0.00	9	324.00	3	108.00	0	0.00	0	0.00	
	11-15"	63.00											
Activity Totals			0	0.00	59	1174.00	13	278.00	25	425.00	25	425.00	2302.00
ROUTINE PRUNING (MAINTENANCE)	6-10"	46.00	0	0.00	0	0.00	0	0.00	0	0.00	30	1380.00	
	11-15"	75.00	0	0.00	0	0.00	0	0.00	20	1500.00	11	825.00	
	16-20"	117.00	0	0.00	0	0.00	10	1170.00	6	702.00	2	234.00	
	21"+	165.00	0	0.00	5	825.00	7	1155.00	3	495.00	0	0.00	
Activity Totals			0	0.00	5	825.00	17	2325.00	29	2697.00	43	2439.00	8286.00
TREE PLANTING	Site Prep	13.00	25	325.00	25	325.00	25	325.00	25	325.00	25	325.00	
	Tree Cost	110.00	25	2750.00	25	2750.00	25	2750.00	25	2750.00	25	2750.00	
	Planting	44.00	25	1100.00	25	1100.00	25	1100.00	25	1100.00	25	1100.00	
Activity Totals			25	4175.00	20875.00								
OTHER MAINTENANCE	Stake Removal	6.50	1	6.50	25	162.50	25	162.50	25	162.50	25	162.50	
	Watering (3x)	17.50	50	875.00	50	875.00	50	875.00	50	875.00	50	875.00	
	Mulching	9.00	25	225.00	25	225.00	25	225.00	25	225.00	25	225.00	
	Watch	6.50									34	221.00	
	Stump Removal	3.00/inch	0	0.00	70	210.00	(M)	750.00	(M)	750.00	(M)	750.00	
	Cable&Prune	150	0	0.00	1	150.00	(M)	500.00	(M)	500.00	(M)	500.00	
Girdling Root	115	0	0.00	0	0.00	5	575.00	6	690.00	7	805.00		
				1106.50		1622.50		3087.50		3202.50		3538.50	12557.50
Totals per Year				13677.00		13296.50		15365.50		15999.50		16077.50	74416.00

(M) = REGULAR MAINTENANCE ITEM REOCCURRING YEARLY OR ON A CYCLE

In House cost based on \$25.00 per hour

C. Summary

The data projected in **Tables 3 and 4** was extrapolated directly from the database created from the public tree inventory that was conducted during the summer of 2014. It provides a starting point for City 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 projections for the first five year period of the Implementation Schedule for all public trees averages about \$73,500 per year over the projected five years. Based on the 2014 estimate of \$10,000-\$12,000 for trimming and removal activities and the starting budget of \$59,148 there would be a \$47,148 budget shortfall in 2015. This will progressively become much greater over the succeeding four years. With an average annual projected cost of \$73,500 for the five year period, it is apparent that instituting a more aggressive public tree program will have a substantial impact on the current funding level. This is further exacerbated by the financial strain that Emerald Ash Borer management will be putting on the City. It is strongly recommended that the City of Reedsburg also strive 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 1,200 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 through fund-raising events in conjunction with the business community or possibly homeowners paying for the wholesale cost of the tree and the City 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 3, 4 and 5 are when most routine pruning would expand in activity level.

D. Implementation Detail (Street Trees)

Tree and Stump Removal (see **Table 3**)

The first year of budgeting will take care of the tree removals that were determined from the inventory (total of 140 trees, \$14,063.50; 1,671 inches of stumps, \$5,013.00). After 2015 this activity becomes a regular maintenance item with \$3,000.00 budgeted annually for tree removal and \$1,000.00 for stump removal. Since some time has evolved 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.

Safety and Clearance Pruning (see **Table 3**)

Safety Pruning (deadwood, broken limbs hanging in trees and clearance issues) involves 270 trees in 2015 and 418 trees in 2016. 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.

Of the 678 trees designated as needing *Safety Pruning*, 160 are in need some form of clearance pruning. 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.

Training Pruning (see Table 3)

The corrective *Training Pruning* is spread out over the five year rotational pruning schedule. Beginning in 2017 and continuing into 2018 the number of trees needing training pruning will level out to a more constant total. Some trees because of diameter increase will move into the routine prune category, while others because of their species or habit of growth may be able to be skipped for a rotation. This category involves 588 trees, all in the 1 - 8 inch diameter categories. It holds the second largest number of trees of any of the maintenance categories. As new trees are planted, they will need to be added to the *Training Pruning* rotation.

Young trees should be pruned every two to three years for the first 10 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 chain saw at age 30 is obvious. This can greatly reduce future pruning expense and reduce tree decay along with stress.

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. As the trees grow older, this category will become more important.

Due to budget constraints, routine pruning has been held off until 2017. As the priority problems are taken care of (by the end of 2016), more money is then budgeted to this category. 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 beginning in 2017. In 15 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! The same applies to trees; maintenance prevents problems, extends life and reduces costs.

Tree Planting (see Table 3)

An annual planting program by the city should be implemented in 2015 with the planting of a minimum (25) 2.0" caliper balled and burlaped trees. This number should be maintained at this level or greater based on the number of vacant terrace planting sites (1187) 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 City uses outside contractors for planting, a primary focus should be to establish planting and aftercare specifications (see **Appendix J - Tree Planting Standards**, p. 3-5) that will be adhered to by all private contractors planting in the public right-of-way. 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 (2016 or 2017). Don't use conifers for street side planting, scale way back or eliminate *Acer* (Maple genus), scale back *Tilia* (Basswood/Linden genus), scale back *Gleditsia* (Honeylocust genus), eliminate *Fraxinus* (Ash genus) 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 City's current tree planting program involving residents is a great way to maintain yearly planting goals. It is recommended though that a higher price be requested of residents for the trees and that the City takes over tree planting. This will ensure greater quality control over how the trees are planted. It is also recommended that the available tree list be expanded.

