URBAN & COMMUNITY FOREST MANAGEMENT PLAN

ABSTRACT

This plan is intended to guide decisions related to preserving and enhancing the urban and rural forests of Marine on St Croix, Minnesota, for the benefit of its citizens and the environment.

October 11 2018

Executive summary

An inventory of Marine on St. Croix's urban trees, completed in 2017, found that 925 trees occur within 50 feet of public streets in the city's central district and surrounding residential neighborhoods. An urban forest can be thought of as comprised of trees growing on developed sites in proximity with people. Trees in the urban forest are a major component of managed landscapes. The area delineated and defined as Marine's urban forest covers 287 acres (11%) of Marine and includes 8.7 miles of public roads.

The ten most common species in Marine's urban forest represent 70% of the population. As many as 37 other species make up the remaining 30% of the population. Species of ash (*Fraxinus*) account for 10% of the population and are at risk of total loss due to the impending infestation by Emerald Ash Borer.

There are many large, old veteran trees in relatively good condition in the urban forest. One of these trees has been recognized as both the Minnesota State Champion and National Champion and is the largest known individual of its species (black willow - *Salix nigra*). On the other end of the scale younger age classes of trees appear to be underrepresented. These trees will be Marine's future urban forest.

An inventory of available planting sites in the urban forest was competed in 2018 and identified room for an additional 250 trees. Loss of existing veteran trees as they age out of the population, along with the total loss of ash, will create demand and opportunities for additional tree planting.

Marine's urban forest currently generates nearly $150,000 per year in ecosystem services, which include enhancing quality of life and property values, stormwater management, energy conservation, reduction in air pollutants, and carbon sequestration. These benefits will increase with time as the existing trees continue to grow and new plantings are established.

This plan focuses on the urban forest. Further work needs to be done to incorporate other areas of natural forest cover into a cohesive strategy for the remainder of Marine. Marine's City Tree Ordinance establishes a Forestry Advisory Committee, that serves under the direction of City Council. This plan is intended to guide the activities of the Committee, working with city staff and Council, to further develop and implement an urban and community forest program.

This study and plan were conducted by the City of Marine Urban Forest Task Force, a task force of eight community volunteers formed by the City Council in 2016. The task force developed revisions to Chapter 16 of the City Code (City Forestry Ordinance) and facilitated Arbor Day activities.

This plan is intended to be a dynamic reference and will be revised as necessary.

Cover photo: The *"Montfort Ash"* - This 34 inch diameter veteran tree is located in a public green space dedicated to Montfort Dunn on the occasion of his 97th birthday (5/15/04).

Contents

Statement of Purpose and Scope

The urban forest in the city of Marine on St. Croix, Minnesota, is generally described as composed of trees in close association with people, and typically includes trees that occur in managed landscapes. The prevalence of more intensively developed sites sets the urban forest apart from naturally occurring forests in rural areas. Both urban and areas of natural forest cover occur in Marine.

This management plan defines current conditions, projects future challenges and opportunities, and is intended to guide active management and stewardship of Marine's urban forest. It is intended to assist the Forestry Advisory Committee, city staff, and the City Council in establishing priorities and objectives related to the goal of maintaining a productive and beneficial community forest.[1] This management plan describes a long-term vision that is achieved through short-term and long-term goals, an inventory, assessment, monitoring, and recommended action plans. It provides a point of reference for measuring progress in achieving a long-term vision for Marine's urban forest.

Urban forest trees have well-documented positive impacts on water quality, are effective in moderating storm water flows, reduce energy demands, and generally increase the quality of life within communities.

Defining the Urban Forest

The boundaries of Marine on St. Croix's urban forest were delineated based on land cover type. While much of Marine is rural in character and includes extensive areas of natural forest, this project focused on trees and green spaces in proximity to people.

The National Land Classification Database (NLCD)[2] was used to determine the extent of development within the central core of Marine. NLCD describes four classes of land cover types that were used to generally identify the urban forest:

- ✓ **Developed, Open Space** - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes
- ✓ **Developed, Low Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
- ✓ **Developed, Medium Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
- ✓ **Developed, High Intensity** - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.

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[1] Urban Forestry Best Management Practice for Public Works Directors, Urban Forest Management Plan, Page 17, APWA Press.

