City of Fridley Urban Forestry Study

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Acknowledgements
City of Fridley Urban Forestry Study: 2015-2016

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The City would also like to express our gratitude to Minnesota GreenCorp Member Erika Van Krevelen who served from September 2015 through August 2016 at the City Fridley. She walked miles of City streets to measure and assess City trees, provided research and met with staff, Council, citizens and businesses in an eleven month period in order to produce this Urban Forestry Study for the City of Fridley, Minnesota.
Executive Summary

The City of Fridley, Minnesota’s urban forest—which includes all trees, both public and private, within city-limits—adds considerable value to Fridley’s environment, economy, ability to enjoy energy savings, and the wellness of its inhabitants. Trees are an essential part of a city’s green infrastructure by improving stormwater quality and are a resource to be protected, cultivated and enhanced.

The City of Fridley Urban Forestry Study was developed using State agency resources through the Minnesota Pollution Control Agency’s Minnesota GreenCorps program in Green Infrastructure—Urban Forestry. The University of Minnesota Department of Forestry Resources research support was a key factor in completion of the project, which used analytic tools, industry research, and emerging practices in its preparation.

In addition, new field research was conducted by GreenCorp member Erika Van Krevelen, between September of 2015 and July of 2016, during which over 5,500 trees were measured and evaluated. This study presents the results of examining these trees in categories such as overall tree species composition and tree condition.

Adjunct to this Study and year of field research was the cooperative interaction with State Agencies such as the Department of Natural Resources and the Minnesota Department of Transportation Landscape Division. With Agency and U-MN support, volunteer tree planting groups were established, a gravel bed for young tree root development was constructed, and training took place toward a community tree stewardship program to add to community capacity for new tree care.

A major portion of this Study addresses the imminent loss in canopy from the insect pest Emerald Ash Borer. Without action toward ash tree preservation, this will result in a changed Fridley, environmentally and in terms of energy savings and property value. Fridley will lose more than 25% of its canopy cover or more than 1,060 trees in the immediate future. This Study also offers some budget impact scenarios for review, including a recommendation for one plan that is preemptive, yet practical.

Weather events, insects, disease and the natural deaths of trees through senescence adversely impact a City’s trees. An urban forest that has even-aged mature or post-mature trees is one that does not progressively install a good variety of small trees on a gradual basis, making that Urban Forest more susceptible to tree loss. Using this study to move toward an Urban Forestry Plan that is proactive, in order to address the potential losses to the urban canopy using species diversification, updated treatment methods, age/size class diversification through increased tree planting, cultivation of tree stewardship through community capacity-building and tree maintenance on public and private property is an important next step.
Background

Fridley is located on the Anoka Sand Plain, a subsection of the Eastern Broadleaf Forest Province. Marked by its sandy, well-drained soils and nearly 60,000 acres of State forest land, the Anoka Sand Plain hosts many Bur Oak and Northern Pin Oak trees. Many century-old oak trees remain in parts of Fridley, giving character to neighborhoods like South Innsbruck and Flanery Park. Just downhill from the oak trees, bottomland species such as silver maple and eastern cottonwood can be found growing along the banks of the Mississippi River on Fridley’s western edge.

With natural amenities such as the Mississippi River and Rice Creek, Fridley is a destination for outdoor activities. Residents and visitors can appreciate trees in Springbrook Nature Center, Innsbruck Nature Center, City and Anoka County parks, other recreations areas, or by walking and biking down tree-lined city streets and trails such as the Mississippi River Trail (MRT).

The devastation caused by severe weather events has taken a considerable toll on Fridley’s canopy cover. In May of 1965, two F4 tornadoes swept through Fridley, leveling houses and toppling trees. [2] Quick reforestation was needed, but was done so without attention to species diversity. This likely resulted in the monoculture of green ash—a fast-growing and versatile tree—that was planted in the Melody Manor neighborhood and elsewhere throughout the city. Similar devastation is likely to be faced by this already heavily-impacted neighborhood with the advent of the emerald ash borer and other potential tree threats (see Appendix for detail map).

Park, boulevard and right-of-way trees are aging and few trees have been planted to take their place.

In other aspects of the City, Fridley is an inner ring fully-developed city—not a bedroom community. It is fortunate to have a robust business climate, although this means many additional vehicles are traveling into and out of the community daily, impacting air quality.
Value of Fridley’s Trees

Ash Trees lined shaded streets, Melody Manor neighborhood, Fridley, MN, 2016
Urban trees provide quantifiable benefits to a community

The following benefits may be attributed to trees:

- Improved water quality by reducing stormwater runoff through interception
- Reducing soil erosion along streets, shorelines and riverbanks
- Reduced air pollution by capturing pollutants
- Efficient carbon storage
- Energy savings—shaded homes and buildings have lower energy costs
- Increased property values
- Temperature reduction, helping to stave off heat-island effect in an increasingly urbanized community
- Increased walking and biking along shaded streets
- Wildlife and bird habitat: as a Mississippi River, Rice Creek and lakes community, protection and enhancement of our unique natural resources are aided by a healthy and regenerated urban forestry canopy

Additionally, since over 10% of Fridley’s area is open water, the positive impact of urban trees on water quality is another major consideration when thinking about the benefit of urban trees.

Using i-Tree Streets, an analysis tool developed by the USDA Forest Service that quantifies the environmental and aesthetic benefits of trees, it was determined that Fridley’s 5,123 public trees provide $833,310 in annual benefits, which equals an average of $162.66 per tree, or $30.12 in benefits per capita.