The planting that does take place should only be trees from the list of Recommended Species (**Appendix C**). 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. During the inventory data collection process, numerous younger trees were observed that had poor structure, primarily double leaders with included bark. It was obvious that this was a problem at the nursery that was not corrected before trees were prepared for sale. The City should expect to receive quality nursery stock from its suppliers that do not exhibit poor structural problems. By using quality nursery stock, the City 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).

Tree Stake Removal (see Table 3)

The inventory detected (0) 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. The year stakes are to be removed is identified in the inventory database. 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 2016, hours are budgeted to remove stakes systematically from trees that were planted two years previous.

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 City substantial man-hours that can be redirected towards other tree maintenance activities including new park/public 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 off on the right foot and reduces their chances of succumbing to insects, diseases or environmental stresses in the future. Minimal dollars have been budgeted to provide three visits to visibly stressed 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.

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 J**, mulching for planting). This work needs to be ongoing project of the department. Maintenance funds need to be budgeted every year beginning in 2014 to maintain the mulch at a two to three inch thickness. This mulch can be wood chips from City 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.

Watch (see Table 3)

There is also a projected budget amount that includes *Watch* trees as identified in the inventory. These trees should be inspected in 2018 (40 trees); 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.

Cable and Prune (see Table 3)

A total of 13 trees were identified as needing cable and pruning. These trees are budgeted for work being performed in 2016. This category will need regular funding beginning in 2017, with \$500.00 being budgeted every year to stay ahead of future problems. There are 2,474 public (non-Ash) trees ranging from 0.5" to 56" dbh that under *Special Conditions* have codominant trunk/stems and/or included bark. These trees are potential candidates for future cabling and the larger diameter trees should be inspected periodically for structural safety issues. Training pruning on the smaller diameter trees should alleviate many of the codominant issues with these younger trees.

Girdling Roots (see Table 3)

At present, there were 587 identified trees with girdling roots. Again, because of budget constraints this work will not be started until 2016. The bulk of the girdling root issues will begin being addressed in 2017. Girdling root 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 1,245 Norway Maples (41.6% of the non-Ash population) this may become a problem over time. Instead of the trees living 80+ years, they may only live 30 - 40 years. This will increase removal and planting budgets. With the use of an air spade, 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. Better species selection for new plantings is the long term answer. As the existing Norway Maple population matures, beginning in 2020 and every year thereafter, \$500.00 is budgeted for inspection and removal of identified girdling roots.

E. Implementation Detail (Park Trees)

Tree and Stump Removal (see Table 4)

The first year of budgeting will take care of the tree removals that were determined from the inventory (total of 14 trees, \$1,834.00). The identified stumps will be removed in 2016 (70 inches, \$210.00). After 2016 this activity becomes a regular maintenance item with \$3,000.00 budgeted annually for tree removal and \$1,000.00 for stump removal. Since some time has evolved 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.

Safety and Clearance Pruning (see Table 4)

Safety Pruning (deadwood and broken limbs hanging in trees) involves 71 trees in 2015. 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.

Training Pruning (see Table 4)

The corrective *Training Pruning* will be completed in the second and third year. Beginning in 2018 and continuing into 2019 the number of trees needing training pruning will level out to a more constant total. Some trees because of diameter increase will move into the routine prune

category, while others because of their species or habit of growth may be able to be skipped for a rotation. This category involves 72 trees, all in the 1 - 8 inch diameter categories. It holds the third largest number of trees of any of the maintenance categories. As new trees are planted, they will need to be added to the *Training Pruning* rotation.

Routine Tree Pruning (see Table 4)

Minimal routine pruning will begin in 2016. As the priority problems are taken care of more money is then budgeted to this category. The number of trees requiring *Routine Pruning* increases annually beginning in 2017. In 15 years the number of trees requiring routine pruning could double and will increase even more over time as the trees mature.

Tree Planting (see Table 4)

An annual planting program by the city should be implemented in 2015 with the planting of a minimum (25) 2.0" caliper balled and burlaped trees. This number should be maintained at this level or greater to continue introducing new tree species into the park tree population.

Better quality (single leader) planting stock should be specified and required when ordering nursery stock. During the inventory data collection process, numerous younger trees were observed that had poor structure, primarily double leaders with included bark. It was obvious that this was a problem at the nursery that was not corrected before trees were prepared for sale. The City should expect to receive quality nursery stock from its suppliers that do not exhibit poor structural problems. By using quality nursery stock, the City 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).

Tree Stake Removal (see Table 4)

The inventory detected (1) site where tree stakes were still in place supporting younger trees. These stakes should be removed in 2015. Tree stakes should not be left on for more than two growing seasons. Beginning in 2016, hours are budgeted to remove stakes systematically from trees that were planted two years previous.

Young Tree Watering (see Table 4)

A most critical phase of new tree establishment is young 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 off on the right foot and reduces their chances of succumbing to insects, diseases or environmental stresses in the future. Minimal dollars have been budgeted to provide three visits to visibly stressed 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.

Mulching (see Table 4)

Creating mulched beds around park 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. Maintenance funds need to be budgeted every year beginning in 2015 to maintain the mulch at a two to three inch thickness. This mulch can be wood chips from City tree care operations (free) or shredded hardwood mulch (will stay in place better, last longer and look nicer, but must be purchased).

Educating seasonal employees on the importance of protecting trees is vital. Numerous instances were observed when conducting the park tree portion of the inventory field work where basal damage had occurred as the result of mower or string trimmer damage.

Watch (see Table 4)

There is also a projected budget amount that includes *Watch* trees as identified in the inventory. These trees should be inspected in 2019 (34 trees); 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.