[2] USGS National Land Classification Database - https://catalog.data.gov/dataset/usgs-national-land-cover-dataset-nlcd-downloadable-data-collection

Land cover maps, created from remote sensing survey work done by NLCD in 2011, is available[3] in the public domain at no cost to users. Once graphically displayed, the 30 m^2 resolution images show spatial distribution of developed sites. These maps guided the task force's qualitative delineation of the urban forest boundary.

The urban forest area assessed included the town center, as well as the majority of established residential neighborhoods to the north, south, and west of the downtown.

The study was limitied to the cental core of Marine, concentrating on the city's most highly developed areas. Additional surveys may be done in the future.

A summary of land cover types in Marine on St Croix, as well as a break-out of land cover types within the urban forest, is presented in Table 1 below. The table presents the land cover types across the entire four-square miles of Marine as compared to those within the urban forest boundary.
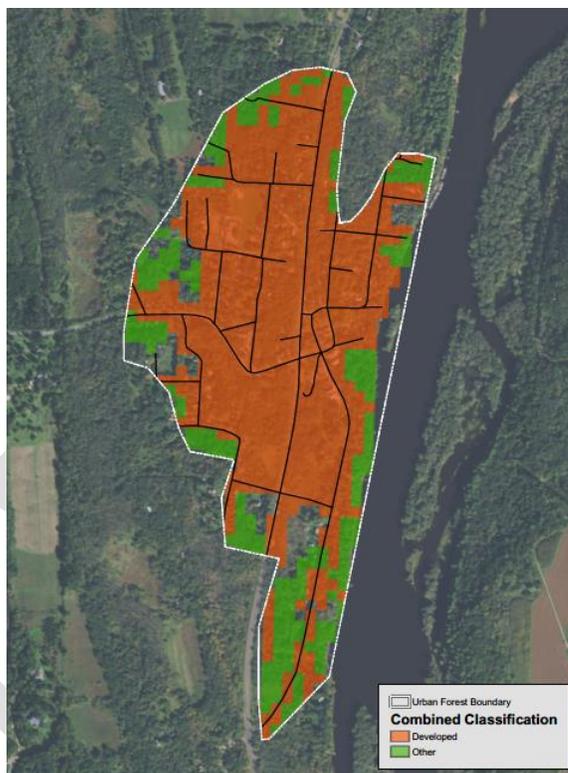

*Figure 1 Urban forest study area*

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[3] More recent (2014) NLCD data at finer resolution (2m^2) is available for purchase.

Table 1 Land cover types of Marine on St. Croix (4 sq. mi.) and the central urban forest based on 2011 NLCD mapping

2011 NLCD Land Use Class	Entire City Area of Marine on St. Croix (Acres)	Central Urban Forest Area (Acres)
Developed Low Intensity	44.92	22.80
Developed Medium Intensity	9.12	5.56
Developed High Intensity	1.11	1.11
Developed Open Space	284.23	123.88
Total Developed land cover classes	**339.89**	**153.35**
Deciduous Forest	836.89	42.26
Evergreen Forest	125.43	1.33
Mixed Forest	2.00	0
Woody Wetlands	70.50	9.12
Shrub	125.21	5.78
Grassland	448.36	0
Pasture/Hay	291.12	0.44
Cultivated Crops	173.47	0
Emergent Herbaceous Wetlands	82.73	0.22
Open Water	180.14	7.11
Total area	**2,675.23**	**286.67**

The urban forest area as defined in this study is approximately 11% of the total land area within Marine on St. Croix. Thirty nine percent (8.66 miles) of the public roads in Marine are included within the urban forest boundary.

A review of these data reveal that there are significant areas of developed landscapes within Marine on St. Croix that are not included within the core urban forest. These include areas such as Jackson Meadows, the Marine Stugas, and other significant areas of off-road greenspace (e.g. Marine Mill Historic Site, Burris Park, Oakland Cemetery, etc.). It also does not include scattered pockets of development across the landscape. An urban and community forestry plan should eventually include these areas, as well as areas of natural forest cover.

DEVELOPED LAND COVER AREA

Other Developed areas within Marine 55%

Within the Urban Forest 45%
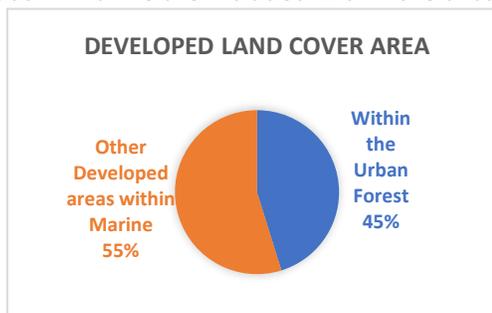
Characterizing the urban forest

The data acquired from the inventory of 925 urban trees was used to analyze Marine's trees at the population level, using the US Forest Service's i-tree software. Characteristics such as species, size, age, and ownership of trees were evaluated.

