City of Columbia Heights

Emerald Ash Borer Management Plan

February 2014

ACKNOWLEDGEMENTS

Mayor and City Council

Gary Peterson, Mayor
Tammera Diehn, Councilmember
Bruce Nawrocki, Councilmember
Donna Schmitt, Councilmember
Robert “Bobby” William, Councilmember

PARKS AND RECREATION COMMISSION

Eileen Evans, Chair
Tom Greenhalgh, Vice Chair
Sean Clerkin, Jr.
Stan Hoium
Kevin McDonald
David Payne
Marsha Stroik
Gary Peterson, Council Representative

City Staff

Kevin Hanson, Public Works Director
Lauren McClanahan, Public Works Superintendant

Consultant

Rainbow TreeCare

Rainbow Treecare
11571 K-Tel Drive
Minnetonka MN, 55343
Phone: 952-922-3810

Table of Contents

Introduction

Public trees provide numerous environmental services to the City of Columbia Heights (City). These services include reducing rainfall that reaches storm drains and increasing rainfall that penetrates the soil. Trees also improve air quality by absorbing and intercepting pollutants and providing shade and windbreaks to buildings, which lowers the heating and cooling needs and reduces the pollutants created during energy production. These environmental services contribute to higher property values and decreased crime rates compared to similar properties that do not contain trees. When the quantifiable environmental benefits of trees are weighed against the costs (e.g. purchase, planting, pruning, and removal), the benefits outweigh the costs by a margin of about three to one.

According to the Public Ash Tree Inventory conducted by City staff, 935 ash trees are growing on boulevards and public spaces within the City, and all of them are at risk of being killed by the emerald ash borer (EAB). Discovered in Minnesota in 2009, EAB is spreading across the metro area. If not already in the City, it will soon arrive. As of February 2014, the nearest known EAB infested tree is 3 miles from the City's borders.[1] To replace the 935 trees that could be lost to EAB, thousands more would need to be planted to maintain and expand the City's tree cover.

Purpose of the Plan

The purpose of the *City of Columbia Heights Emerald Ash Borer Management Plan* (Plan) is to prepare the City for the EAB infestation before it is discovered, and to buffer its impact on public and private property throughout the community. The Plan will help the City distribute the costs associated with certain and widespread tree death over an extended time period, and lessen the social and economic impacts on the quality of life in the City. By taking a proactive approach toward EAB planning and preparation, the City can better position itself to deal with the ecological and financial impacts of EAB and help prevent the City from being caught off guard.

The Director of Public Works will lead the City's efforts to implement and follow up on the provisions of this Plan, with assistance from the Public Works Superintendent and the Parks Foreman.

The Emerald Ash Borer Infestation

The emerald ash borer, *Agrilus planipennis*, is an exotic beetle from Asia that was discovered in the United States during the summer of 2002 near Detroit, Michigan. The adult beetles nibble on ash foliage but cause little damage. However, the larvae (during the beetle's immature stage) feed on the inner bark of ash trees and disrupt the tree's ability to transport water and nutrients. EAB may take years to build populations large enough to infest an entire tree, but

[1] According to the Minnesota Department of Agriculture Emerald Ash Borer Status Map. http://gis.mda.state.mn.us/eab/

once an ash tree is infested, it has almost zero chance of survival. The current evidence from Michigan and Ohio shows that it takes five to ten years to infest and kill the majority of the ash trees in a city. Cities infested with this devastating pest have lost tens of millions of ash trees and endured costs that have reached into the billions. It is highly likely the pest is currently attacking trees in the City but has yet to be discovered. The complete loss of ash trees throughout the City due to EAB would have a devastating effect on home values, quality of life, and the environment if the City does not begin to act.

Tree Inventories and Surveys

To anticipate the effects of the imminent EAB infestation, the City and Rainbow Treecare (RTC) conducted a *Public Ash Tree Inventory* and *Private Parcel Ash Tree Survey*.

Columbia Heights Public Ash Tree Inventory

City staff completed an inventory of the ash trees on public building sites, parks and on City Right-of-ways. Staff collected a variety of useful information including tree type, location, size, and condition. Tree size was measured in inches of diameter at breast height (DBH). Tree condition was determined using a rating system of 2-7, with descriptions assigned to each rating. Table 1 summarizes the results of the inventory:

Table 1: Columbia Heights Public Ash Tree Inventory, 2013

Condition Rating	Condition Description	Total Trees	Total DBH	Average DBH
2	Excellent	7	97	14
3	Very Good	60	925	15.5
4	Good	343	5811	17
5	Fair	436	7480	17
6	Poor	77	1179	15
7	Critical	7	112	16
0	Unassigned	5	90	18

Columbia Heights Private Parcel Ash Survey

In September 2013, Rainbow Treecare (RTC) conducted a survey of the ash trees growing on private property within the City. A survey is not an inventory. An inventory counts and measures each individual tree. A survey is an appropriate alternative because it gathers a sufficient sampling of trees to be statistically representative of the whole. The *Columbia Heights Private Parcel Ash Survey* was designed to give a statistically valid estimate of the number of trees growing on private property within the City. RTC first determined the total number of private parcels in the City using publicly available information, 6,175 parcels, randomly selected

105 private parcels, and surveyed them for ash trees. Thirty six of the private parcels surveyed contained ash trees with a total of 41 ash trees counted.

