EMERALD ASH BORER PLAN ASSESSMENT

Village of Shorewood, Wisconsin

December 2019

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INTRODUCTION

The emerald ash borer (*Agrilus planipennis* Fairmaire), an exotic, invasive wood boring beetle native to Asia, was first discovered in North America during the summer of 2002 feeding on ash trees in a suburb outside of Detroit, Michigan. Believed to have arrived on solid-wood packing material used to ship cargo from Asia, the beetle's larvae were found feeding in the cambium layer of ash trees, just beneath the bark, where they disrupted the flow of food and water throughout the tree. Research suggests that the emerald ash borer (EAB) arrived in Michigan 10–15 years before its discovery, and with no natural predators and a lack of tree defenses to protect against the insect, EAB flourished. By the time of its discovery, ash trees in southeast Michigan were so heavily infested with EAB larvae, that their feeding completely disrupted the flow of water, food, and nutrients, causing the trees to die. Since its discovery in 2002, EAB infestations have been discovered in 35 states (including Wisconsin), the District of Columbia, and 5 Canadian provinces, and is estimated to have killed over a hundred million ash trees.

The first discovery of EAB in Wisconsin was in 2008 in a community in the southeastern part of the state. Since that initial discovery, EAB populations have been found throughout the state, including Milwaukee County. EAB infests all ash species native to Wisconsin, including *Fraxinus pennsylvanica* (green ash), *F. americana* (white ash), *F. nigra* (black ash), and *F. quadrangulata* (blue ash), and the non-native *F. excelsior* (European ash). These species are fairly common in the Wisconsin landscape, and according to University of Wisconsin Extension[1], there are an estimated 750 million ash trees growing in forested areas of the state, and over 5 million growing in urban areas, like the Village of Shorewood.

EAB was first detected in several private trees in the Village of Shorewood in 2016 and has since spread to Village-owned untreated ash. Even before EAB was discovered in Shorewood the Village had started to proactively prepare and manage for its arrival with the development of the "*The Village of Shorewood Emerald Ash Borer Readiness Plan"* in 2009. The plan provided an assessment of the village's current ash tree population, existing resources, including staffing, equipment, and budget, and provided ash management recommendations. The village began implementing the Readiness Plan in 2010, focusing on treating ash trees, and in 2014 implemented a program to remove and replace select ash trees as part of curb and gutter replacement projects and major infrastructure improvement projects.

In 2019, the Village of Shorewood continued its proactive EAB management approach by contracting with the Davey Resource Group, Inc. "DRG" to update the village's street tree inventory and review their EAB management program.

This report details DRG's review of Shorewood's EAB management program. It highlights EAB program successes, identifies challenges, and provides recommendations and opportunities to improve Shorewood's EAB management program. Recommendations are based on current research, generally accepted industry best management practices (BMPs) and assumed continued village resources. The analysis and recommendations provided will help achieve the village's EAB

[1] University of Wisconsin-Madison Extension - http://labs.russell.wisc.edu/eab/2013/12/09/welcome/

management goal "*to minimize the economic, aesthetic, and ecological impacts of the emerald ash borer on the Village of Shorewood and surrounding communities.*"

REVIEW AND ANALYSIS: VILLAGE OF SHOREWOOD EAB READINESS PLAN (2009)

The review of the Village of Shorewood's EAB program focused on an analysis of the 2009 *EAB Readiness Plan* (*Plan*), and provides a summary of the information, actions, and strategies in the *Plan;* highlights successes and challenges in implementation; examines how the *Plan* relates to the 2015 urban forest management plan and the 2014 ash tree removal and replacement program; and provides recommendations/opportunities to improve the village's EAB program.

Summary of Plan Elements, Actions, and Strategies

The Village of Shorewood's *EAB Readiness Plan* recommended a hybrid EAB management approach that focused on targeted ash tree removal and replacement, and chemical treatment. The ultimate goal of the hybrid strategy was to proactively manage Shorewood's public ash tree population utilizing existing staff and budget resources, which would allow for the eventual removal and replacement of the ash resource over 20- to 30-year period versus a 5- to 10-year period with a reactive program (no chemical treatment; assumes all ash trees die within ~5 years of EAB confirmed presence).