Cable and Prune (see Table 4)

1 tree was identified as needing cable and pruning. These trees are budgeted for work being performed in 2016. This category will need regular funding beginning in 2017, with \$500.00 being budgeted every year to stay ahead of future problems. There are 203 parks (non-Ash) trees ranging from 1” to 53” dbh that under *Special Conditions* have codominant trunk/stems and/or included bark. These trees are potential candidates for future cabling and the larger diameter trees should be inspected periodically for structural safety issues. Training pruning on the smaller diameter trees should alleviate many of the codominant issues with these younger trees.

Girdling Roots (see Table 4)

At present, there were 19 identified trees with girdling roots. Because of budget constraints, this work will not be started until 2017. Each year will see a larger budget needed for this work. Beginning in 2020, this maintenance work will require a regular annual budget to handle any future problems.

F. City of Reedsburg Downtown Planting Plan

For the purposes of this plan the Downtown area is defined as E. Main Street from the Baraboo River Bridge East to Locust Street along with Webb Avenue, Walnut Street, Park Street, and Locust Street one block North and South of E. Main Street.

46 records were inventoried in this area. They consist of existing trees, stumps, and vacant planting sites. Growth spaces are either terraces greater than 5 feet in width or boxout street planters set into the sidewalk. Trees growing in terraces were in relatively good shape and should be routinely pruned to remove immediate hazards and to maintain the health of the tree. The boxout plantings were vacant, stumps from recent removals, or trees in relatively poor shape.

Downtown boxout plantings tend to be harsh growing environments. Drainage is poor, temperatures are extreme, damage is a constant threat in high traffic areas (both foot and

vehicular), and salt tends to accumulate during the winter months. Hardy trees that are tolerant of these conditions should be selected (See **Table 5.**). Upright forms are favored over spreading forms due to close proximity of roads, sidewalks, and traffic. The boxout plantings should be filled with high-nutrient amended soils and expanded as much as space will allow.

Trees should be planted with the root flare at ground level. If the tree is unstable in the new planting, stakes can be used for no longer than 1 year. Maintain optimal soil moisture by manually inspecting the planting site once a week. Dig your fingers into the soil and check the consistency. The soil should have a cool moist feel. If it is dry and crumbly, more frequent watering is need. If the soil is very wet and mushy avoid watering. If this continues, cut back on the watering and inspect for possible drainage issues.

Trees should be pruned to allow for adequate travel on the road and sidewalk. Only minimal pruning for the first 2 to 3 years is allowed while the tree establishes itself. All large deadwood in established downtown trees should be removed to prevent hazards.

Even with proper care these trees will only be around short term, 10-15 years. By selecting small to medium stature trees, removal costs are kept lower. Even though the trees are around for a short time period, high importance should be placed on keeping the sites filled and the trees within them looking beautiful. Many visitors to a City spend the majority of their time in the central marketplace and a well-kept appearance is a positive impression to be left with.

Table 5. Downtown tree planting list

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<i>Acer miyabei</i>	State Street Miyabei Maple	Morton
<i>Ginkgo biloba</i>	Ginkgo (Male only)	Magyar
<i>Gleditsia triacanthos</i>	Honeylocust	Impcole “Imperial”
<i>Pyrus calleryana</i>	Callery Pear	Cleveland Select
<i>Malus</i>	Crabapple	Adirondack, Cinzam, Lamzam, Red Baron
<i>Tilia x Redmond</i>	Redmond Linden	
<i>Tilia cordata</i>	Greenspire Linden	Greenspire
<i>Tilia cordata</i>	Chancellor Linden	Chancole

G. Webb and Nishan Park Plans

Nishan Park is located in the North Central part of the city. It is a highly used recreation area with playgrounds and multiple sports fields. A new war memorial has been constructed in the Southwest corner of the park. Currently this park is stocked with 123 trees. Most trees are located along borders lining streets, parking lots, service roads, and sports fields.

It was observed that many of the new plantings in the park were in poor condition. Proper care and maintenance of a new planting within the first few years is critical to a tree’s survival. See **Appendix J** for proper planting recommendations. It is recommended that future plantings

continue along field borders to increase the beauty of the park. These ‘tree borders’ can help to isolate activities in one area of the park from others.

Nishan park is an ideal spot to target Ash trees for treatment. Many of the trees in this park are Ash trees that border the streets and parking lots. With proper care these trees can be retained to preserve the beauty of this park.

Webb Park is located Northwest of the downtown area. It is currently stocked with 73 trees. Mature trees with large deadwood are prevalent in this park. The first priority of the City should be to address removing large deadwood in trees that pose a risk to public safety. Other mitigation options include cabling trees with co-dominant stems and removing large trees in very poor condition.

It was noticed that the majority of the Ash trees along Webb Avenue adjacent to the park were experiencing stress and decline. It was also observed that some of the Ash trees in Webb Park were beginning to show signs of stress. There was not enough evidence to positively identify Emerald Ash Borer at the time of the inventory. Even though EAB was not identified, these trees should be targeted for removal and replacement. Ash trees in stress and decline are favored by the beetle and this park could become ground zero of an infestation.

There is a lot of room in this park for future plantings. Not only will Ash removals create new space for plantings, there already exists many locations for immediate plantings. Wide open spaces available for multiple recreational activities can be preserved by focusing plantings along the edges of the park. Reference **Appendix C** for favorable tree species.

H. Disease & Insect Problems

Dutch Elm Disease

There are (74) American Elms in the entire inventory for the City. These trees range in size from 1” to 44” dbh. Fortunately this is a small percentage of the overall public tree population. 1 tree in Webb Park was noticed to be suffering from Dutch Elm Disease. 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 City has been planting several varieties of disease resistant hybrid elms. This is a great way to keep the *Ulmus* genus part of the species diversity mix.