Table 2. Environmental and Energy-Saving Benefits of Fridley’s Public Trees

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater</td>
<td>$311,894</td>
</tr>
<tr>
<td>Energy</td>
<td>$219,641</td>
</tr>
<tr>
<td>Air Quality</td>
<td>$36,310</td>
</tr>
<tr>
<td>CO2</td>
<td>$30,121</td>
</tr>
<tr>
<td>Aesthetics/Other</td>
<td>$234,344</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>$833,310</strong></td>
</tr>
</tbody>
</table>

Source: i-Tree Streets 2016 Analysis
Trees are part of *Green Infrastructure*, a term which encompasses the following:

**Stormwater Management**—trees capture rainfall on the surface of their leaves where it eventually evaporates. The water that does reach the ground is doing so at reduced speeds, as the canopy slows it down. This reduction in water volume and velocity lessens the demand on our storm drains, and furthermore, reduces the amount of sediment and other pollutants that enter our waterways via runoff. [3][13]

**Energy Conservation/Temperature Reduction**—trees, through shading and evapotranspiration, can reduce temperatures by 2-9°F in the summer. They also lower heating and cooling costs of buildings by providing shade in the summer and windbreaks in the winter. [1][15]

**Air Quality Improvement**—Trees improve air quality by absorbing atmospheric pollutants and also intercepting airborne particulate matter on the surface of their leaves [5]. The need for these environmental benefits is particularly amplified in Fridley due to the three large roadway corridors that run through the city.

**Carbon Dioxide Reduction**—trees capture and store atmospheric carbon dioxide, with a large tree able to absorb nearly 50 pounds of carbon dioxide a year. [23][24]

**Aesthetic Benefits**—Street trees increase the property values of homes. A study done in Portland found that houses with street trees sold for an average of $8,870 more than houses in areas of similar socioeconomic status that did not have street trees. [21]

**Social Benefits**—Studies have found that greener cities encourage increased outdoor activity, neighborly interaction, and crime reduction. [3][20]
Assessing Fridley's Urban Forest

Tree Inventory

Inventory as a Management Tool
A tree inventory is a vital tool in the assessment and ongoing management of an urban forest. This inventory involves field collection of data for every city-owned (public) tree. After individual trees are measured and rated, the information is loaded into a database. Information is included such as tree species and the diameter-at-breast-height, also known as DBH—measurements of the trunk diameter at 4.5 feet off the ground, which is used as the standard in the forestry industry. The tree inventory also includes a condition rating, specific to a GPS location. Using this data, the City has the ability to view and manage individual trees. The inventory can also be used to assess the urban forest at a neighborhood-level and the city as a whole. The tree inventory should be continually updated with the use of an existing City tree management computer software program or a City-specific program constructed. The tree inventory should be updated to reflect any removals as they occur with the program. It is also recommended that the condition ratings and DBH of City trees be updated every five years.

The City previously conducted a tree inventory in 2013. It was determined that additional information was required for better management of Fridley's urban forest. This required updating the existing inventory to include rankings of size and condition to provide a more complete database report.

2016 Municipal and School Tree Inventory
The city-wide tree inventory conducted by Public Works staff in 2013 was updated in 2016 to reflect current DBH and condition ratings. All municipal trees, public and private school trees were inventoried by MN GreenCorps Member Erika Van Krevelen from 2015 to 2016, after the City was awarded this assistance through the competitive Minnesota GreenCorp process with the Minnesota Pollution Control Agency. Regional park trees and trees in natural groves with understory plants were not included. This inventory included all 5,123 public trees, which are trees found in city parks and right-of-ways (ROWS).

Public and private school trees were also inventoried, but analysis of these trees in not included, only municipal trees are used in this Study. Results of school survey information will be shared with school administrators.
Data and analysis from the City of Fridley 2016 Municipal Tree Inventory is provided herewith and will be used for recommendations and policy suggestions for the comprehensive Urban Forestry Plan in future.

Using the data from Fridley’s 2016 tree inventory, there are 5,123 total trees located in City parks and in ROWs, 1060 being species of ash. The size and conditions of these trees can be found in the table below, additional information about Ash trees is in the Emerald Ash Borer response section.

Table 1. Diameter and condition of ROW and park ash trees in Fridley (2015)

<table>
<thead>
<tr>
<th>Tree Conditions</th>
<th>Diameter class (inches)</th>
<th>Total Ash Only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-10</td>
<td>11-20</td>
</tr>
<tr>
<td>Excellent</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Very Good</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Good</td>
<td>45</td>
<td>195</td>
</tr>
<tr>
<td>Fair</td>
<td>28</td>
<td>198</td>
</tr>
<tr>
<td>Poor</td>
<td>13</td>
<td>89</td>
</tr>
<tr>
<td>Critical</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>86</td>
<td>486</td>
</tr>
</tbody>
</table>
Species Diversity

Species diversity is the genetic richness within a population of trees. A common recommendation for establishing tree diversity is the 10-20-30 rule. This rule recommends that no more than 10% of trees are of the same species, no more than 20% of trees are of the same genus, and no more than 30% of trees are of the same family. Following these guidelines promotes genetic diversity, which makes an urban forest more resilient to pest threats. [18] As seen in Figure 1, three tree species make up more than the recommended 10% of the urban forest: green ash (20.7%), blue spruce (11.8%), and silver maple (10.9%). Even greater diversity than that provided by the 10-20-30 rule is preferable, with many urban forestry experts recommending no more than 5% of an urban forest be comprised of a single species. [19] 1,060 of the 5,123 city-owned trees are green ash, or 20.7%.

**Figure 1: Species Composition of Public Trees**
Species Composition of Medium and Large Broadleaf Trees

*Figure 2: Municipal Medium and Large-sized Broadleaf Trees (non-evergreen)*

Other species on the chart (no single species is > 2%) includes Sugar Maple, Red Maple, American Basswood, Littleleaf Linden, Boxelder, Elm species, Black Walnut, Paper Birch, Willow, Kentucky Coffeetree, Swamp White Oak, River Birch, Black Locust, Northern Pin Oak, Tamarack, Northern Catalpa, American Sycamore, Ohio Buckeye, Quaking Aspen, Birch species, and Russian Olive.
Species diversity can be broken down further by considering the value that different types of trees provide. Since medium- and large-sized broadleaf deciduous trees provide the most abundant leaf surface area, they cast more shade and intercept more rainwater and pollutants. They therefore provide the most environmental benefits. Because of their greater importance value, their species composition is worth assessing separately. Figure 2, above, shows the current species composition of Fridley’s medium- and large-sized broadleaf deciduous trees located on Municipal property.