This section provides a summary of the information, actions, and strategies in the 2009 *EAB Readiness Plan* and highlights successes in implementation.

Municipal Authority

The Village of Shorewood has a robust ordinance declaring Dutch elm disease and elm trees infected with the disease a public nuisance. The plan recommended that the village update its ordinances to include the emerald ash borer and provide general language to cover any other future tree pest or disease that may impact the community's trees.

Hybrid Management Approach: Removal and Replacement and Chemical Treatment

The Readiness plan recommended the targeted, pre-emptive removal and replacement of ash trees less than 8" in diameter at breast height (DBH) or trees with a condition rating below 50%. Ash trees meeting the size and/or condition removal criteria were then further prioritized based on location, with trees in the combined sewer system having a higher removal priority than those growing in areas with a separate sewer system. The location prioritization was based on the impact that the loss of ash trees and their canopies would have on the quantity of stormwater runoff entering the combined sewer system. Trees removed would be replaced with a focus on selecting tree species to increase the diversity of the street tree population.

Ash trees larger than 8" DBH with a condition rating greater than 50% were recommended for chemical treatment under the plan. Treatment of trees would be scheduled and prioritized based on the following factors:

- Size (largest trees = highest priority)
- Location
  - Combined sewer areas were a higher priority based on the impact that the loss of these large trees would have on the quantity of stormwater entering the sewer system.
  - Streets with blocks that were ash monoculture or where they were the dominant species.

Wood Waste Disposal

Due to the small number of ash trees anticipated to be removed each year, the village did not establish a wood waste disposal strategy in the plan.

Cost Analysis

Contract Versus In-House Staff

The village conducted a cost analysis comparing the use of contractors versus the use of village staff to conduct the *EAB Readiness Plan* recommendations. Based on the 2009 analysis, the cost for village staff to perform select, preemptive ash tree removals/replacements and ash treatment was 50% less than the cost of a contractor to perform the same work at the time the plan was written.

Public Education and Outreach

The Village of Shorewood is committed to utilizing existing communication channels (i.e., village website, Shorewood Today) and explore opportunities to expand outreach and awareness around EAB and how the community and residents can manage the infestation.

Plan Accomplishments

The Village has had success in implementing several strategies and recommendations in their *EAB Readiness Plan*, including:

- Adopting Ordinance 2063, *Declaring trees infested with emerald ash borer a public nuisance in the Village of Shorewood,* in 2016.
- Removing 372 ash trees that were either small in diameter, in poor condition, or removed in conjunction with public infrastructure projects (see Table 1).
- Planting a diverse mix of tree species to replace removed ash trees.
- Instituting a moratorium on the planting of *Fraxinus* (ash) species.
- Administering approximately 3,155 treatments of TREE-age (*Emamectin benzoate)* to prevent emerald ash borer. Note: the number of ash treatments does not equal the number of individual ash trees treated. The number of ash treatments reported includes those ash trees that have been treated multiple times since 2010.
- Dedicating a line item in the village's budget for EAB treatment. In fiscal year 2019, $20,000 was allocated for EAB treatment.

Table 1. Comparison of Ash Street Tree Population 2009–2019

Year	Number of Ash Street Trees	Percent of Street Tree Population
2009	1,814	28%
2015	1,627	26%
2019	1,442	22%

Evaluation and Recommendations

Along with program accomplishments the analysis of the plan also revealed opportunities, challenges, and recommendations for improving Shorewood's EAB management program. They are detailed below and are organized around the items described in the "Summary of Plan Elements, Actions and Strategies" section.

Municipal Authority

Shorewood adopted Ordinance 2063 that specifically addresses the emerald ash borer; however, the *Plan* recommended a more general ordinance revision that would cover emerald ash borer and other insects/diseases that may attack trees.

Recommendation

1. To prepare for future insect/disease pests, the village should revise its ordinance to include more general language related to insects and diseases that may impact trees. This is also an opportunity to address the future hazard of private trees infested with EAB that have the potential to impact neighboring residences or public property.