Oak Wilt

There was no active oak wilt detected in either the street or park/municipal property 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: (35) Red Oak, (2) White Oak, (19) Bur Oak, (8) Pin Oak, (2) Chinkapin Oak, and (1) Swamp White Oak. The Oak family accounts for 1.6% of all the public trees that were inventoried in the City. This total is far below

the threshold of 10% for any one genus in the overall public tree population. Planting of trees in the *Quercus* genus such as the Swamp White x Bur Oak hybrid should be considered for future plantings.

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).

Gypsy Moth

Gypsy moth was first found near Reedsburg in Mirror Lake State Park in 2008. Gypsy moth populations were on the rise in the surrounding areas during the outbreak of the following two years. Intensive spraying programs were applied to suppress increasing gypsy moth populations. There has been no DNR-organized aerial spraying in the City of Reedsburg since the DNR gypsy moth suppression program began in 2000.

Emerald Ash Borer

An Emerald Ash Borer Plan Update was prepared for the City by Wachtel Tree Science in September 2014. This document provides a detailed work plan for City staff to follow as they manage their ash tree population with regards to EAB.

The Emerald Ash Borer (EAB) is an exotic woodborer 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 Colorado, Connecticut, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin and Quebec and Ontario 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, 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.

Because EAB has been found near Reedsburg and the high potential for EAB to become established here, it is recommended that the City place a minimum 5-year moratorium on the planting of new ash trees until the full ramifications of this insect are known.

It is unlikely that there is a one-size-fits-all strategy for managing an infestation of EAB. The best response to an infestation must take into account the unique circumstances surrounding the infestation. Management recommendations involve a number of control options including:

- Mechanical controls, such as removing symptomatic or asymptomatic trees
- Chemical controls, such as using pesticides in specific circumstances

- Biological controls, such as using parasitoids or other natural enemies
- Silvicultural controls, such as reducing the number of target trees and replanting diverse, non-target trees
- Regulatory and Behavioral controls, such as enacting quarantines and enforcing regulations regarding firewood movement

An excellent resource management tool for estimating the economic impact that EAB will have on public Ash populations is the “**Emerald Ash Borer Cost Calculator**”. It was developed by Extension Entomology at Purdue University. The software is free to use and can be accessed at: <http://extension.entm.purdue.edu/treecomputer/inc>

What follows is an overview of what the cost calculator can provide in helping tree managers determine the best option/options for managing EAB in their particular community.

Forest managers have 3 options available for managing emerald ash borer:

- Treat ash trees with insecticides
- Remove ash trees
- Remove ash trees and replace them with resistant trees

The particular combination of these options that is best for any forest depends on the number and size of your ash trees as well as the size of your management budget.

Use this calculator to:

- Compare the annual and cumulative costs over a 25 year period for ANY management strategy that includes a mixture of tree removal, replacement, and insecticide treatment.
- Compare size of the forest remaining over a 25 year period for ANY management strategy that includes a mixture of tree removal, replacement, and insecticide treatment.
- Generate printed reports of projected costs of up to 3 management strategies at a time.

To run the calculator you will need:

- An inventory of the number and size of ash trees
- An estimate of costs for removing and treating trees based on the size of each tree.
- An estimate of costs for replacing each ash tree that is removed.

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”

Other Pest Problems (by 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.

I. Crew Training

Customized training workshops should be considered to improve the knowledge and confidence of City personnel responsible for maintaining the public trees. Workshops could be planned for tree biology and pruning techniques, plus chain saw safety, personal protective equipment and felling techniques. Funding for these workshops could be included in DNR Urban Forestry Grants.

Additionally, some general fund money should be included each year for continued training. 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 City of Reedsburg's 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 City departments understand importance of trees
- revenue generating opportunities

Resource Needs:

- street tree removals
- safety and clearance pruning
- training pruning
- 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 r-o-w 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 City 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 Common Council should be informed of these accomplishments. A major review and updating should take place in **2019** by an outside urban forestry consulting firm.

X. CONCLUSION

The City of Reedsburg 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 just making the City of Reedsburg a more beautiful community to visit, work and live in.

APPENDIX A

CITY OF REEDSBURG – SPECIES LIST STREETS and PARKS/MUNICIPAL PROPERTIES

Species Code	Common Name	Genus	species	Species Class
001	vacant	<i>VACANT PLANTING SITE</i>		n.a
002	stump	<i>STUMP</i>		n.a.
015	White Fir	<i>Abies</i>	<i>concolor</i>	80
068	Eastern Redcedar	<i>Juniperus</i>	<i>virginiana</i>	70
091	Norway Spruce	<i>Picea</i>	<i>abies</i>	70
094	White Spruce	<i>Picea</i>	<i>glauca</i>	70
096	Colorado Spruce	<i>Picea</i>	<i>pungens</i>	80
125	Red Pine	<i>Pinus</i>	<i>resinosa</i>	60
129	Eastern White Pine	<i>Pinus</i>	<i>strobus</i>	70
130	Scotch Pine	<i>Pinus</i>	<i>sylvestris</i>	60
136	Austrian Pine	<i>Pinus</i>	<i>nigra</i>	80
202	Douglas-Fir	<i>Pseudotsuga</i>	<i>menziesii</i>	80
241	Northern White-Cedar	<i>Thuja</i>	<i>occidentalis</i>	80
310	Maple Spp	<i>Acer</i>	<i>spp.</i>	70
311	Amur Maple	<i>Acer</i>	<i>ginnala</i>	90
312	Tartian Maple	<i>Acer</i>	<i>tartarica</i>	80
313	Boxelder	<i>Acer</i>	<i>negundo</i>	10
315	Freeman Maple	<i>Acer</i>	<i>freemanii</i>	80
316	Red Maple	<i>Acer</i>	<i>rubrum</i>	70
317	Silver Maple	<i>Acer</i>	<i>saccharinum</i>	30
318	Sugar Maple	<i>Acer</i>	<i>saccharum</i>	80
320	Norway Maple	<i>Acer</i>	<i>platanoides</i>	60
321	Norway Maple Var.	<i>Acer</i>	<i>platanoides var.</i>	70
331	Ohio Buckeye	<i>Aesculus</i>	<i>glabra</i>	60
355	European alder	<i>Alnus</i>	<i>glutinosa</i>	60
356	Serviceberry	<i>Amelanchier</i>	<i>spp.</i>	90
370	Birch Spp.	<i>Betula</i>	<i>spp.</i>	70
373	River Birch	<i>Betula</i>	<i>nigra</i>	80
407	Shagbark Hickory	<i>Carya</i>	<i>ovata</i>	60
450	Catalpa Spp.	<i>Catalpa</i>	<i>spp.</i>	40
462	Hackberry	<i>Celtis</i>	<i>occidentalis</i>	90
471	Eastern Redbud	<i>Cercis</i>	<i>canadensis</i>	70
500	Hawthorn Spp.	<i>Crataegus</i>	<i>spp.</i>	90
532	European beech var.	<i>Fagus</i>	<i>sylvatica</i>	90
541	White Ash	<i>Fraxinus</i>	<i>americana</i>	70
542	White Ash var.	<i>Fraxinus</i>	<i>americana var.</i>	80
544	Green Ash	<i>Fraxinus</i>	<i>pennsylvanica</i>	70
545	Green Ash Var.	<i>Fraxinus</i>	<i>pennsylvanica var.</i>	80