Diversity of Tree Species

The top ten species present in the urban forest represent 70% of the population. Thirty-seven other species were identified and make up the remaining population. This would suggest that there are at least 47 different species present (several trees were identified at the genus rather than species level). For example, there are at least two species of spruce (Norway and white) present in Marine, and three species of ash (white, green, and black) native to Minnesota, yet trees in the inventory were identified simplify as spruce or ash.
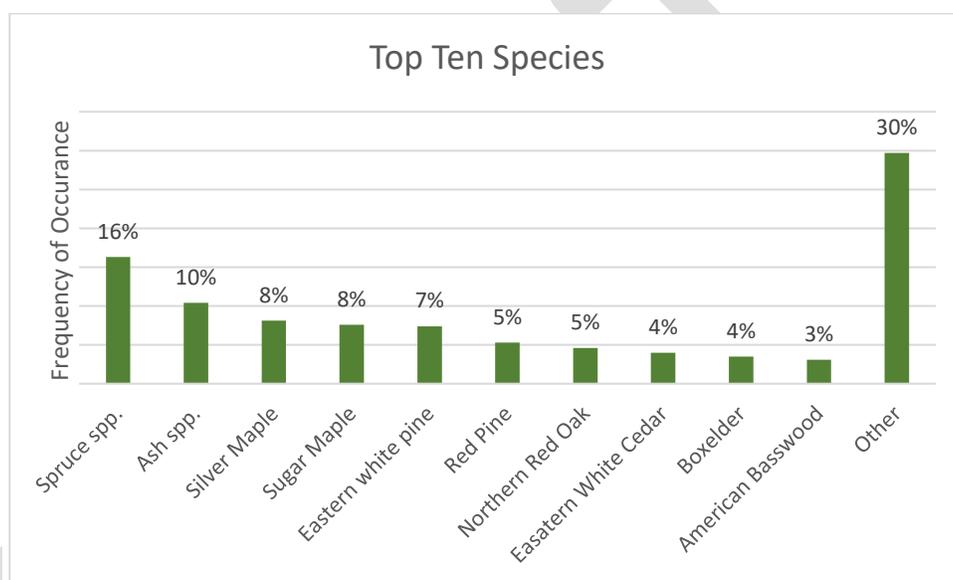
Figure 2 Frequency of occurrence, top ten species in Marine's urban forest.

The diversity of species in any forest is an important consideration. Lack of diversity carries with it potentially adverse consequences such as increasing the risk of pathogen infestations or disease outbreaks. A general rule of thumb is that no more than 10 percent of one species, 20 percent of one genus, and 30 percent of any one family be planted within a city's landscape. Marine's urban forest generally falls within this guideline. (Note on Fig 2: "Spruce (spp)" includes at least two species). The relative abundance of spruce is related to it commonly being planted in groups or rows of trees, often serving as a landscape screen planting. The same is true of eastern white cedar, where individual cedar trees were not counted in the inventory, but the presence of a cedar hedge of screen planting was noted.

Condition of trees

Most trees in Marine's urban forest were rated as being in good (or better) condition. This is typical for a population of trees that is valued for their landscape value. On the other end of the spectrum, four standing dead trees were identified.

There are noticeable differences in condition at the species level. Boxelder and butternut are the two species in which the trees are in the poorest condition. Butternut is a species in decline due to a virulent fungus.
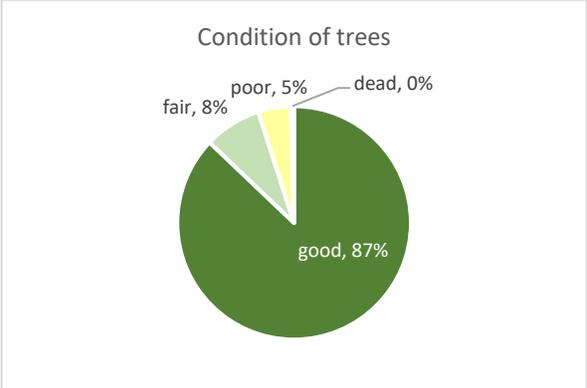
Figure 3 General conditions of trees in the urban forest

Size of trees

In a natural northern hardwood forest, small-diameter young stems typically represent a very large portion of the entire population. Competition between individual trees for limited resources and loss to pathogens, pests and herbivores result in a reduction in the number of stems in each subsequent diameter class. In contrast, the public tends to favor large trees. As a result, larger and older stems tend to be over-represented in formal landscapes associated with more intensive land uses such as urban and residential sites. This trend is apparent in the population of urban trees in Marine.