The survey estimated the most likely number of ash trees growing on private property to be 2,117. With 6,175 private parcels in the City, there is approximately one ash tree for every 3 residential properties. The survey sample has a 95% chance of representing the actual total private ash tree population.

Strategies for Public Trees

Public trees are defined as those existing wholly or partially upon City-owned property, such as parks or on public rights-of-way including street boulevards or medians. The City's strategies for dealing with EAB management of public trees are as follows:

- Protection of high-quality ash trees (condition 2-4) with insecticides.
- Removal of low-quality ash trees (condition 5-7 and unassigned).
- Replacement of removed public ash trees on a one-to-one basis.

Protection of High-Quality Public Ash Trees with Insecticides

Because of the numerous benefits that trees provide to the City, efforts will be taken to protect high-quality public ash trees using chemical treatments. These treatments have been shown to be highly effective when used before EAB damage is visible, and they drastically reduce the costs associated with EAB management. Over a 10-year period, 2.5 trees can be treated for the cost of removing and replacing a single tree. The City will utilize the trunk-injection application method for the insecticide, Emamectin Benzoate, on all public ash trees during the months between leaf emergence and leaf-drop. The City adopts a balanced management approach that will allow many of the high-quality trees to be preserved while removing low-quality trees that will eventually pose a hazard to the public. This plan calls for the treatment of 410 ash trees on public land that have been identified as high-quality trees.

Removals

Public ash tree removal will be prioritized based on quality. The lowest quality public trees will be removed first followed by those that are no longer assets to the community (unhealthy or miss-sited). During the development review process, staff will recommend that ash trees be prioritized for removal over other species when tree impacts cannot be avoided. The current City contractor will be utilized for all public ash tree removals. This plan calls for the removal of 525 low quality public ash trees.

When EAB is discovered in Columbia Heights, removals will occur under the requirements and guidance of the Minnesota Department of Agriculture (MDA).

Canopy Replacement and Care

As the budget permits, removed public ash trees will be replaced with appropriate plantings selected to enhance the planting site and add to the diversity and general health of the urban forest. The City will attempt to maintain current canopy cover as determined by repeated "fly-over" analyses. New trees will be planted in accordance with the City's Tree Planting Specifications and with City ordinances related to tree diversity. No plantings will be made that cannot be adequately maintained.

Strategies for Private Trees

Private trees are defined as those that exist wholly or partially upon privately owned land and exist outside of City easements and right-of-ways, such as in yards. The City will utilize the following strategies when dealing with private ash trees that are infested with EAB:

Responding to EAB Infestations on Private Property

EAB infestations, known or suspected, on private property will be handled by City staff in accordance with existing City ordinances (See Section 4.201 of the City Code). This section of the Code gives the City the authority to enter upon private property to inspect private trees for tree pests and requires the property owner to remove the infested material. All infested material must be disposed of in accordance with the Minnesota Department of Agriculture EAB Quarantine information. Early detection and control of trees infested with EAB are important strategies for protecting surrounding ash trees. Removal of dying and dead ash trees on private property will become an increasingly important strategy as dead trees quickly become brittle and pose risks to people, property, and overhead utility lines due to falling limbs.

Removal of Private Ash Trees

Ultimately, the removal of dead and infested ash trees is the responsibility of the property owner (see 4.201 of the City Code). However, City resources will continue to be used to subsidize 25% of the removal cost of private trees based on the current City tree removal contract pricing. Private ash trees outnumber public ash trees, which makes successful EAB management throughout the City also depend on citizen response. Successful EAB management is enhanced when the City takes an active role in supporting private tree owners in the management process.

Public Education and Communication

The Mayor, City Council, Parks and Natural Resources Commission, and the community at large will receive periodic updates on the status of EAB in our community through normal channels. All media relations will follow normal City protocol.

Public Works staff will continue to coordinate with the Minnesota Department of Agriculture and other entities concerned with EAB to ensure that the City is following the best practices for detecting and managing EAB. As timing and budget allow, staff will attend conferences, workshops, and seminars related to EAB. Staff will also maintain good communication with adjacent municipalities to ensure mutual awareness of EAB management strategies and to develop mutual aid and equipment sharing as appropriate.

The City will endeavor to educate its citizens on EAB impacts and management through the following tools on the City's website:

- An EAB informational page updated and maintained by City staff that addresses the EAB questions and concerns.
- Advertisements of the annual tree sale where the City will offer non-EAB susceptible, trees at wholesale prices.
- A contact list containing pertinent resources for EAB information and management.

In addition to making information available on the website, City staff will also educate citizens through the following methods:

- Attending community group meetings upon request**.**
- Disseminating information to targeted citizens surrounding known infestations.
- Appearing on local television programs.
- Collaborating with the University of Minnesota's Tree Care Advisors program and its educational workshops. The Tree Care Advisors are a network of community-based volunteers under the direction of the University's Department of Forest Resources, who have been trained to give free or low-cost EAB educational workshops to the public.