APPENDIX A

549	Ginkgo	<i>Ginkgo</i>	<i>biloba</i>	90
553	Honeylocust (Thornless)	<i>Gleditsia</i>	<i>triacanthos inermis</i>	70
554	Honeylocust var.	<i>Gleditsia</i>	<i>triacanthos var.</i>	90
602	Black Walnut	<i>Juglans</i>	<i>nigra</i>	60
660	Apple Spp.	<i>Malus</i>	<i>spp.</i>	40
661	Crab Apple Spp.	<i>Malus</i>	<i>spp.</i>	60
680	Mulberry Spp.	<i>Morus</i>	<i>spp.</i>	40
731	Sycamore	<i>Platanus</i>	<i>occidentalis</i>	60
740	Poplar spp.	<i>Populus</i>	<i>spp.</i>	30
742	Eastern Cottonwood	<i>Populus</i>	<i>deltoides</i>	40
746	Quaking Aspen	<i>Populus</i>	<i>tremuloides</i>	30
752	White Poplar	<i>Populus</i>	<i>alba</i>	30
760	Cherry and Plum Spp.	<i>Prunus</i>	<i>spp.</i>	60
762	Black Cherry	<i>Prunus</i>	<i>serotina</i>	40
781	Callery Pear Spp.	<i>Pyrus</i>	<i>calleryana</i>	80
802	White Oak	<i>Quercus</i>	<i>alba</i>	90
804	Swamp White Oak	<i>Quercus</i>	<i>bicolor</i>	90
809	Northern Pin Oak	<i>Quercus</i>	<i>ellipsoidalis</i>	70
823	Bur Oak	<i>Quercus</i>	<i>macrocarpa</i>	90
826	Chinkapin Oak	<i>Quercus</i>	<i>muehlenbergii</i>	80
830	Pin Oak	<i>Quercus</i>	<i>palustris</i>	50
833	Northern Red Oak	<i>Quercus</i>	<i>rubra</i>	80
901	Black Locust	<i>Robinia</i>	<i>psuedoacacia</i>	30
920	Willow	<i>Salix</i>	<i>spp.</i>	40
933	Mountain-Ash Spp.	<i>Sorbus</i>	<i>spp.</i>	70
940	Lilac Spp.	<i>Syringa</i>	<i>spp.</i>	70
941	Japanese Tree Lilac	<i>Syringa</i>	<i>reticulata</i>	80
951	American Basswood	<i>Tilia</i>	<i>americana</i>	70
952	Redmond Linden	<i>Tilia</i>	<i>amer 'Redmond'</i>	80
954	Littleleaf Linden	<i>Tilia</i>	<i>cordata</i>	70
955	Silver Linden	<i>Tilia</i>	<i>tomentosa</i>	80
970	Elm Spp. (Hybrid)	<i>Ulmus</i>	<i>spp.</i>	70
972	American Elm	<i>Ulmus</i>	<i>americana</i>	50
974	Siberian Elm	<i>Ulmus</i>	<i>pumila</i>	10
997	Russian-olive	<i>Elaeagnus</i>	<i>angustifolia</i>	50
999	other, unknown	<i>UNKNOWN</i>	<i>UNKOWN</i>	70

APPENDIX B

CITY OF REEDSBURG SPECIES FREQUENCY – ALL PUBLIC TREES

Genus	Common Name	Species Count	% Population
Abies	White Fir	2	0.05%
Acer	Amur Maple	26	0.60%
Acer	Boxelder	11	0.26%
Acer	Freeman Maple	140	3.25%
Acer	Maple Spp	12	0.28%
Acer	Norway Maple	993	23.03%
Acer	Norway Maple Var.	293	6.80%
Acer	Red Maple	205	4.76%
Acer	Silver Maple	475	11.02%
Acer	Sugar Maple	174	4.04%
Acer	Tartian Maple	2	0.05%
Aesculus	Ohio Buckeye	15	0.35%
Alnus	European Alder	1	0.02%
Amelanchier	Serviceberry	8	0.19%
Betula	Birch Spp.	35	0.81%
Betula	River Birch	7	0.16%
Carya	Hickory Spp.	1	0.02%
Carya	Shagbark Hickory	1	0.02%
Catalpa	Catalpa Spp.	11	0.26%
Celtis	Hackberry	23	0.53%
Cercis	Eastern Redbud	1	0.02%
Crataegus	Hawthorn Spp.	2	0.05%
Eleagnus	Russian-Olive	1	0.02%
Fagus	European Beech Var.	1	0.02%
Fraxinus	Green Ash	874	20.27%
Fraxinus	Green Ash Var.	12	0.28%
Fraxinus	White Ash	79	1.83%
Fraxinus	White Ash Var.	9	0.21%
Ginkgo	Ginkgo	3	0.07%
Gleditsia	Honeylocust (Thornless)	294	6.82%
Gleditsia	Honeylocust Var.	2	0.05%
Juglans	Black Walnut	36	0.84%
Juniperus	Eastern Redcedar	9	0.21%
Malus	Apple Spp.	5	0.12%
Malus	Crab Apple Spp.	78	1.81%
Morus	Mulberry Spp.	6	0.14%
Other	Other, Unknown	7	0.16%
Picea	Colorado Spruce	8	0.19%
Picea	Norway Spruce	3	0.07%

