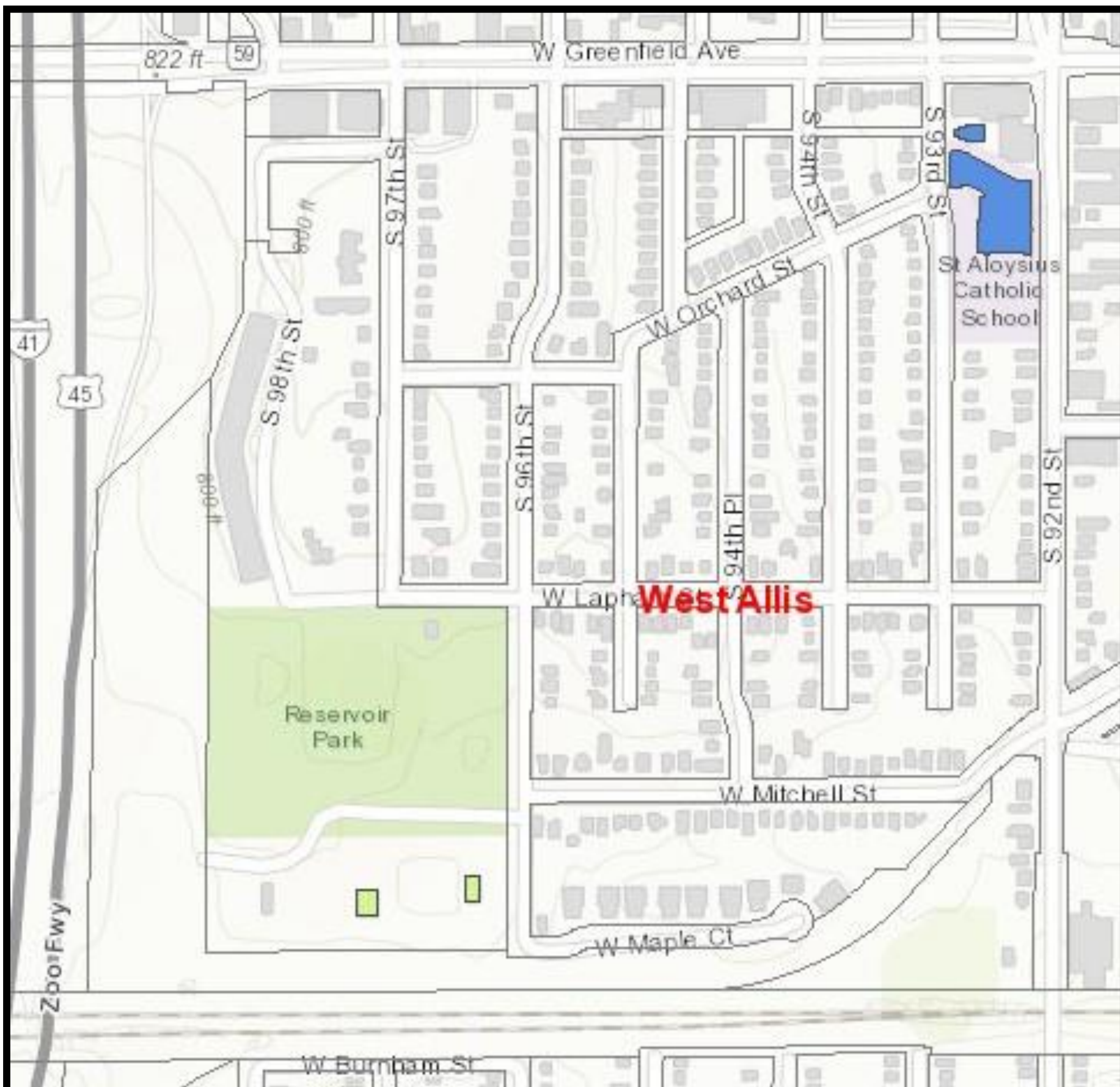
Demonstrating the Benefit Loss Due to Ash Tree Removal in West Allis Forestry Section 26

– A Conrad Gardens Neighborhood –



Introduction:

It has been known for quite some time now that in a social, economic, and environmental way, old, large trees provide more benefit than younger, smaller trees. Large trees possess more leaves and leaves are the real provider of tree benefits. They remove pollutants from the air. Through photosynthesis, they grab up the greenhouse gas, carbon, and produce oxygen. They also act as a huge sponge during rain events by intercepting and slowing the rate of runoff into our sewer system and surrounding waterways, decreasing water pollution.