   Resource: The Arbor Day Foundation's sample Tree City USA tree ordinance can be used as a model for the Village of Shorewood.

   > *"Section 15. Dead or Diseased Tree Removal on Private Property. The City shall have the right to cause the removal of any dead or diseased trees on private property within the city, when such trees constitute a hazard to life and property, or harbor insects or disease which constitute a potential threat to other trees within the city. The City Tree Board will notify in writing the owners of such trees. Removal shall be done by said owners at their own expense within sixty days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal on the owners property tax notice."*
   >
   > Source: Arbor Day Foundation: arborday.org/programs/treecityusa/apply.cfm

Hybrid Management Approach: Removal and Replacement and Chemical Treatment

The *Plan* recommended the targeted, pre-emptive removal and replacement of ash trees less than 8" in diameter at breast height (DBH) or trees with a condition rating below 50%; and the chemical treatment of ash trees larger than 8" DBH with a condition rating greater than 50%.

In 2009, the village had 346 ash trees that were less than 8" DBH and 155 ash trees that had a condition rating below 50% for a total of 501 trees recommended for removal. Based on the numbers outlined in Table 1, Shorewood has removed 372 ash trees since 2009, below the *Plan's* recommended number of removals. The slower pace in addressing ash tree removals has been due, in large part, to a significant storm event in the summer of 2010 where 8 inches of rain fell on the village within a 2-hour period, leading to significant flooding and sewer system failures. For several years following this event, storm related clean-up activities were the highest priority for village resources. As a result, ash tree removals were prioritized and completed only in areas where major infrastructure projects were occurring.

For chemical treatment, the *Plan* recommended the treatment of half of the village's ash population each year or 657 trees. The village began ash treatments using *Emamectin benzoate* (tradename: TREE-age) in 2010. TREE-age is a systemic insecticide that is injected directly into the tree trunk, where it is transported and absorbed through the tree's vascular system. According to the multi-state extension bulletin "*Insecticide Options for Protection Ash Trees from Emerald Ash Borer",* for the chemical treatment of TREE-age to be most effective, it must be applied to an ash tree in the spring every 2 years.

While it is easy to understand why the village has strived to treat as many ash trees as possible, village staff have been unable to meet the goal of the *Plan* to treat 657 trees each spring. According to the urban forest management plan and interviews with village staff, there are not adequate resources for staff to fully implement the EAB management strategy outlined in the *EAB Readiness Plan* and to also continue to plant, care for, and maintain the non-ash trees in Shorewood's urban forest.

With the current village resources allocated for EAB treatment and the limited treatment window (approximately 4-6 weeks each spring), the village adheres to a 3-year cycle to treat ash trees. The cycle treats ash trees on select village blocks with TREE-age every 3 years; the TREE-age dose injected by Village staff is adjusted to account for the 3-year cycle. This allows staff to be efficient with time and resources by staying within pre-determined geographic areas each spring. In 2019, staff treated 363 ash trees, and not the *Plan* goal of 657 trees. While studies have indicated that a 3-year TREE-age treatment cycle provides effective EAB protection, maintaining a 3-year cycle does not allow for unexpected changes in village priorities and reallocation of resources that could lead to missing a treatment year. This could extend the treatment cycle to 4 years, putting the community's most valuable ash trees at risk of EAB infestation.

There is currently no long-term solution to protect ash trees against the emerald ash borer. The village's choices are limited to removing and replacing ash trees or chemically treating them to provide short-term protection and repeating treatment every several years to maintain protection. Extensive studies conducted by Michigan State University, Ohio State University, Purdue University and the Morton Arboretum have found that TREE-age is a highly effective short-term treatment option for EAB. However, it should be noted that there are currently no published studies on the long-term effectiveness of TREE-age on ash trees or the effects that repeatedly wounding the trunk has on the long-term health of the tree.

The recommendations described below outline four EAB management level of service scenarios from the Village's current service level to a high level of service utilizing the hybrid management approach of EAB chemical treatment and select ash tree removals and replacement. Each level of service is described in the recommendations, and Table 2 provides details including the annual

cost for each level. Additional details on the level of service analysis can be found in Appendix A.