City Budget and Anticipated Implementation Costs and Benefits

<u>About the Cost, Benefit, and Budget Analysis</u>

Appendices C, D and E present the key findings of the cost and benefit analysis that compares two primary scenarios over a 20-year study period. The first scenario, the Base Case, assumes all low-quality public trees will be preemptively removed during Years 1-5 and each tree will be replaced the same year it is removed. No high-quality trees will be treated and are assumed to succumb to EAB in accordance with the well-established "EAB death curve" and be replaced the same year they are removed. . The scenario also accounts for the anticipated costs to provide a

25% public subsidy of the tree and stump removal costs to private property owners who remove ash trees on their property.

The second primary scenario, the Ash Tree Preservation Plan (ATP Plan), varies from the Base Case in only one important respect—all high-quality trees will be treated (1/3 of the trees every year). It assumes that 3% of the treated trees will succumb to EAB during the first 10 years and an additional 3% during Years 11-20. As with the Base Case, all dead trees will be replaced the same year they are removed.

The comparison of the two main scenarios account for tree size over time, costs, and tree benefits based on the National Tree Benefit Calculator. It also includes a third scenario that shows theoretical tree size and benefits as if there was no EAB infestation, and a treatment/no treatment scenario for an individual tree. Appendices C and D include tables and charts of the costs and benefit comparisons. Finally, Appendix E includes the 20-year budget figures for the ATP Plan.

The following lists the main components of the analysis:

- **Physical characteristics of the 3 tree groups:** Since costs and tree benefits vary by tree size, the two scenarios take into account the different average tree sizes (DBH and cross-sectional area) and growth rates for each of the 3 groups of trees—high-quality trees (condition 2-4), low-quality trees (condition 5-7), and replacement trees.[2]
- **Costs:**[3]
    - Tree deaths and removals:
        - Mortality rates:[4, 5]
            - EAB death curve
            - Treated trees
            - Replacement trees[6]
        - Tree and trunk removal based on tree size at time of death[7]

[2] Growth rates for trees from: "Predicting Dimensional Relationships for Twin Cities Shade Trees," Lee E. Frelich, Department of Forest Resources, University of Minnesota, June 1992. http://www.forestry.umn.edu/prod/groups/cfans/@pub/@cfans/@forestry/documents/asset/cfans_asset_249769.pdf.

[3] Cost estimates assume city crews perform the work at median wages and that the city pays wholesale prices for chemical treatments. If the city contracts the work out, costs must be escalated to account for corporate profit and possibly higher operating and chemical costs.

[4] Source of the EAB "death curve:" "EAB-Induced Ash Mortality in the Upper Huron River Watershed, SE Michigan," OARDC, Ohio State University. http://www.oardc.ohio-state.edu/hermslab/images/Herms_EAB_Management_12_Feb_2013.pdf

[5] Source for mortality rates for treated and untreated trees: McCullough, Deborah G.; Mercader, Rodrigo J.; "Evaluation of potential strategies to SLow Ash Mortality (SLAM) caused by emerald ash borer (Agrilus Planipennis): SLAM in an urban forest," *International Journal of Pest Management*, Vol. 58, No. 1, January–March 2012, 9–23.

[6] New trees have a higher mortality rate than mature trees. Plan assumes 5% of new trees will die in first year and 2% of the remaining trees over the next 5 years consistent with field studies. This will equal a 6.9% loss overall. Source: Purdue University EAB Cost Calculator. http://extension.entm.purdue.edu/treecomputer/

[7] Averages for tree and stump removal costs are from the City of Columbia Heights.

- Replacement trees:
  - Cost of tree and planting[8]
  - Additional costs related to the higher maintenance costs and mortality rates of new trees versus mature trees[9]
- ATP Plan treatments for surviving trees: Labor, materials, and overhead based on tree size[10]
- Cost escalators during the peak of the infestation[11]
- Return on investment analysis that accounts both for inflation and the time-value of money[12]

- **Benefit analysis:**[13]
  - Overall economic value
  - Property value increase
  - Blended benefit factor that accounts for different economic benefit rates by land use[14]
  - Stormwater interception
  - Conservation of electricity and natural gas
  - Carbon sequestration and avoidance
  - Calculation of how surviving trees offset the energy consumption and carbon emissions of average Minnesota households[15]

[8] Source of estimates for purchase and planting of replacement trees: Rainbow TreeCare. New trees require more per-tree maintenance costs for pruning, watering, etc. The annual additional maintenance costs are based on: "Value, Benefits, and Costs of Urban Trees," Brian Kane, Assistant Professor, University of Massachusetts, Amherst, Jeff Kirwan, Extension Forestry Specialist, Virginia Tech. http://pubs.ext.vt.edu/420/420-181/420-181_pdf.pdf.

[9] New trees require more per-tree maintenance costs for pruning, watering, etc. The annual additional maintenance costs are based on: "Value, Benefits, and Costs of Urban Trees," Brian Kane, Assistant Professor, University of Massachusetts, Amherst, Jeff Kirwan, Extension Forestry Specialist, Virginia Tech. http://pubs.ext.vt.edu/420/420-181/420-181_pdf.pdf.During the peak of the infestation, demand for all tree-related services (pruning, removals, replanting, treating, maintenance, debris management, etc.) will explode. For example, the pruning contract for the City of Fort Wayne Indiana increased 53% between the beginning and the peak of the infestation (personal communication with the City Arborist). This plan assumes the EAB death curve is an appropriate surrogate for the expected increases.

[10] Assumed labor cost rate: Minnesota median hourly wage for pesticide handlers, sprayers, and applicators (source: http://www.bls.gov/oes/current/oes373012.htm#st) plus 25% in benefits.