Additionally, large trees do a better job of lowering heating and cooling costs to adjacent homes and businesses by shading structures in the summer and slowing winter winds.

There have also been a number of studies that demonstrate that trees and nature, as a whole, are beneficial to human mental and physical wellbeing.

The Section 26 neighborhood is bordered by W. Greenfield Ave. to the north and the Union Pacific railroad to the south, it has S. 92nd St as an eastern border and the I-43/45 freeway corridor to the west.

At the onset of the Emerald Ash Borer infestation in West Allis (2010), the Section 26 neighborhood tree population was mostly Green and White ash. It was designated that this area should not be injected for the insect, rather, West Allis Forestry would remove and replace most of the ashes with other preferred street tree species. So as a result, only the most valuable, structurally sound Green and White Ash have been retained (60 trees). Over time it has become a model for the plan to not inject and remove city-wide ash trees.

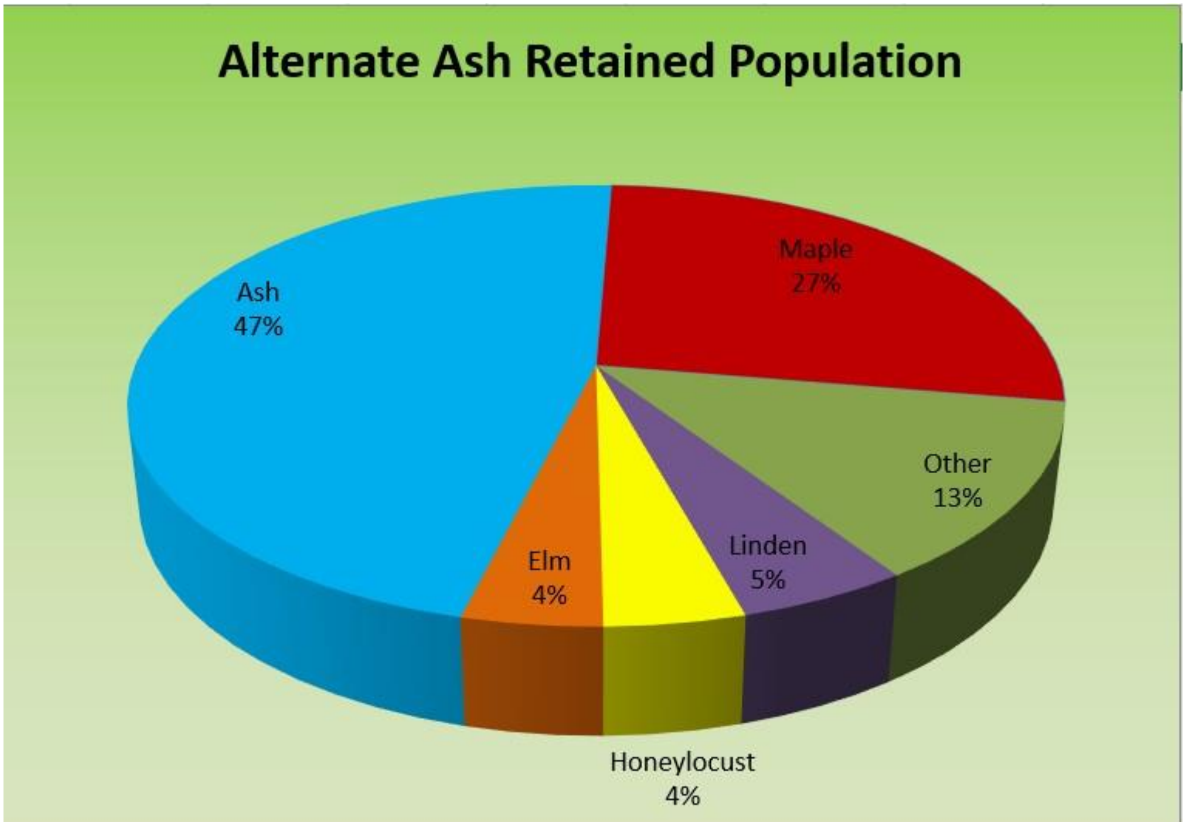
By using the Forestry Division tree inventory, we set up two alternate timelines. One where all ashes were retained and maintained to present day. The other is the current real-life neighborhood forest. By comparing these two alternate timelines using i-Tree software, we can compare forests to show the lost benefits these large ash trees provided. i-Tree is a software suite from the USDA Forest Service that provides urban and rural forestry analysis and benefit assessment tools to its users. Results are returned in report form.