**Figure 3. Percentage of Canopy Cover Provided by Top 5 Tree Species**

- **White oak**: 5.09%
- **Norway maple**: 5.26%
- **Bur oak**: 9.86%
- **Silver maple**: 21.04%
- **Green ash**: 25.62%
Age/Size-class Diversity

While it is difficult to determine the age of a standing tree, size can be used as a proxy when determining the relative age distribution of trees in the urban forest. Size is determined by measuring the DBH. In an ideal urban forest, 40% of trees would have a DBH of 6 inches or less. [16] At present, less than 10% of Fridley’s trees have a 6 inch DBH or less. More than 44% of trees have a DBH of 18 inches or greater (Figure 4). While this means that Fridley is currently enjoying the environmental benefits of these large trees, there are few young trees to replace the canopy loss that will result as old trees die. This underscores the importance of routine, staggered tree planting as a way to ensure enduring canopy cover.

Figure 4: Fridley Tree Size Class graph shows large numbers of trees in large and very large sizes
Urban Tree Canopy

The urban tree canopy (UTC) is the cover that is provided by the branches and leaves of trees and largely contributes to the environmental benefits that trees provide. The tree inventory is limited to public trees, whereas the urban tree canopy assessment includes trees on both public and private property. The UTC is a useful tool for analyzing Fridley's urban forest as a whole. Using existing land use area calculations from 2007 along with urban tree canopy cover calculations using aerial imagery and i-Tree, the canopy cover of the different land use types were made. Fridley’s overall canopy cover was determined to be at 24.6%. It is recommended that Fridley establish a UTC goal of 30% to be reached by 2040. This goal can be met through the management of existing trees, and the planting of new trees. Outreach programs that highlight the benefits trees have on energy savings and property value is one way to encourage tree planting on private property, including residential and commercial property. [12][14]

Table 2. Existing Land Use Areas and Respective Canopy Cover

<table>
<thead>
<tr>
<th>Land Use Category</th>
<th>Percent of Area</th>
<th>Percent Canopy Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Land Area</td>
<td>100</td>
<td>24.6</td>
</tr>
<tr>
<td>Single-family Residential</td>
<td>29.6</td>
<td>35.9</td>
</tr>
<tr>
<td>Multi-family residential</td>
<td>4.7</td>
<td>18.1</td>
</tr>
<tr>
<td>Commercial</td>
<td>5.5</td>
<td>9.7</td>
</tr>
<tr>
<td>Industrial</td>
<td>18.1</td>
<td>8.5</td>
</tr>
<tr>
<td>Public/Semi-public</td>
<td>6.8</td>
<td>14.2</td>
</tr>
<tr>
<td>Parks</td>
<td>7.7</td>
<td>55.0</td>
</tr>
<tr>
<td>Roadways</td>
<td>13</td>
<td>4.1</td>
</tr>
<tr>
<td>Water features</td>
<td>10.8</td>
<td>5.8</td>
</tr>
<tr>
<td>Railroads</td>
<td>1.9</td>
<td>.4</td>
</tr>
<tr>
<td>Vacant Lands and ROWs</td>
<td>1.9</td>
<td>12.2</td>
</tr>
</tbody>
</table>

Source: i-Tree Canopy.
Planning for Emerald Ash Borer

Approach for tree removals due to impacts from Emerald Ash Borer

The emerald ash borer (EAB), *Agrilus planipennis* Fairmaire, is a destructive exotic beetle that feeds on ash trees (*Fraxinus* species). It was first discovered near Detroit, Michigan in 2002 and has been found in 25 states as of January 2016. It is native to Asia and likely arrived in the U.S. in shipping materials. EAB are found in larval or adult form, with the larval stage being the most destructive. The larvae kill the tree by boring into and feeding upon the cambium layer, which is the region responsible for the transport of water and nutrients throughout the tree. As this layer becomes damaged by EAB activity, the ability for the tree to move these materials throughout the tree is disrupted (Emerald Ash Borer, n.d.). This will eventually kill the tree. The process from infestation to death can take from 2-5 years (Emerald Ash Borer FAQ, 2015).

Emerald ash borer (EAB) has not been found in Fridley yet, but the Minnesota Department of Agriculture confirmed an infestation in Shoreview in 2011. Additionally, an EAB infestation in Ham Lake caused Anoka County to be placed in the quarantine zone. Because of a delay from infestation to the appearance of symptoms, it is likely that EAB is present in Fridley’s urban forest, just not identified and confirmed at present.

Fridley’s updated city tree inventory reflects current condition ratings of City-owned trees in 2016. Trees in this inventory include all public trees in landscaped areas of city parks, as well as trees in the boulevard or right-of-way of streets maintained by the City. This does not include public trees in natural/woodland areas, such as Springbrook Nature Center, the Mississippi National River and Recreation Area, and the four Anoka County regional parks in Fridley. From this inventory, it was determined that 1,060 of the 5,123 city-owned trees are green ash, or 20.7%. The kill ratio for untreated trees is high. It is expected that EAB’s spread will not be arrested and that most ash trees in the U.S. will die without treatment with systemic insecticides. Because of this, we are outlining three possible scenarios for dealing with an EAB infestation.