[11] During the peak of the infestation, demand for all tree-related services (pruning, removals, replanting, treating, maintenance, debris management, etc.) will explode. For example, the pruning contract for the City of Fort Wayne Indiana increased 53% between the beginning and the peak of the infestation (personal communication with the City Arborist). This plan assumes the EAB death curve is an appropriate surrogate for the expected increases.

[12] Assumes 2% annual inflation and a 5% discount rate over the 20-year budget period.

[13] Source: National Tree Benefit Calculator: http://www.treebenefits.com/calculator/treeinfor.cfm?zip=55118&city=SAINT%20PAUL&state=MN&climatezone=Midwest

[14] The National Tree Benefit calculations are based on ash trees on single-family residential lots. In order to account for the reduced economic benefits attributable to ash trees on multi-family and non-residential lots, the benefits are reduced on a pro-rata basis per the share that each land use category represents overall.

[15] Sources for the calculations for energy and carbon offsets for the average Minnesota household are extensive and are available upon request.

Findings of the Cost and Benefit Analysis

- **Overall costs:**
    - By Year 10, every dollar invested in the ATP Plan preserves over 4 times as much DBH compared to having to pay for the Base Case: 7,000 additional inches of trunk diameter.
    - Assuming 2% annual inflation and 5% discount factor, the ATP Plan approach provides a return (i.e. additional dollars on top of the original investment) of $0.22 in Year 3 for every dollar invested, and a return as high as $3.37 in Year 7 for every dollar invested. Returns remain highly positive in Year 15 and Year 20.
    - If private tree owners preserve 5% of the private trees and the City provides a 25% subsidy of the removal costs for other private trees, the program will cost the City $216,000 over Years 1-11. This equals 30% of the total costs for the ATP Plan with the subsidy program.
    - For the individual tree comparison, treatment preserves all of the tree's benefits for less than half of the costs of the no-treatment approach using less than 13 ounces of pesticide over each 10-year period.
- **Tree value:**
    - By Year 10, every dollar invested in the ATP Plan preserves over twice as much tree value compared to having to pay for the Base Case: $337,000 more in overall tree value.
    - By Year 10, every dollar invested in the ATP Plan preserves 33% more of the property value benefit from trees compared to the Base Case: $71,000 more.
    - By Year 10, every dollar invested in the ATP Plan preserves almost twice as much of the stormwater interception benefit compared to the Base Case: 4.4 million additional gallons.
    - By Year 10, every dollar invested in the ATP Plan preserves 1.5 times as much of the electricity conservation benefit compared to the Base Case: 470 megawatt hours more. Preserved trees offset the electricity consumption of 10 Minnesota households every year.
    - By Year 10, every dollar invested in the ATP Plan preserves 1.5 times as much of the natural gas conservation benefit compared to the Base Case: 65,600 more therms. Preserved trees offset the natural gas consumption of 21 Minnesota households every year.
    - By Year 10, every dollar invested in the ATP Plan preserves twice as much of the CO_2 emission reduction benefit compared to the Base Case: 920 more tons. Preserved trees offset the CO_2 emissions of 51 Minnesota households every year.

Budget

The City budget for 2014 includes $12,500 for EAB management and $65,000 for removal and replacement costs for ash and other public and private trees. The City goal is to remove and replace 60 low-quality ash trees in 2014 and 110-115 additional trees each year until this group of trees is completely replaced (refer to Table 3).

The ATP Plan implements the City budget amounts and tree removal and replacement expectations for 2014 and subsequent years. After reserving about $20,000 per year for Years 1 to 11 to subsidize the removal of private ash trees, there will be excess funds in 2014 that could be used to treat an additional 162 trees or remove and replace an additional 17 trees. Some of the money could also fund other EAB-related activities such as detection and trap trees, or a program to subsidize the treatment of private trees that contribute to the public realm. Appendix E provides budget detail for Years 1-20.

Table 2: Budget Assumptions and Calculations[16]	**Current Budget**	**ATP Plan**	
		2014	**2015**
EAB management:			
2014 budget need for treatments for EAB	$12,500	$8,887	$9,232
Budget for removals and replacements (private and public ash and other trees):			
Dollars available in 2014	$65,000		
Low-quality trees to be removed in 2014	60	60	
Low-quality trees to be removed in subsequent years (Year 2-5)	100 to 115		116
Removal costs for ash trees and stumps		$19,241	$38,482
Replacement costs for ash trees		$18,960	$37,581
Public subsidy rate for private tree removals	25%		
Expected average annual public subsidy over Years 1-11		$19,848	$19,848
Total removal and replacement costs incl. public subsidy		$58,047	$95,909
Remaining budget (EAB and removals) for removals and replacements of trees other than ash (includes excess funds from EAB budget)		$10,566	
Number of additional trees that can be removed and replaced with remaining budget		17	
Number of additional trees that can be treated with remaining budget		162	

Appendices:

Appendix A: Web Resources
Appendix B: Columbia Heights Private Parcel Ash Survey
Appendix C: Cost and Benefit Findings
Appendix D: Comparative Charts of Costs and Benefits
Appendix E: Budget Summary for Years 1-20

[16] Cost estimates assume city crews perform the work at median wages and that the city pays wholesale prices for chemical treatments. If the city contracts the work out, costs must be escalated to account for corporate profit and possibly higher operating and chemical costs.