Recommendations

1. The Village's EAB program was designed to manage the impacts of EAB on the community with the goal of wisely using limited resources to treat select ash trees while removing small or poor-quality trees and replacing with non-ash trees to build a resilient and sustainable urban forest. Utilizing Table 2 and the descriptions below, identify the Village of Shorewood's desired EAB program goals and level of service taking into consideration the Village's overall urban forestry program goals as outlined in the Urban Forest Management Plan and available resources.

   IMPORTANT NOTES:

   - When selecting a Level of Service and EAB management strategy consideration should be given to resources necessary to perform management activities on the remaining non-ash tree resources, which make up 78% of the ROW tree canopy.
   - Current EAB level of service is not meeting 2009 *Plan* treatment and removal recommendations or industry standard BMPs and is putting ash trees at risk for EAB infestation.
   - The treatment size is recommended to increase from 8" DBH or greater to 12" DBH or greater based on BMPs that prioritize resources on treating the highest value ash trees in a community. Trees less than 12" DBH are considered young/establishing and not high value ash trees.
   - To maximize the Village's resources, it is recommended all European ash trees, regardless of size, are removed. Village staff have noted this species has difficulty taking up the EAB chemical treatment and in general does not thrive within Shorewood's urban environment, especially during periods of hot/dry weather.
   - Any Level of Service other than the current low level of service (A) **will require additional resources,** including contracting EAB management activities
   - The Level of Service Scenarios B & C include the costs to address the highest priority EAB management activities and are based on industry standard best management practices (BMPs).
     - The average tree care contractor costs for Midwest US cities is used because Village staff cannot perform all necessary activities under these LOS scenarios and some EAB management activities will need to be performed by contracted tree care companies.
   - Level of Service C recommends a 2-year treatment cycle based on current research that establishes that treatment cycle length as the most effective to protect ash trees from EAB. It also allows for flexibility in the event that village EAB treatment resources are reallocated to a different village priority for one year.
   - Costs for the Ash Tree Replacement Program (ash trees removed in conjunction with major capital improvement projects) apply to all scenarios and are shown as a separate chart in the Appendix.

a. **Level of Service A (Current - LOW):** Maintain current EAB level of service treating ash trees 8" DBH or greater, that are in fair or better condition, on a 3-year treatment cycle; remove/replace ash trees as resources allow. Fully implement the village's Ash Tree Replacement Program. Through the program, remove and replace ash trees in conjunction with major infrastructure and improvement projects that have a condition rating of less than 50% and all green and European ash less than 24" DBH regardless of condition. Costs of this level of service remain the same year to year because no changes are proposed to current practices.

   Please Note: The current EAB level of service **is not meeting 2009 *Plan*** treatment and removal recommendations or industry standard BMPs and is **putting ash trees at risk** for EAB infestation.

b. **Level of Service B (Medium):** Increase the minimum diameter to treat ash trees in fair or better condition, from 8" DBH to 12" DBH; remove green and white ash trees less than 12" DBH and all European ash, regardless of size, within 3 years; replace with a diverse palette of species. Continue to treat ash street trees on a 3-year cycle. Fully implement the village's Ash Tree Replacement Program. Through the program, remove and replace ash trees in conjunction with major infrastructure and improvement projects that have a condition rating of less than 50% and all green and European ash less than 24" DBH regardless of condition. Level of Service B has higher costs in Years 1-3 with costs decreasing beginning in Year 4.

c. **Level of Service C (High):** Increase the minimum diameter to treat ash trees in fair or better condition, from 8" DBH to 12" DBH; treat trees on a 2-year cycle; remove green and white ash trees less than 12" DBH and all European ash, regardless of size, within 2 years and replace with a diverse palette of species. Fully implement the village's Ash Tree Replacement Program. Through the program, remove and replace ash trees in conjunction with major infrastructure and improvement projects that have a condition rating of less than 50% and all green and European ash less than 24" DBH regardless of condition. Level of Service C has higher costs in Years 1 and 2 with costs decreasing beginning in Year 3.