Three different scenarios for the ash trees on the City of Fridley’s municipal properties are as follows:

- A proactive approach to ash tree management would be the preemptive removal of ash, beginning with the lowest-quality trees (trees with critical and poor condition ratings*, trees planted under utility lines, small trees, etc.) and the professional injection of systemic insecticide every two years to save the best quality City ash trees, preserve shade and canopy for City neighborhoods. This will spread costs over a number of years, and is only slightly more costly than simply cutting down the trees as they die and is recommended.
In response to the imminent threat of emerald ash borer, the City of Fridley is developing a response plan that will take place over the next 10 years to mitigate the damages of this pest on our urban forest. Assessments of size and condition rating of ash trees in the city have been made. This will help the City determine where low-quality ash trees are located for removal consideration, and where high-quality ash trees are located for treatment consideration. If and when treatment is chosen, the City will likely opt to use emamectin benzoate as a trunk injection. This is an insecticide which is effective for about two years and then needs to be repeated.

The remaining trees will be removed and replaced with suitable species that will diversify Fridley’s urban forest, beginning with the preemptive removal of the lowest quality ash trees, gradually, each year. Trees in naturalized areas will not be removed unless they present a hazard risk.

With this Emerald Ash Borer Response Plan Draft, using the Recommended Treatment Plan, the City of Fridley will protect its existing canopy cover, grow a more resilient urban forest, and limit the damages caused by EAB. This will be done through the following actions:

- Maintaining the City’s tree inventory
- Monitoring for EAB through visual assessment and branch sampling
- Treating select high-quality ash with chemical injections every three years
- Removing low-quality ash
- Utilizing ash logs when possible
- Disposing of ash debris at appropriate sites
- Replanting a suitable tree species in place of removed ash tree to promote genetic diversity
- Providing community outreach
- Updating the City’s tree disease ordinance to include language on EAB
- Establishing a tree board and tree steward group
- Budgeting at least $2 per capita ($55,334) for urban forestry tasks
- Achieving Tree City, USA status
- Developing a sustainable urban forestry management plan through the next steps
EAB Monitoring and Detection Strategies

As mentioned above, EAB was discovered in Shoreview in 2011 and Arden Hills in 2013. These two cities are approximately 4 miles from Fridley. Because EAB is easily spread through human movement of infested plant material, it is key that signs and symptoms of EAB are monitored for in Fridley’s ash trees (Emerald Ash Borer FAQ, 2015).

Symptoms of EAB can take two or more years to appear, and so it is possible that Fridley already has an EAB population in its urban forest. Symptoms that could indicate the presence of EAB include vertical splits in the bark, woodpecker damage, sprouts along the trunk and base of the tree, and canopy dieback. Definitive signs of EAB in ash trees are as followed: a D-shaped exit hole, serpentine larval galleries under the bark, or the larvae itself (Wilson and Rebek, 2005).

Visual Assessment
There are a number of ways to monitor for EAB. One way is through limited visual assessment, which is easily conducted during a tree inventory. If any of the aforementioned symptoms of EAB are evident, it should be noted in the tree inventory so that the suspect tree can continue to be monitored for the presence of EAB.

Branch Sampling
Another monitoring option is branch sampling. This involves designating a number of ash trees as sampling trees from which two branches will be removed and stripped of its bark on an annual basis to search for signs of EAB (Ryall, Fidgen, & Turgeon, n.d.). Because the branches used for sampling should be at least 4 inches in diameter, these trees should be considered “sacrificial” and be of low-quality. The branch sample should be 3 feet in length and be taken from the bottom of the branch where it connects with the stem. It is best done in fall or winter, and should be in areas by the nearest known EAB infestation for the greatest likelihood of early detection.

EAB Strategies

The City of Fridley is reviewing the following EAB management procedures for city-owned ash trees:

- Chemical treatment combined with tree removal of poor condition trees
- Tree removal as trees are killed by EAB
- Pre-emptive tree removal of ash over a period of the next few years

Criteria such as tree condition, DBH, site, logistics, and community impact will be considered when deciding which strategy to employ where. The possible use of biological controls is being considered in naturalized areas where treatment or removal is not a viable option.
Chemical Treatment

Treatment of ash tree is a management option that helps protect the canopy that an urban forest already has. The drawback to this strategy is that trees will probably require treatment for the life of the tree, and so only high-quality ash trees with a DBH greater than 12 inches are recommended for treatment. Smaller trees are not recommended because they provide minimal canopy cover and will require treatment for a greater number of years. Treatment cost is typically charged per DBH inch when using the trunk injection method with emamectin benzoate. Larger trees cost more than small trees.

If the City pursues treatment for ash trees in the best condition and obtains cost information for this service by licensed and certified contractors, an RFP could be written to offer property owners the ability to obtain group rates from this contractor. Encouraging injection rather than soil drenching is preferred.

Tree Removal

Some of the industry figures for the number of ash trees that that will die if not treated are over 90%. Ash will eventually succumb to EAB if within an infested area and Anoka County and Fridley are in a quarantined area. Because of this, the partial preemptive removal of ash trees is an important part of a proactive response plan that will spread costs out over a longer period of time. In one (preferred plan) City will begin by removing the lowest-quality ash. These include trees that are hazardous, poorly-sited, and/or have structural deficiencies. If and when EAB is discovered in Fridley, ash that are confirmed to have an EAB infestation will be removed. Reevaluation of scheduled removals may become necessary (see Budget section, below).

Biological Controls

Recent trials of experimental parasitoid releases in naturalized areas were conducted by the Minnesota Department of Agriculture and have shown promising results. Two types of stingless wasps native to Asia have been released into natural areas in different areas that have EAB infestations. These wasps are natural enemies of EAB, and trial releases have shown that the wasps are laying eggs and are growing in population in Minnesota forests where they are released, making it a potential option for EAB management in naturalized areas. Because this process is still in the early stages, this form of control is limited, but should be considered as a control option in the future if available.