There are many large trees present in Marine's urban forest. Their impressive size lends a sense of history to the community. Fully two thirds of the trees are at least 12 inches in diameter at breast height (dbh), and the overall average diameter for the population is 16.6-inch dbh.

Also notable is the relative lack of trees in the smaller diameter classes used in the inventory. Trees less than 12 inch diameter make up just one third of the population – they are the future of Marine's urban forest. Finally, it is important to note that individual stems within continuous hedge plantings of eastern white cedar were not counted during the inventory.
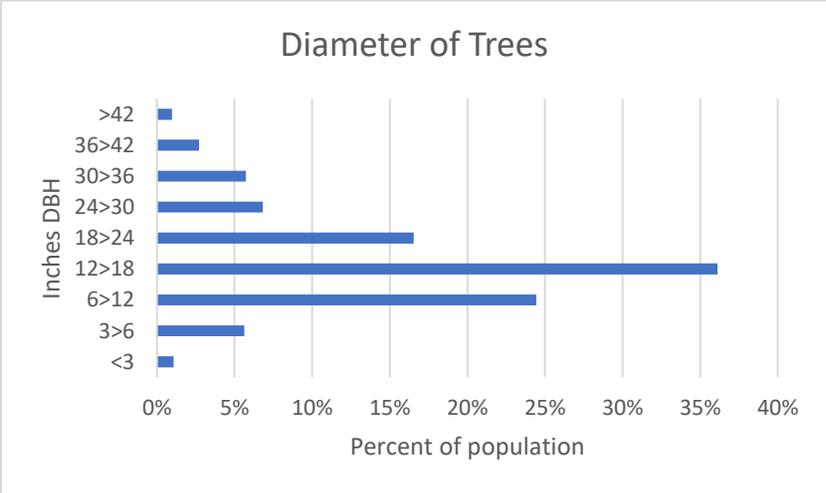

Figure 4 Diameter class distribution of trees in the urban forest

Age of trees

While tree diameter is influenced by site quality and competition, there is a general relationship between tree diameter and age. This relationship makes it possible to develop an approximate age profile for the trees in Marine's urban forest. Given that Marine Mills was founded in 1839, it should come as no surprise that there are many large old trees growing in the older residential areas of town. Many of these were likely established soon after homes were built and occupied, and some few may even pre-date original European settlement.
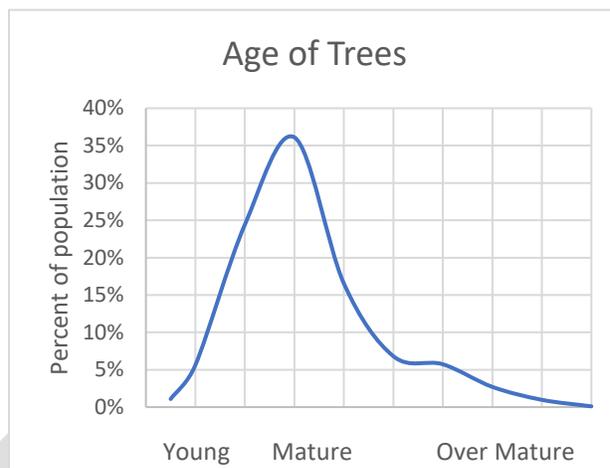

Figure 5 Estimated age class profile of the urban forest

Significant Trees

Several large specimen trees were noted during inventory. It should come as no surprise that there several very large, old trees growing in Marine, given the community's age. Nine trees had diameters in excess of 42 inches, the largest diameter class in the i-tree program, and another 25 trees were found to be more than three feet in diameter. The largest diameter recorded was an impressive silver maple that measures 54 inches.