Appendix A: Web Resources

1. Emerald ash borer
http://www.emeraldashborer.info
2. Minnesota Department of Natural Resources on Emerald Ash Borer
http://www.dnr.state.mn.us/invasives/terrestrialanimals/eab/index.html
3. United States Forest Service on Emerald Ash Borer
http://www.nrs.fs.fed.us/disturbance/invasive_species/eab/
4. Stop the Beetle presented by the USDA
http://stopthebeetle.info/
5. Minnesota Department of Agriculture on Emerald Ash Borer
http://www.mda.state.mn.us/eab
6. Emerald Ash Borer: Invasion of the Urban Forest and the Threat to North America's Ash Resource by Poland and McCullough
http://originwww.nrs.fs.fed.us/pubs/jrnl/2006/nc_2006_Poland_003.pdf
7. HungryPests.com by the United States Department of Agriculture on Emerald Ash Borer
http://www.hungrypests.com/the-threat/emerald-ash-borer.php
8. Michigan Department of Agriculture and Rural Development on Emerald Ash Borer
http://www.michigan.gov/mdard/0,4610,7-125-2390_18298---,00.html
9. University of Minnesota Extension on Emerald Ash Borer
http://www.extension.umn.edu/garden/insects/find/emerald-ash-borer/about/
10. Michigan State University Extension on EAB
http://msue.anr.msu.edu/resources/emerald_ash_boer_website
11. Ohio Department of Agriculture on Emerald Ash Borer
http://www.agri.ohio.gov/eab/
12. Take Action for Trees
http://www.takeactionfortrees.com
13. The Tree Geek on Emerald Ash Borer
http://www.thetreegeek.com/emerald-ash-borer/
14. Rainbow Treecare on Emerald Ash Borer
http://www.rainbowtreecare.com/common-problems/emerald-ash-borer/
15. Stop the Emerald Ash Borer on Facebook
https://www.facebook.com/stopthebeetle

Videos
16. Time.com feature "Meet the Beetles" (3:41 run time)
http://content.time.com/time/video/player/0,32068,1014292160001_2079432,00.html
17. Emerald Ash Borer Research at Michigan State University (8:09 run time)
http://www.youtube.com/watch?v=QGoyrBJSnek
18. Invaders: Emerald Ash Borer by the Minnesota Department of Agriculture (6:19 run time)
http://www.youtube.com/watch?v=cbt70Efxp5s
19. The Lifecycle of the Emerald Ash Borer by the Minnesota Department of Agriculture (00:30 run time)

http://www.youtube.com/watch?v=9G-0eG632OI
20. University of Illinois Extension Video on Emerald Ash Borer Identification (12:49 run time)
http://www.youtube.com/watch?v=cUod_bw0HCU

Appendix B

October 2, 2013

Private Parcel Ash Tree Survey
For the City of Columbia Heights

Summary

In September 2013, Rainbow Treecare (RTC) conducted a survey of the ash trees growing on private property within the City of Columbia Heights (City). The survey estimated the most likely number of ash trees growing on private property to be 2,117. With 6,175 private parcels in the City, there is one ash tree for every three residential properties. The survey sample has a 95% chance of representing the total private ash tree population.

Statistical methodology and validity

Using standard statistical methods to design the appropriate degree of accuracy for this survey, RTC established a confidence interval of ± 10%. The survey was designed to have a confidence level of 95% (95% confident that the actual number is within ±10%). That range would allow for the total number of private ash trees to be between 2,096 and 2,138.

The standard error (0.047) measures the survey's variation and gives the statistical likelihood that the estimate is near the true value. A smaller standard error means the estimate is less variable and therefore more likely to be accurate.

RTC first determined 6175 to be the total number of private parcels in the City using publicly available information. 105 private parcels were chosen randomly and surveyed for ash trees. 36 of the surveyed private parcels contained ash trees with a total of 41 ash trees counted. The following table lists the survey characteristics.

Private Ash Tree Survey Characteristics	
Confidence Level	95%
Confidence Interval	± 10%
Standard Error	0.047
Population (total number of parcels)	6,175
Sample Size (number of parcels)	105
Ratio of Population to Sample Parcels	58.81
Sample Mean	.343
Sample Standard Deviation	.477
Sample Variance	.227
Sample Sum	36

Columbia Heights Ash Tree Survey

Residential Parcels Surveyed

- Surveyed - No Ash (69)
- Surveyed - 1 Ash (31)
- Surveyed - 2 Ash (5)
- Other Parcels (6,070)

Public Ash Tree Density

- No Public Ash
- Few Public Ash
- Some Public Ash
- Many Public Ash
- Most Public Ash