Trees on Private Property
A majority of Fridley’s land is residential which means that a sizeable portion of Fridley’s urban forest comes from trees growing in the yards of Fridley residents. To further assess the composition of private trees, a survey of private property is recommended. A survey is a limited sampling of random parcels throughout the city that can be used to extrapolate the city’s private tree species composition. This, combined with the tree inventory, will provide a very accurate idea of how many ash trees are in Fridley.

The City requires that homeowners use a tree service contractor that has been licensed with the City of Fridley for any tree care service being provided, including but not limited to tree removal and trunk injection. Treatments made by a contractor must be done by a licensed pesticide applicator. It is recommended that homeowners use trunk injections for treatment of ash trees to minimize the ecological impact of alternatives such as soil drenches with imidichloprid or other pesticides.

Homeowners can take their ash tree waste to a disposal site within the quarantined area. The Ceres Environmental Services in Brooklyn Park and the Bunker Hills Compost Site in Coon Rapids are two nearby disposal sites that do not require a person to leave the quarantined area (see...

The City encourages homeowners to plant trees on their property if the site allows. This will mitigate the loss of canopy cover due to the removal of mature ash trees. The City will host an annual Arbor Day tree sale that will provide Fridley residents with low-cost trees that may be suitable for planting in their yard.

Additional impacts from homeowners who cannot remove ash on private property could affect City procedures and staff time for Code Enforcement, Tree Inspection and Assessment for removal of hazard trees. Staff is developing suggested policy recommendations based on how other cities are addressing the issue of private property non-compliance of hazard or diseased/insect-impacted trees and their removal. Because of the nature of EAB infestations, trees become brittle and could pose safety hazards as branches break off and fall. The lack of a plan can yield negligence implications for affected homeowners. This underscores the need for a proactive approach to ash tree management.

Property owners will be responsible for the ash trees located on their land. If a property owner chooses to treat their ash trees, the City recommends that they use trunk injections of emamectin benzoate and if that chemical is used, the service must be performed by a licensed and certified contractor.

**Ordinances and Policies**

**Tree Disease Ordinance Update Needed**

The City needs to update its *Tree Disease Ordinance* to include Emerald Ash Borer on the list of declared nuisances or to make revisions and create language that cover current and future tree diseases, insects and pests. Inclusion would permit the City Forester to go on private property to inspect hazard or infected trees, if EAB is suspected, would allow removal orders to be made if a tree on the property is confirmed to have...
EAB, and would give the City the right to abate the tree if the property owner fails to comply, resulting in the collection of special assessments in the following years’ taxes.

Tree Service Contractors

The City requires that any contractors performing tree services be licensed with the City. It is recommended that the license application be updated to make contractors submit proof that they are registered with the Minnesota Department of Agriculture’s Tree Care Registry. Based on recommendations by GreenCorp Member Van Krevelen, the City has now requested that tree companies who apply for tree care licenses with the City indicate whether they have Certified Tree Inspectors and/or Arborist Certified with the International Society of Arborists. This will allow property owners to make informed selections for tree care and removal from the list of licensees.

Replacement

It is recommended that the City of Fridley use a 1:1 replacement ratio for ash trees that were removed in those locations which will adequately support the growth of shade trees. This will minimize the canopy cover loss of the removal of ash trees. The replacement tree will be one that is not susceptible to EAB and is suitable for the site. Using the 30-20-10 model (Santamour, 2002) to increase species diversity will promote a more resilient urban canopy. In addition, if select ash trees are treated with systemic insecticides, even though those trees will continue to contribute to City canopy cover, additional shade trees should be started in proximity to the treated ash, in the event that treatment is discontinued in the future.

Because the time frame for tree growth is measured in decades, replacing these trees with new trees to begin replenishing and even adding to the canopy is important. State agency grant programs, community gravel beds and service organization may all contribute to this goal.

A list of recommended tree species may be found through the following University of Minnesota web page:
http://www.extension.umn.edu/garden/yard-garden/trees-shrubs/recommended-trees-for-minnesota/southeast/
**Budget**

A commitment to a modest annual tree purchase of container trees in spring and for bare root starter trees in the City gravel bed for fall planting will ensure much greater resilience for Fridley’s municipal tree population. A more wide-spread variety of trees, planted and pruned by volunteers during early development is recommended.

One way to estimate costs of contractor removal and stump grinding per tree was historical, based on a few trees removed annually in the City yields approximately $850-$950 per tree for cost, according to Jeff Jensen, City Operations Manager-Streets and Parks. For larger quantities of trees due to mass cutting of ash, the price per tree would likely drop, but depending on demand and the number of licensed tree removal companies during a time of heavy infestation, prices could fluctuate (see the scenario planning budgets in the next section, which pricing was provided by a reputable contractor using current dollars for budget purposes).

Upon confirmed infestations of EAB, this annual removal number may change and accelerate to reflect current demands and not be able to use the timetables estimated in the next section.

Disposal is, at this time, free at several facilities, but it is dependent on our staff or private property owners hauling or contracting for hauling to locations in Brooklyn Park or St. Paul (see Disposal section, below).

It is recommended that the combined cut and treat scenario (the first diagram below) be budgeted starting in 2017.

A few replacement trees are available for municipal property (parks and city street boulevards and rights-of-way areas) for a two-year period for installation by volunteers, based on the 2016 LCCMR grant to the City from the Department of Natural Resources, MnDOT and MPCA Arbor Day grants. Up to 370 trees to replace the 1,053 ash which will be lost (with the no-treatment plan) will be installed through May of 2018, by volunteers. After that time, for the 2018, 2019 and subsequent budgets, it is recommended to replenish the gravel bed nursery (materials provided by the DNR grant) with bare root trees at a total of $2,800 (indexed), each year. That would provide for around 120-135 small trees. The ability to purchase an additional $2,000 in container trees for spring planting would be preferable. That would create a total tree budget, for planting by volunteer labor annually at $4,800.