The Minnesota DNR maintains a Big Tree Registry as part of American Forest's National Registry of Champion Trees. A very large black willow was identified during the urban forest inventory in 2017. It was nominated as a potential Champion Tree (largest know specimen of the species) and must be verified by a Minnesota DNR forester as State Champion. The nomination was then forwarded to American Forest, which recently confirmed it as National Champion for this species. A second potential Champion (northern catalpa, *Catalpa speciosa*) was identified during the inventory and submitted to Minnesota DNR for consideration. Unfortunately, at least for the time being, Minnesota DNR does not recognize non-native species for the big tree registry. This may change (with changing climate), as many of the trees now being recommended for planting in the urban forests of Minnesota are not native to the state.

Other trees noteworthy due to their significance to the community are the towering American elm on the south side of Village Hall, the "Montford Ash" north of the Post Office, and the impressive white oaks on the lawn of Christ Lutheran Church. These and others are "legacy trees," noteworthy for their great age, size or condition, or exceptional cultural, landscape or nature conservation value.

Stocking

Stocking describes the abundance of trees in an area (e.g. trees/acre). There are 253 (27%) trees growing in the public right of way, defined in the inventory as occurring within fifteen feet of roadway

pavement. The remaining 73% of urban trees in the inventory are growing beyond 15 feet to a survey distance of 50 feet, and generally are located in front yards of residences.

An inventory of available (unoccupied) roadside planting sites within fifteen feet of the nearly nine miles of public roads in the urban forest areas identified forty locations where a total of 250 new trees could be planted.

Table 2 Available roadside planting sites within Marine's urban forest area.

Linear feet of planting area	Size of tree suitable for site	Number of open planting sites
6325	large	127
4009	medium	100
709	small	24
11043	**TOTAL**	**250**

Marine on St Croix lacks the formal "tree lawns" between curb and sidewalk more typical of St. Paul or Minneapolis, or towns in New England. Thus, it may not be reasonable or desirable to expect high stocking density along residential streets in Marine.

Benefits of the Urban Forest: $148,395 per year

Once the urban forest inventory was completed it was possible to calculate the value of variety of ecosystem services provided by the trees in Marine's urban forest. The Forest Service's i-tree software tool includes functionality that supports development of such an estimate of the annual contribution urban trees make to a community. The values are defined as what are described as "ecosystem services." These calculations of value are based on a significant body of scientific and economic research.

The annual value attributed to Marine's 925 urban trees is estimated at $148,395 per year. Five different classes of ecosystem services make up this estimate.

Increase in Property Values and Quality of Life: $57,475 per year

Trees make an aesthetic contribution to the quality of life in a community. The presence, size, and growth of trees on a property also help increase the property's value, a benefit based on the estimated annual increase in private real estate. Improved real estate values is the largest annual benefit Marine's urban trees provide to the community. To be clear, this is not the appraised value of the 925 trees in the survey. They are a capital asset and green infrastructure with tangible value. This estimate is the return on investment from this asset.

Stormwater Mitigation: $48,132 per year

The value of this ecosystem services is based on the ability of individual trees and the urban forest canopy as a whole to mitigate adverse impacts of stormwater runoff through water retention. During

precipitation events, some portion of the falling water is intercepted by trees. Tree root systems promote soil permeability, infiltration rates and the soil's capacity to store water.

The value is calculated based on runoff reduction (water volume, economic value of stormwater management infrastructure savings in $). The i-tree models take into consideration the seasonal variation in leaf area for evergreen vs. deciduous trees and calculates precipitation interception based on local weather records.

Energy Conservation: $33,712 per year

This ecosystem service is defined in terms of the ability of trees to provide cooling summer shade. Trees, especially conifers, can provide shelter from winter winds, which reduces heat loss from buildings and unwanted infiltration of cold air into homes and buildings. The direct impact on energy consumption is based on local electric and gas utility rates.

Air Quality: $4,918 per year

Trees remove pollutants – nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (< 10 microns in diameter) – from the air we breathe. They also produce oxygen as a byproduct of photosynthesis. The value of this ecosystem service is based on the amount of pollutants removed and the avoided cost of treating them by other pollution control measures. The avoided cost of energy production emissions due to the energy conservation benefits of trees is also a factor.

Carbon Sequestration Value: $4,168 per year

Trees use carbon dioxide (CO_2) during photosynthesis and store it in woody tissue as they grow every year. The amount of carbon sequestered (stored) increases as the tree grows – a healthy, vigorously growing tree can tie up a significant amount of carbon as it grows larger. The value of carbon sequestration is based on the avoided cost of alternative CO_2 emission controls.

Issues of Concern in the Marine's Urban Forest

The Urban Forest Task Force's assessment of Marine's urban trees helps identify some issues of concern facing the future of Marine's urban forest.