APPENDIX B

Picea	White Spruce	18	0.42%
Pinus	Austrian Pine	8	0.19%
Pinus	Eastern White Pine	34	0.79%
Pinus	Red Pine	1	0.02%
Pinus	Scotch Pine	1	0.02%
Platanus	Sycamore	3	0.07%
Populus	Eastern Cottonwood	5	0.12%
Populus	Poplar Spp.	1	0.02%
Populus	Quaking Aspen	3	0.07%
Populus	White Poplar	6	0.14%
Prunus	Black Cherry	7	0.16%
Prunus	Cherry and Plum Spp.	20	0.46%
Pseudotsuga	Douglas-Fir	3	0.07%
Pyrus	Callery Pear Spp.	20	0.46%
Pyrus	Pear Spp.	5	0.12%
Quercus	Bur Oak	19	0.44%
Quercus	Chinkapin Oak	2	0.05%
Quercus	Northern Pin Oak	7	0.16%
Quercus	Northern Red Oak	35	0.81%
Quercus	Pin Oak	1	0.02%
Quercus	Swamp White Oak	1	0.02%
Quercus	White Oak	2	0.05%
Robinia	Black Locust	32	0.74%
Salix	Willow	4	0.09%
Sorbus	Mountain-Ash Spp.	17	0.39%
Syringa	Japanese Tree Lilac	16	0.37%
Syringa	Lilac Spp.	5	0.12%
Thuja	Northern White-Cedar	9	0.21%
Tilia	American Basswood	38	0.88%
Tilia	Littleleaf Linden	28	0.65%
Tilia	Redmond Linden	18	0.42%
Tilia	Silver Linden	1	0.02%
Ulmus	American Elm	14	0.32%
Ulmus	Elm Spp. (Hybrid)	26	0.60%
Ulmus	Siberian Elm	36	0.84%

APPENDIX C

TREE SPECIES RECOMMENDATIONS

This list is provided as a guide to some of the most appropriate trees for urban settings in USDA Hardiness Zone **5a** for the City of Reedsburg. 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 City of Reedsburg 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.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<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 crus-galli 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.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<i>Aesculus x carnea</i>	Red Horsechestnut	'Ft. McNair'
<i>Aesculus glabra</i>	Ohio Buckeye	'Sunset'
<i>Cladrastis kentuckea</i>	American Yellowwood	
<i>Corylus colurna</i>	Turkish Filbert	
<i>Phellodendron amurense</i>	Amur Corktree (male only)	'Macho'
<i>Prunus sargentii</i>	Sargent Cherry	'Columnaris'
<i>Pyrus calleryana</i>	Callery Pear	'Autumn Blaze', 'Cleveland Select'
<i>Sorbus alnifolia</i>	Korean Mountain Ash	

APPENDIX C

Recommended Tree List (cont.)

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

<u>Scientific Name</u>	<u>Common Name</u>	<u>Cultivars</u>
<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>Cladrastis kentuckea</i>	Yellowwood	
<i>Eucommia ulmoides</i>	Hardy Rubber Tree	
<i>Gingko biloba</i>	Gingko (male only)	'Autumn Gold', 'Magyar', 'Princeton Sentry'
<i>Gleditsia triacanthos inermis</i>	Thornless Honeylocust	'Imperial', 'Shademaster', 'Skyline', 'Sunburst'
<i>Gymnocladus dioicus</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 x euchlora</i>	Crimean Linden	
<i>Ulmus x</i>	Hybrid Elm	'Accolade', 'New Horizon', 'Regal', 'Triumph'

Unacceptable Street Tree 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.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Reason</u>
	All Evergreen Species Not on Recommended List	Obstruct visibility, Okay for parks and open spaces
<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

APPENDIX C

<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>Gingko biloba (female)</i>	Gingko (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 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

Definitions

ANSI: Acronym for American National Standards Institute

ANSI A300 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

Chlorosis: A whitish or yellowish leaf discoloration caused by a lack of chlorophyll, often caused by nutrient deficiency

Co-dominant Branches/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*

DBH: Acronym for diameter at breast height; diameter of a tree measured at 4.5 feet (1.3 meters) above ground

Deadwooding: Removing dead and dying branches from a tree

APPENDIX D

Definitions

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

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

Raising: Selective removal of lower limbs from a tree to provide clearance; Lifting

Root Crown: Area where the main roots join the plant stem, usually flared at the tree trunk base; Root Collar

APPENDIX D

Definitions

Routine Pruning: Pruning done on a regular basis (usually every 5-7 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 are unique due to historical reasons or are rare specimens due to the species, size, age or location.

Species: Taxonomic group of organisms composed of individuals of the same genus that can reproduce among themselves and have similar offspring

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 3 - 4 year cycle.

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 E

REFERENCES & RESOURCES

HAZARD TREES

Council of Tree and Landscape Appraisers, 2000. "Guide for Plant Appraisal (9th ed.)" Inter. Soc. of Arboriculture, Champaign, IL, 143 pp.