Repair of these tree losses helps to mitigate air quality issues, current energy saving benefits for associated properties and stormwater absorption. A major budget expenditure, rapidly upcoming from 2017-2021, is that related to cut-down and/or treatment plans for dealing with ash trees. Three different budget scenarios are presented. They were developed using the actual tree measurements and condition reports and could not have been done without an accurate new inventory. In addition, the sample costs were assisted by current industry information provided by Jeffrey M. Hafner, Rainbow Tree Service, which is one of the licensed City tree care companies. Information about costs for treating or removing ash trees was provided as a courtesy and is not intended to be a quotation. Prices vary, based on market demand and the year for
Recommended Budget plan for 2017-2032: remove critical, poor and fair ash (55-60% of ash); inject best ash (40-45% of population) with systemic insecticide using timetable above

<table>
<thead>
<tr>
<th>City's Total Ash Trees on Municipal Property=1066</th>
<th>Removal Plan Based on Condition: only removing critical, poor and fair Ash Trees</th>
<th>Injection Treatment Plan* for Ash trees only in good + very good condition 40-45% of ash trees = 481</th>
<th>Removal + Treatment Plan Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td># of Ash Trees Removed</td>
<td>Condition/rank</td>
<td>Removal by Public Works Staff</td>
</tr>
<tr>
<td>2016</td>
<td>6</td>
<td>Fair</td>
<td>$ 5,100.00</td>
</tr>
<tr>
<td>2017</td>
<td>110</td>
<td>Poor &amp; critical</td>
<td>$ -</td>
</tr>
<tr>
<td>2018</td>
<td>130</td>
<td>68 Poor &amp; critical + 62 fair ash are cut</td>
<td>$ -</td>
</tr>
<tr>
<td>2019</td>
<td>200</td>
<td>Fair</td>
<td>$ -</td>
</tr>
<tr>
<td>2020</td>
<td>138</td>
<td>Fair</td>
<td>$ -</td>
</tr>
<tr>
<td>2021</td>
<td>minimal / storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>minimal / storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>minimal / storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>minimal / storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>minimal / storm</td>
<td></td>
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</tr>
<tr>
<td>2026</td>
<td>minimal / storm</td>
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<td></td>
</tr>
<tr>
<td>2027</td>
<td>minimal / storm</td>
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<td>2028</td>
<td>minimal / storm</td>
<td></td>
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<td>2029</td>
<td>minimal / storm</td>
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<td>2031</td>
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</tr>
<tr>
<td>2032</td>
<td>minimal / storm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TTL</td>
<td>584</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $28.50 may need indexing as more trees die, demand for services goes up, + $$

I. Recommended Draft Budget for Ash: Partial Removal with Injection Treatment
Removes only critical, poor and fair trees, uses periodic insecticide injection to keep good + very good trees
II. Cut-Down Reactive Draft Budget for Ash  
(Tree removals as ash succumb and become hazard trees, no trees injected)

This plan shows ash tree removals based on waiting for ash trees to die from EAB, starting with critical trees and then accelerating rapidly when major tree die-off occurs. The timetable would hold unless massive dead trees appear sooner than 2020, in which case budgeting might need to move up the timetable. The prices are shown in 2016 dollars, based on one sample quotation for purposes of the Study, but pricing is market and quantity driven and they may vary. This plan does not include any treatment of ash trees to preserve them and is not the preferred plan recommended in this Study, which is #1.

<table>
<thead>
<tr>
<th>Year</th>
<th># of Ash Trees Removed, storm damage and later EAB dead trees</th>
<th>Condition/rank</th>
<th>Removal by Public Works Staff</th>
<th>Total Removal Cost ~$28.50/DBH, poor/critical + impacted trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>6</td>
<td>Fair</td>
<td>$</td>
<td>5,100.00</td>
</tr>
<tr>
<td>2017</td>
<td>20</td>
<td>Dead/hazard trees</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>2018</td>
<td>20</td>
<td>Dead/hazard trees</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>2019</td>
<td>20</td>
<td>Dead/hazard trees</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>2020</td>
<td>500</td>
<td>Dead from EAB</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>2021</td>
<td>500</td>
<td>Dead from EAB</td>
<td>$</td>
<td>-</td>
</tr>
<tr>
<td>Ttls</td>
<td>1066</td>
<td></td>
<td>$</td>
<td>5,100.00</td>
</tr>
</tbody>
</table>
This plan shows ash tree removals based on current condition of ash trees, starting with those in the poorest condition, not necessarily infected with Emerald Ash Borer, initially. Trees are progressively cut down, the ash canopy cover reduced systematically. The timetable would hold unless massive dead trees appear, in which case it might need to be accelerated. The prices are shown in 2016 dollars, based on one sample quotation for purposes of the Study, but pricing is market and quantity driven and they may vary. This plan does not include treatment of ash trees in good condition and is not the preferred plan recommended in this Study, which is #1.