Loss of ash

Ash (*Fraxinus spp.*) is the second most abundant tree in Marine's urban forest. This is a concern given the inevitable total loss of trees in all three species of ash due to Emerald Ash Borer infestation. The impact will be even more acutely felt in the green spaces within the central core of Marine, where ash represent far more than ten per cent of the trees growing in these streetscape and park areas.

Lack of young age classes of trees

Analysis of inventory data tells part of the story – there are many large old trees occurring in close association with homes and residences. More importantly, however, the data show that younger age classes of trees are underrepresented in the population. Figure 4 begins to tell the rest of the story and is confirmed by both casual observation and inventory: there are unoccupied sites where future generations of trees could be established.

Turf grass and landscape practices

The inventory work afforded the opportunity to conduct a less formal assessment of other challenges facing Marine's urban trees. Turf grass is a significant competitor of site resources including soil nutrients and moisture. Increased use of mulch would serve two purposes – reduce grass competition and reduce bark damage caused by string-based grass trimmers (a.k.a. weed whackers). The risk of damage to the thin bark of young trees is a special concern.

There may also be a problem with applications of broad leaf herbicides on lawns. Several conifer trees growing on open weed free lawns are in decline. The herbicide Imprelis® was used by lawn and landscape maintenance contractors for broad leaf weed control in turf, and since has been recognized as causing injury to conifers, in particular to Norway spruce and eastern white pine. While this is simply an observation, it may be worth follow up investigation for homeowners. DuPont, the producer of Imprelis®, has a claims procedure for damaged/dead trees due to application of the herbicide..

Urban and Community Forest Management Objectives

Achieve Tree City USA recognition

This goal includes five elements at the core of the Forest Management Plan. It provides basic structure to Marine's urban forest initiative.

Preservation of existing trees

Marine has nearly 1000 trees that have been identified within the urban forest boundaries. Since it takes time for new plantings to become established, it is important to retain what we already have. This goal also includes developing special recognition of Marine's Heritage Trees.

Increasing stocking

There are approximately 250 open planting sites that could be occupied by trees. Natural attrition and projected loss of ash due to Emerald Ash Borer creates the need for tree planting. The goal is to augment the existing population by planting additional trees in empty planting spaces, and to replace trees that die. Planting new trees will also address the issue of Marine's aging urban forest. This may include development of demonstration plantings of preferred species and developing a means of propagating trees in a gravel bed.

Response to Emerald Ash Borer (EAB)

Ten percent of the trees in Marine's urban forest are ash (*Fraxinus spp*.). There are also significant stands of black ash (*Fraxinus nigra*) on wet sites both within and beyond the urban forest boundary. All will be lost to the coming infestation of EAB. The goal is to develop a strategy to preserve some of the most significant trees (via treatment) and replace landscape trees lost to EAB. Options for mitigating the loss of trees in the black ash swamps need to be developed.

Invasive terrestrial plant management

The abundance of non-native buckthorn is a recognized problem. Amur maple also is becoming problem. Both species aggressively displace native shrubs and understory trees in open woods, and shade out native grasses and herbaceous plants in savanna habitat. Both are also prolific seed producers and re-sprout easily from cut stumps. The goal is to develop an invasive species strategy and work to reduce the abundance of non-native invasive terrestrial plants.

Mitigate tree-related risks

Consider risks trees pose to people and personal property. The risks are related to the structural failure of trees and parts of trees. The risk can occur as trees age and decline, or as trees are damaged in storms. This may also include consideration of storm-related resiliency. The goal is to develop a tree risk assessment and risk mitigation strategy.

Resident and stakeholder engagement

An informed and engaged community is important to the success of the urban forest initiative. The residents of Marine "own" the trees in public spaces, and many of the trees in the urban forest are growing on private property. Public engagement will help ensure

residents are informed, have a voice, and take ownership on tree related matters. Public participation increases opportunities for cooperation with other organizations and potential grants. The goal is proactive active engagement, raising residents' awareness of their city's green infrastructure assets.

Maintain the Forest Management Plan

The management plan should be a living document. It will be important to keep it up to date. The goal is to continue to refine the management plan, and to develop plans for areas not currently included in the plan. The first focus should be the large areas of open greenspace within the urban forest boundary, including Oakland Cemetery. The second area of focus should be incorporate areas of natural forest into the plan.