APPENDIX C

Columbia Heights Emerald Ash Borer Management Plan

Updated: 2/17/14

Key Findings

Key Findings for City Trees: Years 1-10	Base Case	ATP Plan	ATP Plan Minus Base Case	Percent Difference	Public Subsidy Program
Costs and Resulting DBH: Years 1-10					
Total cumulative costs	$ 727,210	$ 508,561	$ (218,649)	-30%	$ 216,196
DBH of ash and replacement trees in Year 10	4,463	11,522	7,059	158%	
Annual costs:					
Year 1	$ 39,191	$ 47,088	$ 7,897	20%	$ -
Year 2	$ 83,490	$ 85,295	$ 1,805	2%	$ 3,330
Year 3	$ 99,963	$ 88,456	$ (11,507)	-12%	$ 12,006
Year 4	$ 119,261	$ 98,964	$ (20,297)	-17%	$ 17,318
Year 5	$ 157,294	$ 110,372	$ (46,922)	-30%	$ 38,347
Year 6	$ 96,168	$ 20,700	$ (75,468)	-78%	$ 60,789
Year 7	$ 71,255	$ 17,753	$ (53,502)	-75%	$ 45,738
Year 8	$ 40,450	$ 14,954	$ (25,496)	-63%	$ 26,152
Year 9	$ 16,425	$ 12,981	$ (3,444)	-21%	$ 10,479
Year 10	$ 3,714	$ 12,000	$ 8,285	223%	$ 2,036
Tree benefits:					
Estimated cumulative tree value for ash and replacement trees	$ 726,788	$ 1,063,697	$ 336,909	46%	
Increase in property value	$ 214,684	$ 286,183	$ 71,499	33%	
Interception of storm water (millions of gal)	7.4	11.8	4.4	60%	
Electricity conservation (MWh)	977	1,447	470	48%	
Natural gas conservation (therms)	126,443	192,016	65,573	52%	
CO_2 reduction (tons CO_2)	1,847	2,766	919	50%	

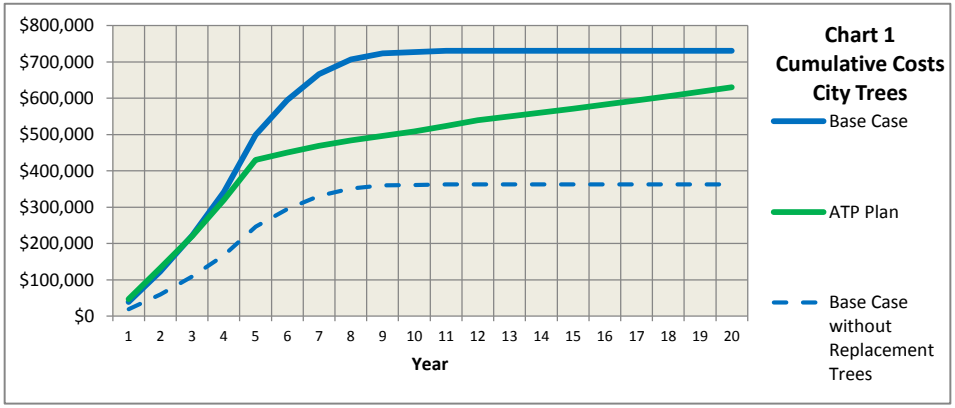
Public Subsidy of Private Tree Removals	Years 1-10	Years 11-20	Totals
Assumes 5% of private trees are treated and survive and a 25% public subsidy of removal costs.	$ 216,196	$ 2,107	$ 218,303

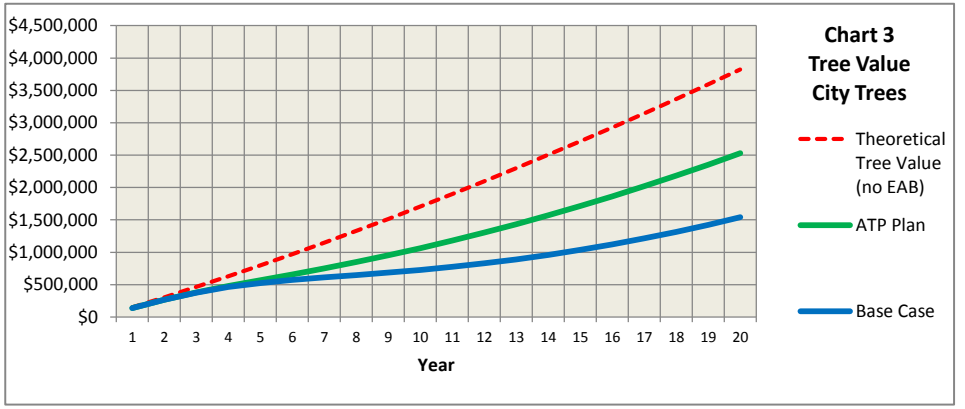
Individual Tree Comparison (17 DBH)	No Treatment	Treatment	% Different
Costs, Resulting DBH, and Tree Value: Years 1-10			
DBH in Year 10	4.8	21.3	344%
Emamectin benzoate dosage (ounces)		13.1	
Total costs	$ 805	$ 288	-64%
Number of trees that can be treated for the same cost as replacement		2.8	
Tree benefits:			
Estimated cumulative tree value for ash and replacement trees	$ 1,007	$ 1,926	91%
Increase in property value	$ 280	$ 451	61%
Interception of storm water (gal)	10,736	22,501	110%
Electricity conservation (MWh)	1,333	2,543	91%
Natural gas conservation (therms)	174	347	99%
CO_2 reduction (lbs. CO_2)	5,067	9,848	94%