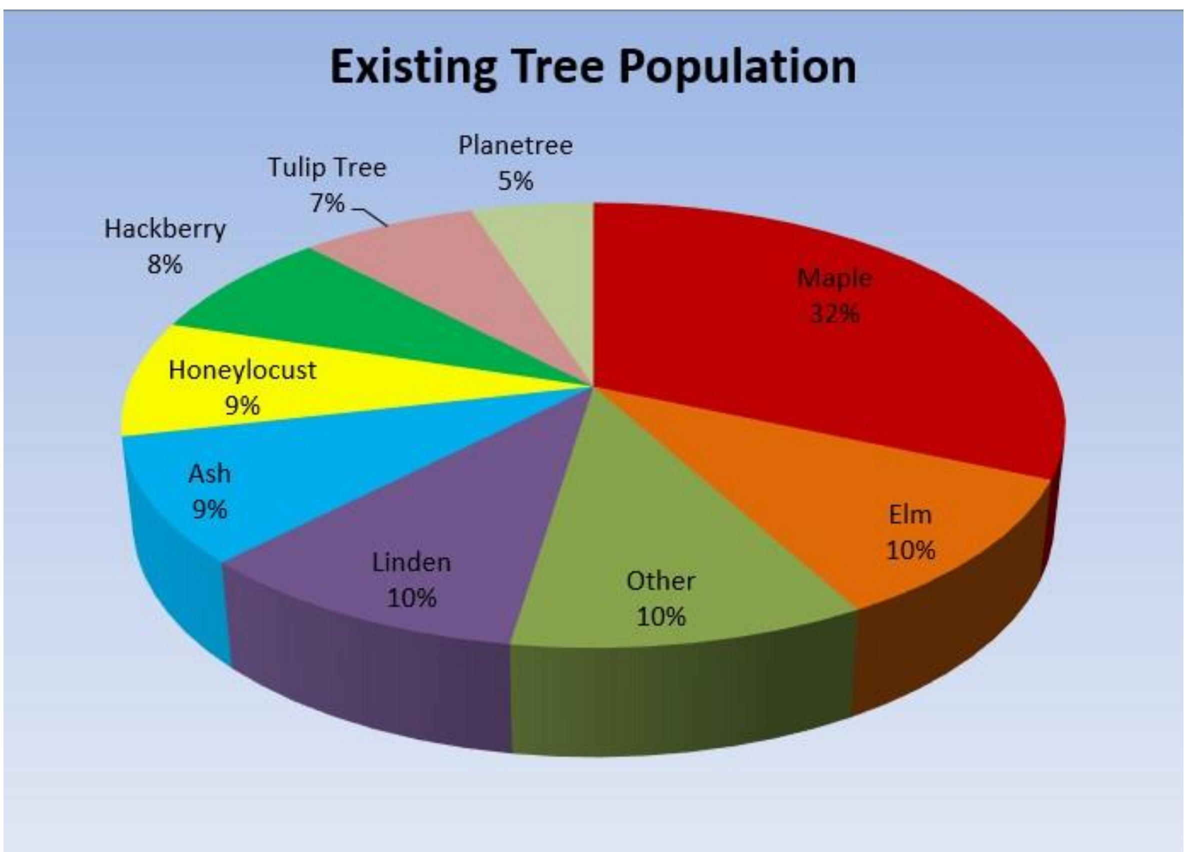
Structure Change:

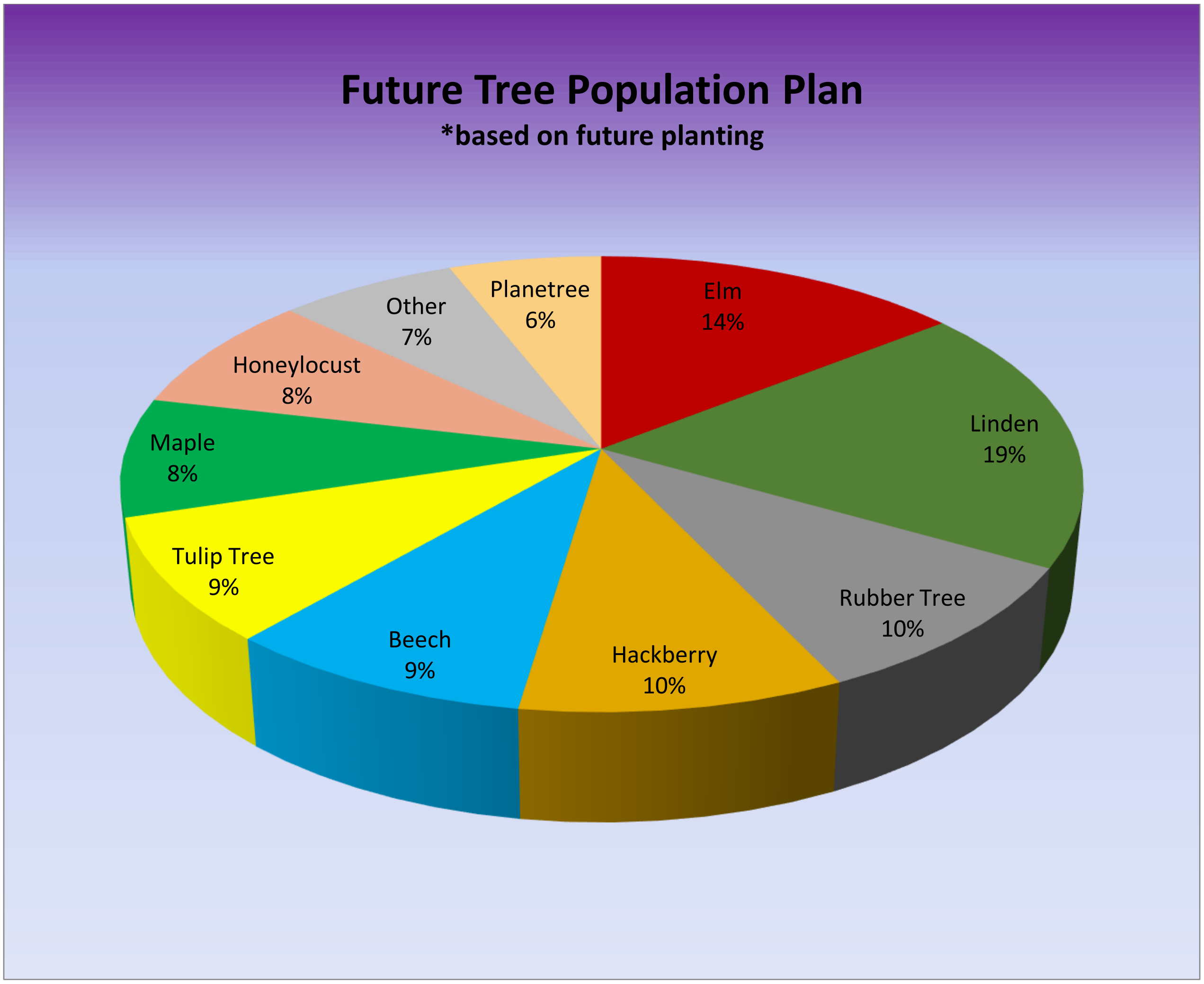
<u>Species</u> - Over the last ten years the neighborhood forest of Section 26 has undergone many changes due to management strategies for Emerald Ash Borer. Overall, the tree population has decreased from 524 to 450 trees. This is mostly a result of not replanting because of Right of Way conflicts.