2. As Village resources allow, increase/re-allocate funding to the forestry's budget to ensure there is adequate funding to meet the village's desired EAB program goals and level of service, while also planting, caring for, and maintaining the non-ash trees in the village's urban forest (77% of the urban tree canopy) (see Cost Analysis Recommendation #1).
3. Continue to remove ash trees in conjunction with major capital and infrastructure improvement projects (Ash Tree Replacement Program).
4. Continue to prioritize ash tree removal/replacement and ash treatment in areas with combined sewers, based on the impact that the loss of these large trees would have on the quantity of stormwater entering the sewer system and on streets with blocks that are ash monocultures or where they are the dominant species.
5. Review, evaluate, and update the village's EAB management practices periodically based on current EAB research on treatment and best management practices.

Table 2. SUMMARY EAB Management Level of Service Scenarios (YEAR 1)

YEAR 1: Total Number of Ash Street Trees Requiring Action Under Each Scenario								
	YEAR 1: TREES PER MANAGEMENT ACTIVITY Number of Trees Based on LOS				MANAGEMENT ACTIVITY ASH TREE REPLACEMENT PROGRAM			
Level of Service Scenarios	**Ash Removal**	**Ash Treatment**	**Stump Removal (Ash)**	**Planting (Ash Replacements)**	**Ash Removal**	**Stump Removal**	**Planting**	**Total Cost**
A (LOW- Current)*	18	363	18	18	28	28	28	**$113,582.00**
B (MEDIUM)**	113	370	113	113	28	28	28	**$192,192.00**
D (HIGH)***	169	555	169	169	28	28	28	**$276,514.00**

* **Scenario A – Scenario is not meeting the Village's 2009 EAB Plan and is putting ash trees at risk.**
Number of Ash Removals is based on average annual number of ash removals in Shorewood from 2015-2018.
Number of Ash Treated is based on number of trees treated in 2019.
Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green ash less than 24" and all European ash, regardless of size, in conjunction with major infrastructure programs over a 20-year period. s number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

****Scenario B – Scenario will require additional Village resources, which will include contracting out EAB management activities.**
Number of Ash Removals is based on removing the 211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 3 years.
Number of Ash Treated is based on treating on a 3-year cycle. Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green ash less than 24" and all European ash, regardless of size, in conjunction with major infrastructure programs over a 20-year period. s number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

*****Scenario C – Scenario will require additional Village resources, which will include contracting out EAB management activities.**
Number of Ash Removals is based on removing the211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 2 years.
Number of Ash Treated is based on treating on a 2-year cycle.
Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green and European Ash less than 24" DBH in conjunction with major infrastructure programs over a 20-year period. This number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

Wood Waste Disposal

To date, the Village of Shorewood has not had a significant number of ash logs that have warranted development of a wood waste disposal plan/program.

Recommendation

1. If the number of ash trees removed becomes significant and wood waste disposal becomes an issue, explore wood utilization opportunities and partnerships with neighboring communities.

   Resource: The Urban Wood Toolkit developed by the Urban Wood Network can help the Village of Shorewood identify ways to utilize wood waste for a higher value. To view the toolkit, visit http://urbanwoodnetwork.org/wp-content/uploads/2019/01/The-Urban-Wood-Toolkit.pdf.

Cost Analysis

The cost analyses provided in the *Plan* included a comparison of in-house staff versus contractor and costs associated with different EAB management scenarios; however, it did not provide costs for a hybrid approach of using in-house village crews and contractors. At the time, the information

in the cost analysis provided a compelling case for performing all EAB and urban forestry management with in-house village crews. However, as described previously, the village does not currently have the staff or resources to adequately and fully manage EAB or its urban forest.

Recommendations

1. Develop cost analysis scenarios for in-house village crews only, contractors only, and a hybrid of village crews and contractors to implement the recommended revised EAB management program, including increasing the DBH for ash treatment to 12", removing ash trees that are less than 12" DBH and removing all European ash, regardless of size.
2. Based on the scenarios created in Recommendations #1, develop a recommended budget and justification to secure additional program resources.

Public Education and Outreach

The Village of Shorewood committed to utilizing existing communication channels (i.e., village website, Shorewood Today) and explore opportunities to expand outreach and awareness around EAB.