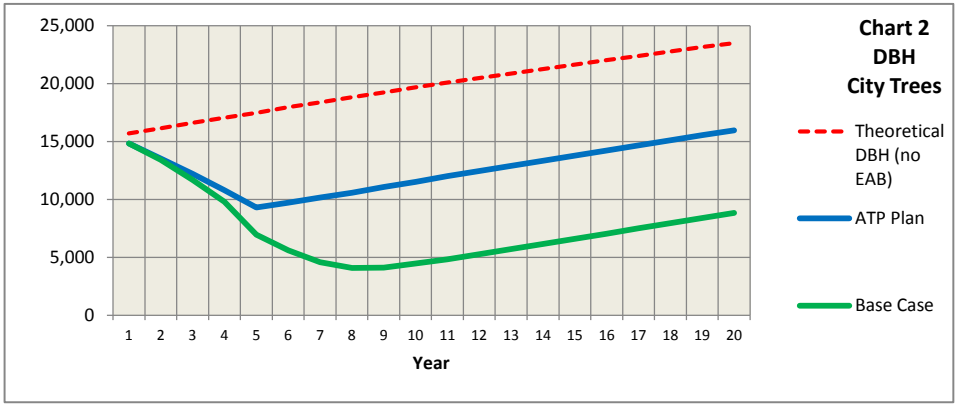
APPENDIX D

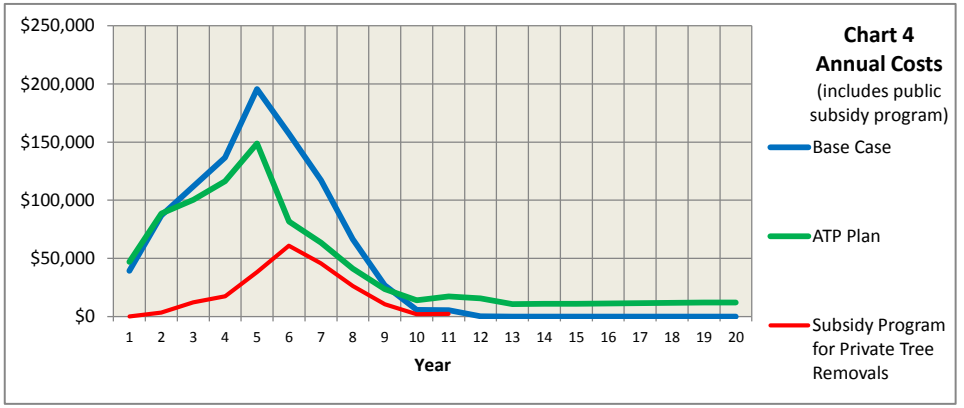
Columbia Heights Emerald Ash Borer Management Plan

Updated: 2/17/14









APPENDIX D

Columbia Heights Emerald Ash Borer Management Plan

Updated: 2/17/14

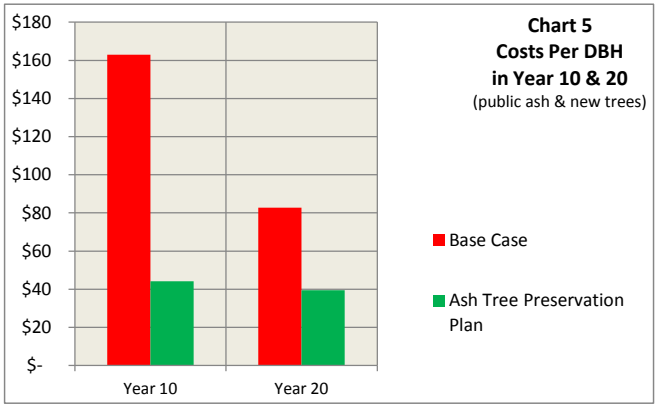


Chart 5
Costs Per DBH in Year 10 & 20
(public ash & new trees)