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APPENDIX E

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PRUNING

* ANSI A300 (Part 1)-2001 Pruning. "Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices (Pruning)". American National Standards Institute, Inc., Washington, DC, 9 pp.

Gilman, Edward F., 2002. "Illustrated Guide to Pruning (2nd ed.)", Inter. Soc. of Arboriculture, Champaign, IL, 330 pp.

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TREE PRESERVATION

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* = Add to City's best practices manual

= Good reference for DPW library

APPENDIX F

WEBSITES FOR INFORMATION ON TREES

Wisconsin's Emerald Ash Borer Resource <http://emeraldashborer.wi.gov/>

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://www.entomology.wisc.edu/entodiag.html>

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

UW-Extension Urban Horticulture <http://www.uwex.edu/ces/wihort/>

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

Guidelines for Healthy Trees <http://www.ina-online.org/treespecs.htm>

Prepared by the Illinois Tree Specifications Review Committee

Selecting Urban Trees and Shrubs <http://www.na.fs.fed.us/spfo/pubs/UF/uts/>

- Produced by the Chicago Botanic Garden
- Slide assistance provided by the school of Forest Resources, Pennsylvania State University.
- Funding provided in part by the USDA Forest Service, Northeastern, Area State and Private Forestry, Midwest Center for Urban and Community Forestry

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 G

SPECIAL CONDITIONS

ABBREVIATIONS CODE

BS	Basal Suckers
BW	Basal Wound
CC	Concreted Cavity
C/D	Cavity/Decay
CD	Crown Dieback
CR	Consider Removal
CT	Codominant Trunks/Stems
DFP	Decay Fungi Present
DL	Dead Leader
DP	Deep Planting
DW	Deadwood (2" +)
HG	Hanger
IA	Invasives Around
IB	Included Bark
IM	Improperly Mulched
IP	Improperly Pruned
LB	Low Branched
LC	Low Crotched
LLD	Large Leader Decay
LML	Lost Main Limb/Leader
LN	Leaning
LS	Lightning Struck
MD	Mechanical Damage
MS	Multi-stemmed
ND	Nutrient Deficiency
OG	Overgrowing Growspace
OS	Overshadowed
PL	Poor Location
PP	Pest Problem
PS	Poor Structure
RD	Root Damage
RP	Raised Planter
RR	Root Rot
SP	Suckers Present
TP	Topped
TS	Trunk Split
TW	Trunk Wound
UP	Utility Pruned
WA	Wooded Area
WG	Weak Growth

APPENDIX H

Sample Tree Protection Provisions

Intent

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 City of Reedsburg finds that such preservation is necessary to promote the general health and welfare of the community by making the City 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 City 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.

Definitions

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.

Diameter-at-Breast-Height (DBH): A standard measure of tree trunk size measured at 4.5' above ground level, on the uphill side.

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

Specimen 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 City of Reedsburg.

Tree Protection Zone (TPZ): A fenced area around a tree or group of trees that will not be disturbed by construction activities.

City Forester: Individual in charge of enforcing the provisions of these specifications.

Sample - Specimen Tree List - City of Reedsburg

SPECIES	Min. DBH	SPECIES	Min. DBH
American Basswood	20"	Common Hackberry	16"
Sugar Maple	12"	American Beech	12"
All Serviceberries	6"	All Oaks	12"

APPENDIX H

Sample Tree Protection Provisions

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.

APPENDIX H

Sample Tree Protection Provisions

Table 1. 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 SEVERANCE	SOIL COMPACTION AND FLOODING	MATURE CROWN SPREAD (FEET)	HAZARD POTENTIAL RATING*	COMMENTS
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

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SPECIES	ROOT SEVERANCE	SOIL COMPACTION AND FLOODING	MATURE CROWN SPREAD (FEET)	HAZARD POTENTIAL RATING*	COMMENTS
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 2. 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	TREE AGE	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.

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Site Clearing Specifications

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 City 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 City 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.

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11. Any damage to trees due to clearing or demolition activities shall be reported to the City 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

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

1. Before beginning work, the contractor is required to meet with the City 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 City Forester.

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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 3. 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 City 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 City 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.

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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.

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Mitigation Requirements for Specimen Trees

1. Report any damage or injury to specimen trees within 6 hours to the City 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 City 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 City 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 City 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 City of Reedsburg.
8. If a specimen tree incurs significant damage to its roots, bole or crown, the City 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.

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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.