The village website provides information about the emerald ash borer management program, including a summary of management activities, and links to the 2009 Readiness Plan and Ash Tree Replacement program. With EAB identified within the Village of Shorewood, the village should continue their public outreach and education efforts.

Recommendation

Continue to develop, explore, and expand public outreach and education opportunities focused on providing information about the emerald ash borer infestation, current village management activities, and proposed program changes and resources for residents when they find EAB on their property.

CONCLUSION

The success of any plan or program is not only in its development but also in its implementation and evaluation. The Village of Shorewood should be commended for not only developing and implementing their *EAB Readiness Plan* in 2009, but also recognizing that after a decade the *Plan* should be reviewed and evaluated.

DRG's review and analysis of the Village of Shorewood's emerald ash borer program and *EAB Readiness Plan* has highlighted program successes, identified issues and challenges related to implementation, and provided recommendations to improve the village's EAB management program. The analysis and recommendations provided will help achieve the village's EAB management goal "*to minimize the economic, aesthetic, and ecological impacts of the emerald ash borer on the Village of Shorewood and surrounding communities."*

While the Village of Shorewood has developed a solid foundation for managing EAB, the relatively recent discovery of it within the village borders will require a renewed commitment and vigilance in the application of the village's EAB management strategies.

APPENDIX A
LEVEL OF SERVICE ANALYSIS

IMPORTANT NOTES:

- When selecting a Level of Service and EAB management strategy consideration should be given to resources necessary to perform management activities on the remaining non-ash tree resources, which make up 78% of the ROW tree canopy.
- Current EAB level of service is not meeting 2009 *Plan* treatment and removal recommendations or industry standard BMPs and is putting ash trees at risk for EAB infestation.
- The treatment size is recommended to increase from 8" DBH or greater to 12" DBH or greater based on BMPs that prioritize resources on treating the highest value ash trees in a community. Trees less than 12" DBH are considered young/establishing and not high value ash trees.
- To maximize the Village's resources, it is recommended all European ash trees, regardless of size, are removed. Village staff have noted this species has difficulty taking up the EAB chemical treatment and in general does not thrive within Shorewood's urban environment, especially during periods of hot/dry weather.
- Any Level of Service other than the current low level of service (A) **will require additional resources,** including contracting EAB management activities
- The Level of Service Scenarios B & C include the costs to address the highest priority EAB management activities and are based on industry standard best management practices (BMPs). For Scenario B – Years 1-3 have higher costs and beginning in Year 4 the costs are lower. For Scenario C – Years 1 and 2 have higher costs and beginning in Year 3 the costs are lower.
- The average tree care contractor costs for Midwest US cities is used because Village staff cannot perform all necessary activities under these LOS scenarios and some EAB management activities will need to be performed by contracted tree care companies.
- Level of Service C recommends a 2-year treatment cycle based on current research that establishes that treatment cycle length as the most effective to protect ash trees from EAB. It also allows for flexibility in the event that village EAB treatment resources are reallocated to a different village priority for one year.
- Costs for the Ash Tree Replacement Program (ash trees removed in conjunction with major capital improvement projects) apply to all scenarios and are shown as a separate chart in the Appendix.

Summary of Ash Tree Population & Recommended Treatment Based on 2019 Street Tree Inventory

Ash Species	Total # of trees	<12" DBH	12–23" DBH	>24"	Poor/Dead Condition	Ash >12" DBH Recommended Treatment	Ash <12" Recommended Removals
White Ash (*Fraxinus americana)*	602	126	351	125	1	476	126
Green Ash (*Fraxinus pennsylvanica)*	711	83	360	268	4	628	83
European Ash (*Fraxinus excelsior)*	129	2	113	14	0	0	129
Total	**1,442**	**211**	**824**	**407**	**5**	**1104**	**338**

EAB Management Level of Service Scenarios - YEAR 1

YEAR 1: Total Number of Ash Street Trees Requiring Action Under Each Scenario

	YEAR 1: TREES PER MANAGEMENT ACTIVITY Number of Trees Based on LOS				YEAR 1: MANAGEMENT ACTIVITY ASH TREE REPLACEMENT PROGRAM			
Level of Service Scenarios	**Ash Removal**	**Ash Treatment**	**Stump Removal (Ash)**	**Planting (Ash Replacements)**	**Ash Removal**	**Stump Removal**	**Planting**	**Total Cost**
A (LOW- Current)*	18	363	18	18	28	28	28	**$113,582.00**
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D (HIGH)**	169	555	169	169	28	28	28	**$276,514.00**

* **Scenario A – Scenario is not meeting the Village's 2009 EAB Plan and is putting ash trees at risk.**

Number of Ash Removals is based on average annual number of ash removals in Shorewood from 2015-2018.