Most common species and amount change:

- Ash trees (250 to 50)
- Maple trees (145 to 145)
- Honeylocust (24 to 39)


Alternate Ash Retained Population
Ash
47%
Maple
27%
Other
13%
Linden
5%
Elm
4%
Honeylocust
4%

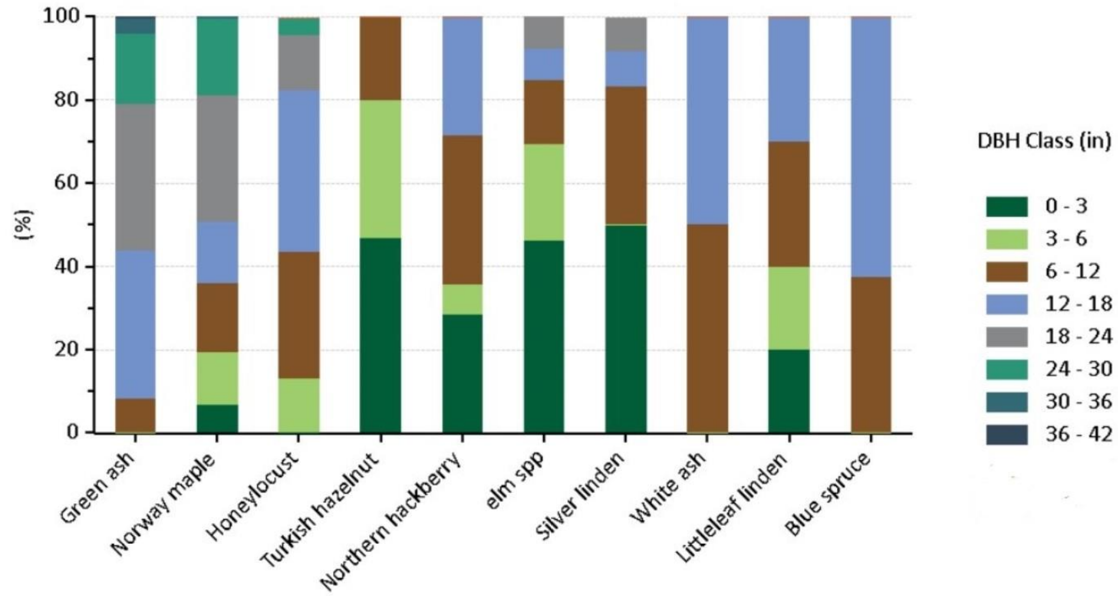

Existing Tree Population
Planetree
5%
Tulip Tree
7%
Hackberry
8%
Maple
32%
Honeylocust
9%
Ash
9%
Elm
10%
Linden
10%
Other
10%



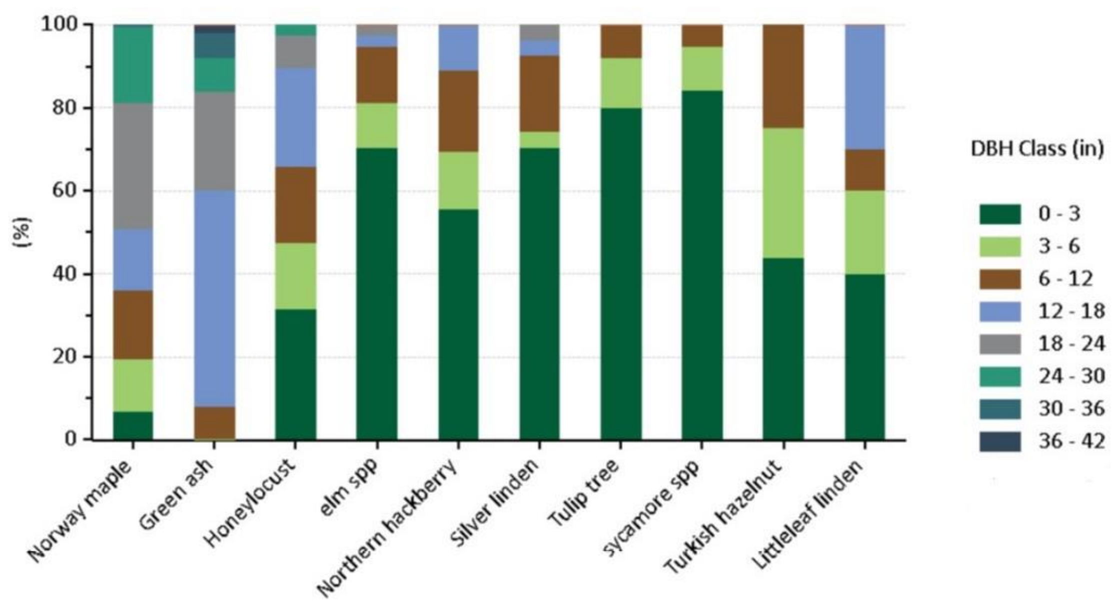
Tree size- The most adverse change is the reduction in the size of the trees in the neighborhood due to the replacement of large ash trees with new younger trees from a variety of species. These smaller trees currently cannot provide the benefits due to smaller leaf area.