References

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APPENDIX I

Arboricultural Diagrams

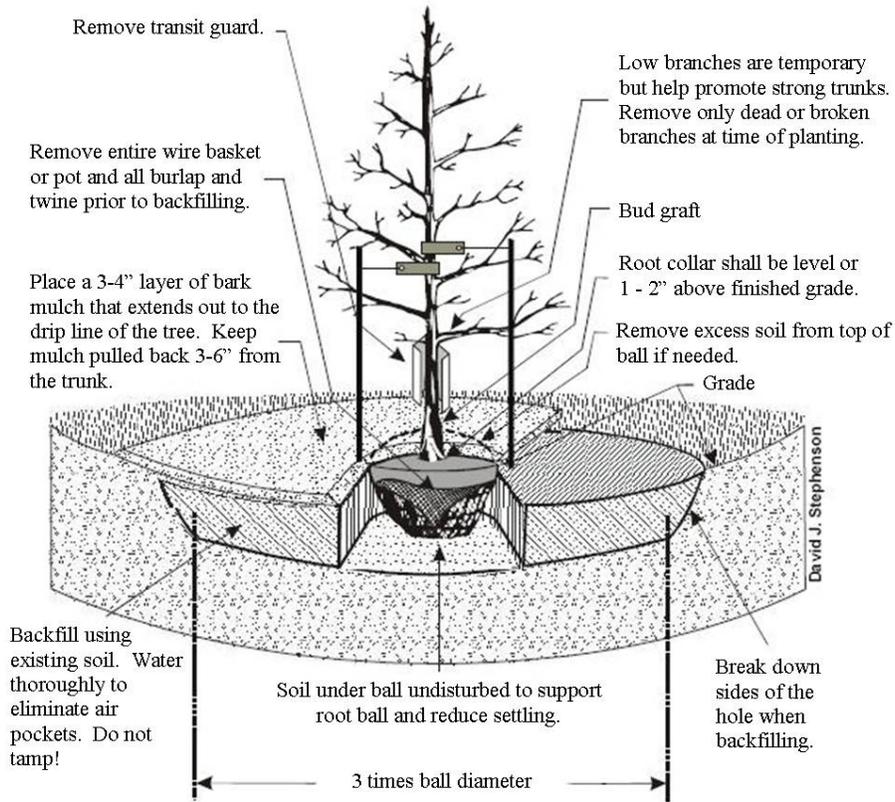


Figure 1 – Tree Planting Detail

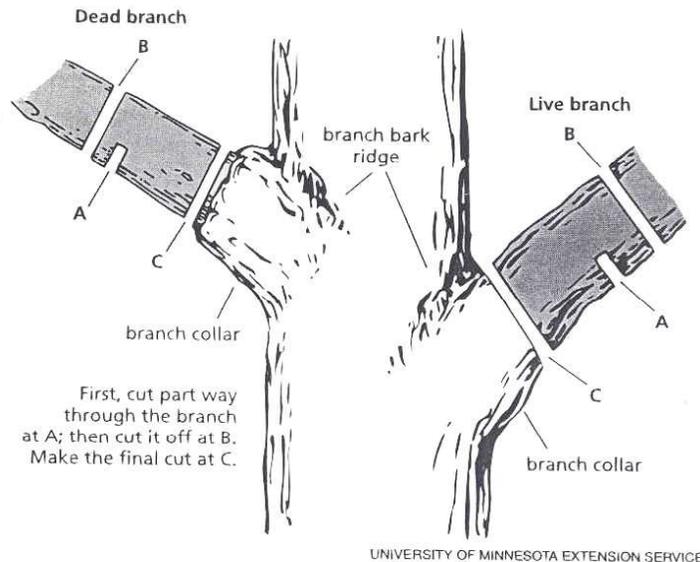


Figure 2 – Proper Pruning Technique

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Arboricultural Diagrams

20 inch diameter tree

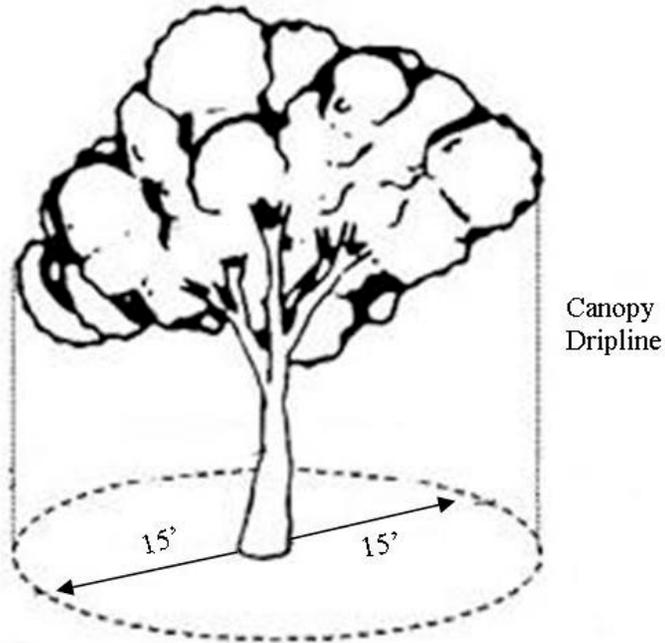


Figure 3 – Extent of Tree Protection Zone

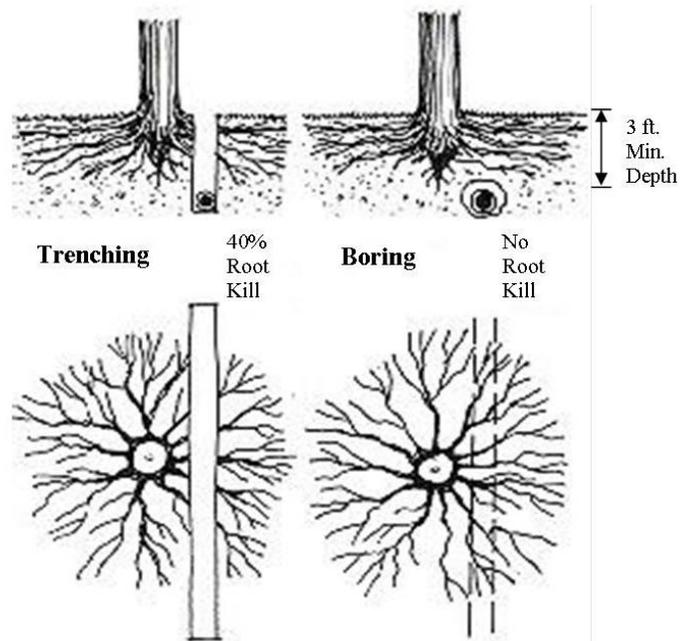


Figure 4 – How Boring Saves Trees

APPENDIX J

City of Reedsburg PLANTING INSTRUCTIONS

- 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 1-3/4" to 2" 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) 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.
- i) At the time of planting, trees shall be pruned to remove dead, broken, or diseased

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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.

j) 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.

k) 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.

l) 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.

m) Only those plants designated by the Purchaser shall be wrapped, staked and/or guyed. Staking shall consist of a minimum of two wood posts that have a minimum diameter of 2-1/2" inches. 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.

n) Trees planted between June 1 and September 15, shall be balled and burlaped.

o) 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.