Number of Ash Treated is based on number of trees treated in 2019.

Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green ash less than 24" and all European ash, regardless of size, in conjunction with major infrastructure programs over a 20-year period. s number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

****Scenario B – Scenario will require additional Village resources, including contracting out EAB management activities.**

Number of Ash Removals is based on removing the 211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 3 years.

Number of Ash Treated is based on treating on a 3-year cycle. Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green ash less than 24" and all European ash, regardless of size, in conjunction with major infrastructure programs over a 20-year period. s number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

*****Scenario C – Scenario will require additional Village resources, including contracting out EAB management activities.**

Number of Ash Removals is based on removing the211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 2 years.

Number of Ash Treated is based on treating on a 2-year cycle.

Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green and European Ash less than 24" DBH in conjunction with major infrastructure programs over a 20-year period. This number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program.

Ash Tree Replacement Program

Costs for the Ash Tree Replacement Program should be added to all Scenarios.

	Number of Trees Per Year*	Average Cost (Midwest)	Total Cost
Removals - Ash Tree Replacement Program	28	$ 378.00	$ 10,584.00
Stump Removal - Ash Tree Replacement Program	28	$ 154.00	$ 4,312.00
Planting - Ash Tree Replacement Program	28	$ 280.00	$ 7,840.00
	Ash Management		**$ 22,736.00**

*Number of Removals/Stumps/Planting for the Ash Tree Replacement Program is based on removal of green and European Ash less than 24" DBH in conjunction with major infrastructure programs over a 20-year period. This number may vary depending on the number of ash trees removed annually as part of the Village's EAB Management Program

Level of Service A (LOW - Current)

- Maintain current EAB level of service treating ash trees 8" DBH or greater on a 3-year treatment cycle.
- Remove/Replace ash trees as resources allow.
- Fully implement the village's Ash Tree Replacement Program
- Years 2-4 have similar costs because this Scenario proposes to continue the current level of service

Note: **The current EAB level of service is not meeting 2009 *Plan* treatment and removal recommendations or industry standard BMPs and is putting ash trees at risk for EAB infestation**.

Management Activity	Avg. # of Trees*	Avg. Cost (Midwest)**	Total Cost
Ash Removal (All Sizes)	18	$ 378.00	$ 6,804.00
Ash Treatment (>8" DBH)***	363	$ 210.00	$ 76,230.00
Stump Removal (Ash)	18	$ 154.00	$ 2,772.00
Planting (Ash Replacements)	18	$ 280.00	$ 5,040.00
	Ash Management		**$ 90,846.00**

* Number of Ash Removals is based on average annual number of ash removals from 2015–2018
** The average tree care contractor costs for Midwest US cities is used because Village staff cannot perform all necessary activities under these LOS scenarios and some EAB management activities will need to be performed by contracted tree care companies.

***Ash Treatment cost of $210 based on average size of ash tree in Shorewood (21" diameter) and average per inch cost to treat an ash tree in the Midwest ($!0/inch)

Level of Service B (Medium)

- **Scenario will require additional Village resources, including contracting out EAB management activities.**
- Increase the minimum diameter to treat ash trees from 8" DBH to 12" DBH.
- Continue to treat ash street trees on a 3-year cycle.
- Remove green and white ash less than 12" DBH and all European ash, regardless of size, within 3 years and replace with a diverse palette of species.
- After 3 years remove ash based on risk posed to the community and as needed.- estimated at 10% of the ash tree population per year
- Fully implement the village's Ash Tree Replacement Program.