<table>
<thead>
<tr>
<th>Year</th>
<th># of Ash Trees Removed, storm damage and later EAB dead trees</th>
<th>Condition/rank</th>
<th>Removal by Public Works Staff</th>
<th>Total Removal Cost ~ $28.50/DBH, divided by 5 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>6</td>
<td>Fair</td>
<td>$ 5,100.00</td>
<td>$</td>
</tr>
<tr>
<td>2017</td>
<td>212</td>
<td>178 Poor &amp; critical; 44 Fair</td>
<td>$</td>
<td>$ 119,540.40</td>
</tr>
<tr>
<td>2018</td>
<td>212</td>
<td>Fair</td>
<td>$</td>
<td>$ 119,540.40</td>
</tr>
<tr>
<td>2019</td>
<td>212</td>
<td>144, Fair, plus infected trees</td>
<td>$</td>
<td>$ 119,540.40</td>
</tr>
<tr>
<td>2020</td>
<td>212</td>
<td>Dead from EAB</td>
<td>$</td>
<td>$ 119,540.40</td>
</tr>
<tr>
<td>2021</td>
<td>212</td>
<td>Dead from EAB</td>
<td>$</td>
<td>$ 119,540.40</td>
</tr>
<tr>
<td>TTLS</td>
<td>1066</td>
<td>$ 5,100.00</td>
<td>$ 597,702.00</td>
<td></td>
</tr>
</tbody>
</table>
Wood Utilization and Disposal Options

As shown in the sample estimates and budget options, the removal and disposal of ash trees will costly for the City. The options presented would likely not provide for ash wood re-use, although use in municipal building flooring or paneling projects after processing by a geographically accessible sawmill is another option for review.

For the City or for private property owners facing ash removals and disposal questions, wood utilization may be a way to recover value from the ash trees being removed. Exploring options and partnerships with local companies and sawmills would be essential for getting the most out of ash logs in a cost-effective way.

*Wood from the Hood*, a Minneapolis-based company that creates products using reclaimed urban timber, has worked with the City of Minneapolis to purchase trees that meet their standards for size and quality. A similar partnership could be ideal for Fridley, if it reduces the disposal costs embedded in any ash take down plan. This would be reserved for high-quality logs that are 6.5 - 8.5 feet in length or longer that do not have branch interruptions.

*Environmental Wood Supply*, co-owned by Ever-Green Energy in Saint Paul, also purchases tree debris for use as biomass in energy production. Further investigation into the cost/benefit of transporting logs to a disposal site or sawmill location is needed.

*Ceres Environmental* in Brooklyn Park has a compliance agreement with the Minnesota Department of Agriculture for handling ash material and offers free disposal of all tree material except stumps as of 2016.

Remaining debris from the removal of Ash trees should be taken to a suitable compost site that does not involve travel outside of the EAB quarantine area. Anoka County and much of the great Twin Cities metropolitan area is in this quarantine. Ash firewood may not be moved outside quarantined counties, either, in order to delay the spread of the pest.
City Urban Forestry: Moving Forward

Diversity to Build Resiliency

Fridley’s urban forest will be affected by present, emerging, and future pest threats. Because tree pests often target specific genus, as is the case with the emerald ash borer, there is a demonstrated need for species diversification in future tree plantings. As shown in the earlier pie-charts, Fridley’s tree population is not well diversified.

The five biggest concerns are the following insect or disease: the Asian longhorn beetle, the emerald ash borer, Dutch elm disease, the gypsy moth, and oak wilt. Based on the preferred hosts of these maladies, the number of public trees in our urban forest that will be affected by each respectively are represented in Table 3 [6][7][11][22].

Table 3. Pest Susceptibility Chart

<table>
<thead>
<tr>
<th>Pest</th>
<th>Number of Trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian longhorn beetle</td>
<td>1,380 (27%)</td>
</tr>
<tr>
<td>Emerald ash borer</td>
<td>1,060 (21%)</td>
</tr>
<tr>
<td>Dutch elm disease</td>
<td>56 (1%)</td>
</tr>
<tr>
<td>Gypsy moth</td>
<td>1,175 (23%)</td>
</tr>
<tr>
<td>Oak wilt</td>
<td>565 (11%)</td>
</tr>
</tbody>
</table>

Tree Maintenance

Like with any infrastructure, green infrastructure including urban trees require maintenance to provide utility. Trees are unique in that—with proper maintenance—the value that they provide continues to grow as they age until they reach senescence, unlike gray infrastructure that deteriorates with age. [10]. Maintaining the health of existing trees is the best way to protect Fridley’s existing canopy cover and provide maximum environmental benefits to current residents. It is recommended that the City creates an urban forest maintenance regime that includes a five-year pruning cycle, which was found to be the optimal cycle length for maximizing tree value while minimizing costs. [9] Lack of routine maintenance can result in indirect costs from unexpected pruning, debris removal, insect and disease management, tree removal, and other unanticipated activities. Tree value also diminishes with longer pruning cycles, as their condition ratings decrease.
Tree City USA, a designation that Fridley is currently seeking, requires a community forestry program to have an annual budget of at least $2 per capita. With Fridley’s currently population of 27,667, that would put the budget requirement at $55,334. Tree care activities such as pruning, watering, and contractual services, help fulfill this budget requirement. [17]

Public Reforestation: Growing the Urban Forest in an Equitable Way

Because of the demonstrated value that trees provide to a community, as well as the lack of small trees in Fridley’s urban forest, it is important that planting new public trees be a part of the City’s on-going tree program. While public tree programs, such as planting, pruning, watering, and pest control add costs to City budgets, they do not outweigh the benefits that trees provide. The USDA Forest Service conducted a study that surveyed arborists and municipalities in the Midwest to determine the average costs of tree care activities. Based on this, the 40-year average cost of a large shade tree is $36.99 a year. That same tree will on average provide an annual benefit of $94.72/year over 40 years. The study also determined that after five years of growing, annual tree benefits outnumber the annual costs associated with the care of that tree. The net-benefit amount increases significantly through the life of the tree [23]. This amount would be decreased with the development of a tree steward program.

It is recommended that reforestation efforts be prioritized in neighborhoods with the lowest canopy cover to work towards equitable distribution of urban trees and their associated environmental and social benefits. An example
of a neighborhood with low canopy cover would be the Hyde Park neighborhood (Figure 5, above, larger version in Appendix). The entire neighborhood has 54 street and park trees, with many in poor condition. Because of the lack of trees providing environmental services, this neighborhood has lower canopy cover which is associated with poorer air quality, less shade, and higher energy costs.