A good measurement of tree size is Diameter at Breast Height (DBH). This is a measurement of the trunk diameter 4½ above the ground. As you can see in the Existing Tree population most DBH's are close to 0. This will reflect a loss of environmental benefits to West Allis.

Alternate Ash Retained Population DBH



Existing Tree Population DBH



Leaf Area and Biomass – In comparing the two timelines, it is determined the Ash removal from Section 26 neighborhood removed large amounts of leaf area and biomass. This correlates to tree benefit loss, which is a resource that will take 20-40 years to replenish.

Leaf Area and Biomass	Leaf Area	Biomass	Loss
Alternate Ash Retained Population	40.8 acres	11.4 tons	-
Existing Tree Population	23.9 acres	6.5 tons	60%

Structural Value - Urban forests have a structural value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree). The structural value of an urban forest tends to increase with a rise in the number and size of healthy trees (Nowak et al 2002a).

Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines. In the removal of Ash from Section 26, structural values plummeted for neighborhood trees.

Structural Value	Tree Value ($)
Alternate Ash Retained Population	$1,700,000
Existing Tree Population	$878,000
Change with Ash Loss	-$822,000
Percent Change	-48%

Tree Benefits:

Urban trees have value based on the functions the trees perform. Annual functional values also tend to increase with increased number and size of healthy trees. The West Allis Municipal Forest provides benefits to city residents by removing air pollution and carbon from the air. The trees produce oxygen. The trees also slow the rate of runoff of water into the sewer system and surrounding waterways, decreasing water pollution and sewer treatment costs.

Air Pollution Removal – Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power sources. Integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (Nowak and Dwyer 2000). The table below demonstrates the change in value between the two forest timelines. Monetary estimates are based on health care costs and environmental damage remediation due to air pollution damage in the Milwaukee area. (Air testing stations 10, 26 and 56)

	Pollution Removal (Annually)	Alternate Ash Population	Existing Tree Population	Change with Ash Loss	Percent Rise in Pollutants
Pounds/Year	CO	6.141	3.446	2.695	44%
	Value	$4.07	$2.29	$1.78	44%
	NO_2	72.417	41.784	30.633	42%
	Value	$30.62	$17.62	$13.00	42%
	O_3	309.281	177.623	131.658	43%
	Value	$976.85	$561.37	$415.48	43%
	$PM_{2.5}$	5.902	3.521	2.381	40%
	Value	$768.50	$467.29	$301.21	39%
	SO_2	14.946	8.574	6.372	43%
	Value	$1.80	$1.03	$0.77	43%