	Average Cost (Midwest)*	YEAR 1: Number of Trees**	YEAR 1: Cost	YEAR 2: Number of Trees**	YEAR 2: Cost	YEAR 3: Number of Trees**	YEAR 3: Cost	YEAR 4 Number of Trees***	YEAR 4: Cost
Ash Removal	$ 378.00	113	$ 42,714.00	113	$ 42,714.00	113	$ 42,714.00	11	$ 4,158.00
Ash Treatment* **	$ 210.00	368	$ 77,280.00	368	$ 77,280.00	368	$ 77,280.00	357	$ 74,970.00
Stump Removal	$ 154.00	113	$ 17,402.00	113	$ 17,402.00	113	$ 17,402.00	11	$ 1,694.00
Planting (Ash Replacements)	$ 280.00	113	$ 31,640.00	113	$ 31,640.00	113	$ 31,640.00	11	$ 3,080.00
Ash Management		**707**	**$ 169,036.00**	**707**	**$ 169,036.00**	**707**	**$ 169,036.00**	**401**	**$ 83,902.00**

* The average tree care contractor costs for Midwest US cities is used because Village staff cannot perform all necessary activities under this LOS scenario and some EAB management activities will need to be performed by contracted tree care companies.

**Number of Trees Years 1-3:

- Ash Removals/Stump Removals and Planting in Years 1-3 is based on removing the 211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 3 years.
- Ash Treatment based on treating each ash tree designated for treatment (1,104 ash trees) once every three years.

*** Number of Trees Year 4

- Ash Removals/Stump Removals and Planting based on an annual mortality rate of 10% per year
- Ash Treatment based on treating each ash tree designated for treatment (1,104 ash trees) once every three years

***Ash Treatment cost of $210 based on average size of ash tree in Shorewood (21" diameter) and average per inch cost to treat an ash tree in the Midwest ($!0/inch)

Level of Service C (HIGH – Industry Standard/BMPs)

- **Scenario will require additional Village resources, including contracting out EAB management activities.**
- Increase the minimum diameter to treat ash trees from 8" DBH to 12" DBH, treat trees on a 2-year cycle.
- Remove green and white ash less than 12" DBH and all European ash, regardless of size, within 2 years and replace with a diverse palette of species
- After 2 years, remove ash based on risk posed to the community and as needed – estimated at 10% of the ash tree population per year
- Fully implement the village's Ash Tree Replacement Program.

	Average Cost (Midwest)*	YEAR 1: Number of Trees**	YEAR 1: Cost	YEAR 2: Number of Trees**	YEAR 2: Cost	YEAR 3: Number of Trees**	YEAR 3: Cost
Ash Removal	$ 378.00	169	$ 63,882.00	169	$ 63,882.00	11	$ 4,158.00
Ash Treatment****	$ 210.00	552	$ 115,920.00	552	$ 115,920.00	552	$ 113,610.00
Stump Removal	$ 154.00	169	$ 26,026.00	169	$ 26,026.00	11	$ 1,694.00
Planting (Ash Replacements)	$ 280.00	169	$ 47,320.00	169	$ 47,320.00	11	$ 3,080.00
Ash Management		**1059**	**$ 253,148.00**	**1059**	**$ 253,148.00**	**574**	**$ 122,542.00**

* The average tree care contractor costs for Midwest US cities is used because Village staff cannot perform all necessary activities under this LOS scenario and some EAB management activities will need to be performed by contracted tree care companies.

**Number of Trees Years 1 and 2:

- Ash Removals/Stump Removals and Planting based on removing the 211 green and white ash trees that are less than 12" in DBH and all 129 European ash (as of July 2019) over 2 years.
- Ash Treatment based on treating each ash tree designated for treatment (1,104 ash trees) once every two years.

*** Number of Trees Year 3

- Ash Removals/Stump Removals and Planting based on an annual mortality rate of 10% per year
- Ash Treatment based on treating each ash tree designated for treatment (1,104 ash trees) once every two years

***Ash Treatment cost of $210 based on average size of ash tree in Shorewood (21" diameter) and average per inch cost to treat an ash tree in the Midwest ($!0/inch)