**Community Engagement, Education and Outreach**

**Tree Stewardship, Volunteer Capacity-building for Urban Forestry**

Many communities throughout the state, including St. Paul, Rochester, and Sherburne County have adopted citizen pruner and/or tree stewardship programs in which trained volunteers from local service groups, faith-based groups and local and regional businesses plant, monitor, and care for newly-planted trees. These programs help alleviate a portion of the costs for Public Works Departments associated with planting and caring for young trees while engaging the community and/or those who work in the community in their urban forest. Public Works summer labor force does not currently receive training in tree care at the level that is provided by

As part of Fridley’s receipt of a LCCMR grant from the Department of Natural Resources for 2016-2018, starter trees in containers, gravel bed bare root trees for fall planting and volunteer training events have been made available to members of the community. This grant has partnered the City not only with the DNR, but also with Hand On Twin Cities, the Tree Trust, the University of Minnesota, the Conservation Corp and more toward building overall community capacity for Urban Forestry and citizen engagement. This is the first step toward implementing a successful tree stewardship program.

The LCCMR grant also provided the resources for materials to install a gravel bed, which is a system that reduces the costs associated with purchasing trees by growing starter bare root trees over the summer in a gravel matrix to facilitate root growth and a fall mass planting on municipal property.

**Corporations Plant Trees in City Parks**

Fridley has several large companies, including General Mills, Medtronic and Cummins, whose corporate culture encourages environmental action and participation in projects like providing trees, tree planting and pollinator planting by their employees. City-sponsored and organized tree planting and pruning activities during business hours were an
outgrowth of the Study and recent grants like LCCMR from the DNR grant and Mn-DOT landscape grant. The University of Minnesota conducted Tree Steward and Certified Tree Inspector training that was made available to area residents and employees of local businesses, as well. All of these programs and educational opportunities should be pursued on an ongoing basis.

Photo: Medtronic volunteers planted 35 trees in Commons Park in 2016

Photo: Erika Van Krevelen, Minnesota GreenCorps Member, worked with a variety of civic, business and school groups for tree planting and tree care training during an eleven-month period from 9/15 through 8/16
Arbor Day
Fridley hosted its first city-wide Arbor Day event of recent times in April of 2016, which united partners from the Fridley Middle School’s Builders Club, students from the University of Minnesota, and sponsorship from the MPCA, in a tree planting and educational event. Continued participation from schools, local service groups, businesses, and other organizations can provide the needed community support for increased tree planting into the future.

Photo: Arbor Day 2016, Middle School students plant trees with U-MN partners, Master Gardener volunteers, GreenCorps members and staff
Additionally, achieving Tree City U.S.A has been stated as a City goal, which necessitates tree planting and an annual Arbor Day celebration.

**Website and Education**

It is recommended that the City continue to update its Environment & Natural Resources webpage on Fridley’s website to provide information on urban forestry-related topics, including shade tree disease management and updates on the EAB status in Fridley, as well as upcoming event information and volunteer opportunities and links to University and Minnesota Department of Agriculture updates on urban forestry issues.

Community events and awareness campaigns will also be considered. Workshops will be held based on public interest and staffing availability. A tree advisory board should be established to link the City with members of the community to inform decisions on tree care.
Summary

The economic and environmental value of trees in a community may be undervalued, because we typically don’t think about their impact on air quality, stormwater quality and energy use. Trees are a tremendous asset to a community and with use of this Study, Fridley work toward lengthening their service life, decreasing the impacts of future pests and diseases by diversification of tree types and maximize the value they provide to the community. It is recommended that Fridley protects and grows its urban forest through active maintenance, tree planting, community engagement, and by continuing to seek out partnership and funding opportunities on a local, state, and national level.
Appendix

Maps, Research, and Research Documentation
City of Fridley Ash
Trees on Municipal property as inventoried from fall of 2015 through June of 2016. Map shows distribution, condition and relative size of trees.
Ash Trees on Public and Private School Properties (all districts) as inventoried from fall of 2015 through June of 2016. Map shows distribution, condition and relative size of trees. School buildings and grounds, school boards will have information needed for urban forestry management programs on their campuses.
Detail Maps for sample neighborhoods, ash impacts:
Rice Creek Terrace
Green Ash Trees
(118 Total)

Diameter Breast Height (inches)

- 1 - 11
- 12 - 18
- 19 - 24
- 25 - 31
- 32 - 55

Condition
- Very Good
- Good
- Fair
- Poor
- Critical

City of Fridley
6431 University Ave NE
Fridley, Minnesota 55432
Phone: (763) 572-3566
Hyde Park Neighborhood: Few Total Trees
Additional information on Tree Inventory Assessment, 2016

Condition Rating Criteria Developed for the 2016 GreenCorp/City of Fridley Municipal and School Property Inventory

Excellent:

- tree has no structural problems
- tree has full and balanced canopy

Very Good:

- tree has no major structural problems
- tree has full and balanced canopy

Good:

- tree has no major structural problems
- tree has healthy canopy

Fair:

- Tree may exhibit structural damage such as codominant stems or cracks in trunk
- Tree may have cambium loss
- Tree may exhibit canopy dieback such as crown imbalance or thinning crown
- Tree may have dead or detached branches that require pruning/removal

Poor:

- Tree may have internal decay
- Tree may exhibit multiple structural or canopy problems
- Tree may exhibit other signs of disease
Critical:

- Tree poses a safety hazard. Immediate removal is recommended.

References and Research Documentation


**Additional General References, Emerald Ash Borer Response Plan Draft**


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http://www.bing.com/images/search?q=urban+forest+canopy+photos&view=detailv2&id=ED8E517A09BEE0C03EC8B29483A63A35DF99A22D&selectedIndex=103&ccid=asTX8prO&simid=608012248875467533&thid=OIP.M6ac4d7f29ace43ae3ba7398267dfc29ao0&ajaxhist=0

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