PROGRAMS/ACTIVITIES

Marine is in the process of developing an approach to urban and community forestry. Currently no programs, and only limited activities, are in place. The following is a forward-looking projection of what might be developed.

Pruning

Currently pruning is limited to repairing storm damage and addressing clearance and visual obstructions. Pruning (training) of new trees will be a part of propagation and planting new trees in the urban forest. A limited amount of structural pruning of young trees may be performed within a planted tree's first five growing seasons.

Removals

Currently tree removal is limited to clean up of storm damage. It is anticipated that need for tree removal will be a result of tree risk assessment activities and ash tree mortality.

Planting

There currently is no tree planting program in Marine. This management plan contemplates the development of a tree planting initiative. There is room for an additional 250 trees within the inventory areas (within 50 foot of a public road) and for additional trees in other large off-road green spaces. Finally, there is an opportunity to promote tree planting on private properties.

Initial work to establish a gravel bed was completed in 2018. The goal is to establish a gravel bed in spring 2019 and produce trees for planting in the Fall of 2019.

A list of preferred tree species and cultivars, and a list of prohibited species, will be developed and included in this plan.

Condition assessment inspections

There currently are no formal tree risk assessment activities. It will be important to consider mitigating risk associated with large trees in public green spaces.

Pests and pathogens

EAB will have a significant impact on Marine. All species of ash will be lost over the next several years. Currently one significant ash tree is being treated with an insecticide to protect it from EAB. There are other publicly owned ash trees that warrant preservation. Plans also need to be developed. It will be important to raise public awareness of EAB and provide some guidance as to mitigation options.

Community education

Work has begun to raise public awareness as to the importance of trees to the community. Work of the Urban Forest Taskforce has been included in the City newsletter and local newspaper. It will be important to regularly provide the citizenry with information of activities and programs.

Arbor Day celebration

Arbor Day activities involving students at River Grove Elementary School included tree-related lesson plans and an 2018 Arbor Day Celebration/tree planting event. An Arbor Day Proclamation was signed by the Mayor. Similar Arbor Day activities will be held each year.

Appendix A – Marine's Ash and EAB

There are eleven significant ash trees in public spaces in downtown Marine. The Emerald Ash Borer (EAB) will soon make its presence known in the community resulting in 100% mortality in the population of ash. The question is whether to preserve these trees because of their amenity value or let them succumb to this virulent invasive pest.

The Bug

Emerald Ash Borer (*Agrilus planpennis*) is an aggressive invasive species that will have a devastating impact on the population of ash trees (*Fraxinus spp*) in Marine. EAB, as the name implies, is a wood-boring insect. It kills trees by girdling them below the bark, interrupting the flow of nutrients between the root system and crown. Initial symptoms of infestation typically go undetected for the first two years, after which trees typically die within three to five years of the first indication of thinning of the leafy canopy. EAB has been officially detected in southern Washington County, and there have been unconfirmed sightings closer to Marine.

Insecticide Application

There are two different Insecticide treatments that target EAB. Treatment with an insecticide[4] injected into the trunk of large ash trees has been shown to be quite effective in protecting them from EAB infestation for up to two years, after which time a follow-up application(s) would be required. The cost of treatment by a qualified applicator would be <$12/diameter inch. A less effective soil applied insecticide[5] treatment that must be applied annual at a cost of <$5/ diameter inch is also an option. In either case, early preventive treatments yield the best results, especially in large mature trees.

The Montfort Ash

This is the largest ash tree growing in public space within the downtown area, and perhaps in all of Marine on St Croix. It has a full spreading crown and a trunk diameter of 34 inches.

The tree is located in Montfort Park (telephone company property) across the street (north) from the post office. A plaque in front of this tree *"Dedicates this green space to Montfort Dunn on the occasion of his 97th birthday (5/15/04)."*

This is a large specimen tree worth saving. Without treatment it will die. Removal of large ash trees from formal landscapes such as this is expensive work.

The cost of treating this tree with the most effective insecticide would be approximately $350 every other year, or $175 annually.

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[4] Emamectrin benzoate
[5] Imidacloprid

Three Ash in the Gazebo Commons

There are three mature ash trees in the public space between Highway 96 and Judd Street. The northern most tree is in a planting with three now-dead Scots pine. Since the three pines need to be removed, it would be the lone remaining tree in an otherwise open lawn area. The other two mature ash trees in this area located north and south of the gazebo. While both are significant trees in the landscape, the aesthetic impact of their loss would be lessened by the presence of other trees.