Pollutants Removed

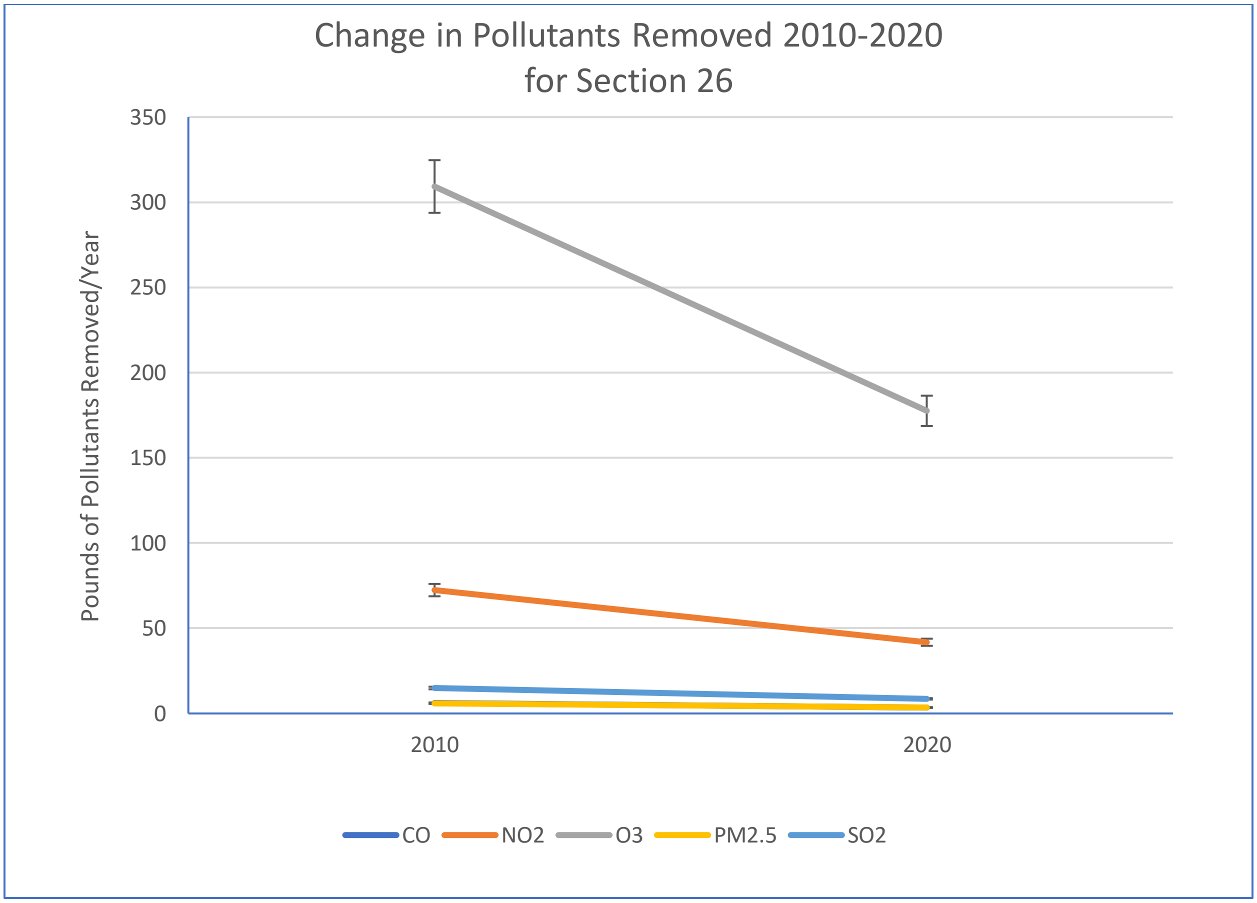
Carbon monoxide (CO) – A colorless, odorless gas that can be harmful when inhaled. The greatest sources of CO to outdoor air are cars, trucks, and other vehicles or machinery that burn fossil fuels.

Nitrogen dioxide (NO_2) – a toxic reddish-brown gas that is a strong oxidizing agent, is produced by combustion, and is an ingredient in smog.

Ozone (O_3) – Ground level ozone is not emitted directly into the air, but is created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC). This happens when pollutants are emitted and chemically react in the presence of sunlight. Ozone at ground level is a harmful air pollutant, because of its effects on people and the environment, and it is the main ingredient in smog.

Small Particulate Matter ($PM_{2.5}$) – Pollution particles that are generally 2.5 µm in diameter or smaller.