Montfort Ash

Three Ash in Commemorative Commons

There are three mature ash trees in the park the contains the commemorative plaque and flag pole, across from the General Store. They range in diameter from 19-22 inches.

Two Ash Behind the Bank

There are two mature 18 inch diameter ash trees along the street behind the Security State Bank of Marine.

Two Ash at the Settlers Cabin

There are two mature ash trees in the public space south of the early settler's cabin in Burris Park. They 19 and 22 inches in diameter.

Ash at Marine Mill Historic Site

Preventive treatment of the many ash trees in the naturally occurring forest stand at the Old Marine Mill site would be impractical. Minnesota Historical Society, which owns the site, has developed a Forest Stewardship Plan that recommends staggered removal of ash, in anticipation of EAB mortality, and replacement with other native species.

	The Tree	Diameter	Tree injection costs, 2-year protection	Equivalent Annual cost for injection	Soil applied Cost, 1-year protection	Estimated cost of removal
1.	Montfort ash	34" dbh	$350	$175/yr.	Not recommended	?
2.	Northern most ash	20" dbh	$240	$120/yr.	$100	?
3.	Gazebo north ash	23" dbh	$275	$135/yr.	$115	?
4.	Gazebo south ash	27" dbh	$325	$160/yr.	$135	?
5.	Flag pole east ash	22" dbh	$260	$130/yr.	$110	?
6.	Flag pole south ash	22" dbh	$260	$130/yr.	$110	?
7.	Parking area ash	19" dbh	$225	$115/yr.	$95	?
8.	Bank north ash	18" dbh	$215	$110/yr.	$90	?
9.	Bank South ash	18" dbh	$215	$110/yr.	$90	?
10.	Settlers cabin ash	19" dbh	$225	$115/yr.	$95	?
11.	Settlers cabin ash	20" dbh	$240	$120/yr.	$100	?

Without preventive treatment, we can expect the coming EAB infestation to result in the total loss of ash in Marine's urban and native forest. Trees in public spaces are assets to the community. Surely some are worth an investment in preventive treatment in order to preserve their value. Such an investment also avoids the cost of removal due to premature mortality as a result of EAB infestation.

Appendix B – Preferred and Prohibited Planting Lists

To Be Developed:

- list of suitable tree species and cultivars that constitutes the official Street Tree species for the City.
- maintain a list of tree species that are unsuitable for planting.

Appendix C – Requirements for becoming a Tree City USA

Standard 1a: A Tree Board or Department

A tree board or commission is a group of volunteer citizens charged by ordinance with developing and administering a comprehensive tree management plan. A tree board can be substituted with a city employee if they are charged with developing and administering a tree management plan.

Standard 1b: A Tree Management Plan

- Elements of a tree management plan
- Vision and goals
- Short-term and long-term action items
- Tree inventory data and analysis–species distribution, planting sites, condition assessment, maintenance needs
- Tree maintenance plan
- Tree trimming, planting, and nursery stock standards
- Tree risk reduction/emergency storm response
- Public relations and education
- Urban forest cost/benefit analysis

Standard 2: A Tree Care Ordinance

A tree ordinance is a tool for proper tree care by delegating authority to a board or department and establishing protection and regulation of public trees. Minimum tree care ordinance provisions:

- Purpose and intent
- Definitions
- Appeals
- Penalty for violations
- Performance evaluation of ordinance
- Severability
- Designate administrative responsibility to implement and enforce ordinance

Standard 3: A Community Forestry Program with an Annual Budget of at Least $2 per Capita

Eligible costs associated with:

- Tree planting and initial care
- Tree removals
- Tree maintenance–pruning, watering, fertilizing, mulching
- Tree inventories
- Public education
- Professional training
- Salaries for city staff or contractors
- Memberships
- Pest management
- Volunteer time

Standard 4: An Arbor Day Proclamation and Observance

Proclamation:

- Issued each year
- Signed by the mayor
- Language–unique to city, based on state proclamation, or based on Arbor Day Foundation proclamation
- Celebration

Observance

An Arbor Day or Arbor Month (May) celebration is an opportunity to educate about trees and tree care. Celebrations can be:

- Tree planting event at a local park or school, along boulevards, other spaces
- Can be combined with other festivals/celebrations
- Involve school children, Scouts, non-profit organizations, local businesses, utilities
- Honoring individuals who have made important contributions to the city
- Community tree sale or give away