Sulfur dioxide (SO_2) – One of a group of gases called sulfur oxides (SO_x). While all of these gases are harmful to human health and the environment, SO_2 is of greatest concern. The largest sources of SO_2 emissions are from fossil fuel combustion at power plants and other industrial facilities.



Carbon Sequestration and Storage - Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in wood and leaf tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Abdollahi et al 2000).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of neighborhood Section 26 of carbon has built up over time.

The demonstrated loss of carbon is actually due to the removal of tree parts from the neighborhood. This is mainly in the form branch and trunk wood. Overall benefit reduction is due to the fact that larger trees make more leaves on an annual basis and in turn remove more CO_2 from the air.

Carbon Sequestration and Storage -	Carbon Stored	CO_2 Equivalent	Value Annually
Alternate Ash Retained Population	283.4 tons	1039.3 tons	$833
Existing Tree Population	3.20 tons	11.75 tons	$547
Ash Removal Weight (wood)	280.2 tons	1027.55 tons	-$286

Oxygen Production - Oxygen production is one of the most commonly cited benefits of urban trees. The annual oxygen production of a tree is directly related to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass. The removal of trees in the Section 26 neighborhood has declined oxygen production from 13 to 8.5 tons per year. This represents a drop of 35% to the oxygen pool.

Oxygen Production	Pounds/Year
Alternate Ash Retained Population	13 tons
Existing Tree Population	8.5 tons
Change with Ash Loss	4.5 tons
Percent Loss	35%

Avoided Runoff - Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, and lakes. In larger rain events, it can overtax sewer systems, leading to overflow dumps. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012).

In urban areas, the large extent of impervious surfaces increases the amount of surface runoff. Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. The change in reduced runoff and the correlated costs to treat that water is listed below.

Avoided Runoff (Annually)	Water	Value
Alternate Ash Retained Population	6348.65 ft^3	$424.38
Existing Tree Population	3740.41ft^3	$250.03
Change with Ash Loss	-2,608.24 ft^3	-$174.35
Percent Change	-41%	-41%

Conclusion:

Part of the Forestry and Grounds Division mission is to promote management decisions that will improve human health and environmental quality for the citizens of West Allis. These decisions translate to real money saved for West Allis in the form of paying less in health care costs, heating and cooling bills, sewer treatment bills, and overall environmental damage remediation.

Although the removal of 200 large Ash trees was not an idea situation, it gave the Forestry Division a unique opportunity to study the benefit loss on a neighborhood-sized scale.

Overall Benefit Loss Due to Ash Removal in Section 26 - **West Allis, WI**			
Benefit	Alternate Ash Retained Population	Existing Tree Population	Demonstrated Loss
Number of Ash Trees	250	50	200 trees
Structural Value	$1,700,000	$878,000	$822,000
Yearly Benefits			
Pollutant Removal Value	$1,781.84	$1,049.60	$732
CO_2 Removal Value	$833	$547	$286
Avoided Runoff Value	$424	$250	$174
Total Yearly Benefit Loss ($)			$1,193

This assessment of the vegetation structure, function, and value in Section 26 was conducted during 2020. The comparison of the two alternate timelines were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station. Both reports (alternate timelines) are available from West Allis Forestry and Grounds Division for further inspection.

References

Abdollahi, K.K.; Ning, Z.H.; Appeaning, A., eds. 2000. Global climate change and the urban forest. Baton Rouge, LA:GCRCC and Franklin Press. 77 p.

Hirabayashi, S. 2012. i-Tree Eco Precipitation Interception Model Descriptions, http://www.itreetools.org/eco/resources/iTree_Eco_Precipitation_Interception_Model_Descriptions_V1_2.pdf

Nowak, D.J.; Crane, D.E.; Dwyer, J.F. 2002a. Compensatory value of urban trees in the United States. Journal of Arboriculture. 28(4): 194 - 199.

Nowak, D.J.; Dwyer, J.F. 2000. Understanding the benefits and costs of urban forest ecosystems. In: Kuser, John, ed. Handbook of urban and community forestry in the northeast. New York, NY: Kluwer Academics/Plenum: 11-22.