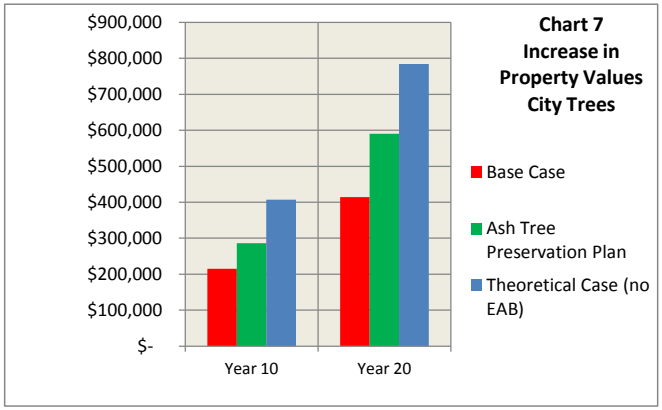


Chart 7
Increase in Property Values City Trees

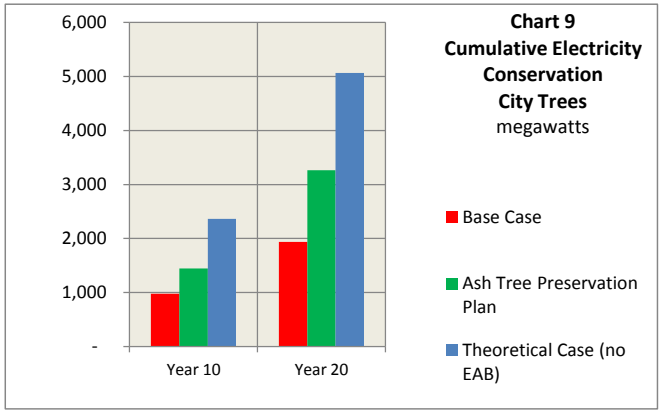


Chart 9
Cumulative Electricity Conservation City Trees
megawatts

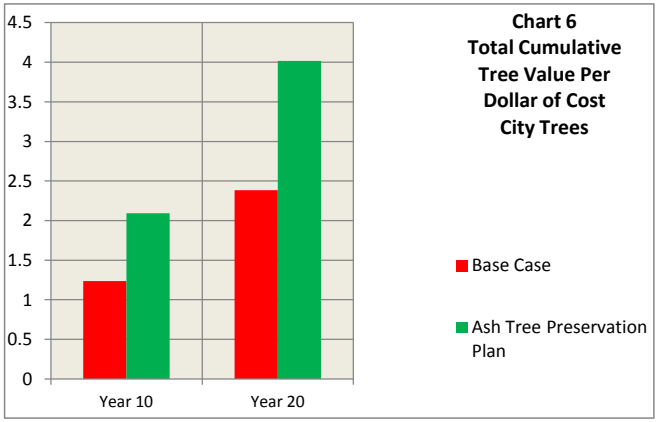


Chart 6
Total Cumulative Tree Value Per Dollar of Cost City Trees

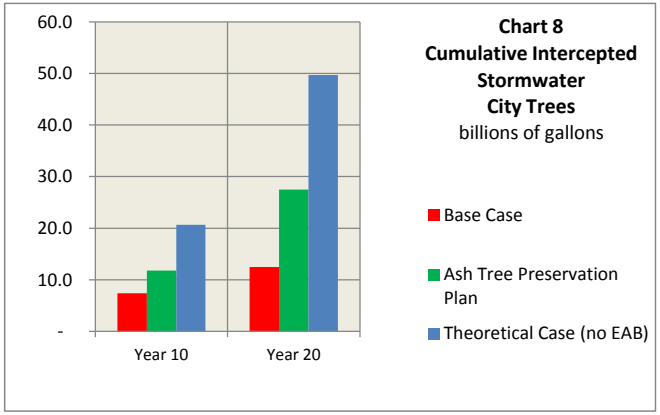


Chart 8
Cumulative Intercepted Stormwater City Trees
billions of gallons

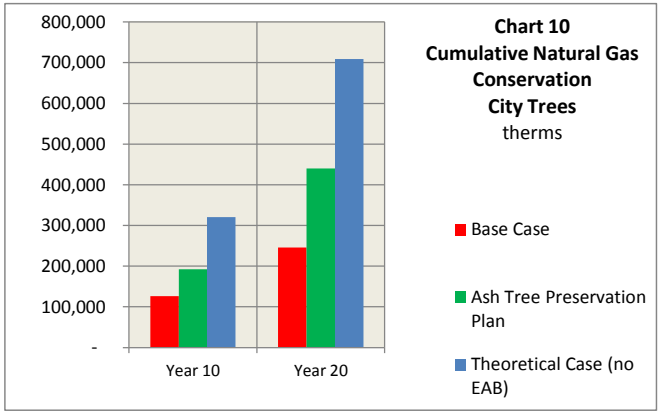


Chart 10
Cumulative Natural Gas Conservation City Trees
therms

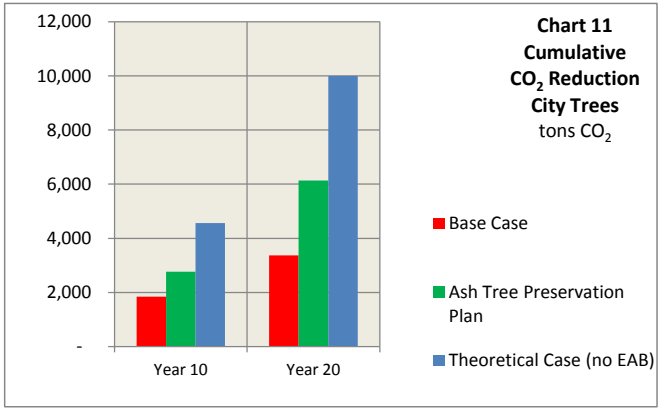


Chart 11
Cumulative CO_2 Reduction City Trees
tons CO_2

APPENDIX E

Columbia Heights Emerald Ash Borer Management Plan

Updated: 2/17/14

Summary of Budgets

Out-of Pocket Costs to City for Ash Trees (current dollars)	Year 1 2014	Year 2 2015	Year 3 2016	Year 4 2017	Year 5 2018	Year 6 2019	Year 7 2020	Year 8 2021	Year 9 2022	Year 10 2023	Year 15 2028	Year 20 2033	Subtotals (Yr. 1-10)	Subtotal (Yr. 11-20)	Grand Totals (Yr 1-20)
Base Case															
Preemptive removals	60	116	116	116	116										
Replacement trees	60	124	145	153	189	106	81	49	20	4	0	0	**$ 931**	**$ 4**	**$ 935**
Costs:															
Removal costs	$ 19,241	$ 41,040	$ 49,035	$ 57,778	$ 79,398	$ 48,148	$ 36,226	$ 20,714	$ 8,300	$ 1,613	$ -	$ -	**$ 361,492**	**$ 1,669**	**$ 363,161**
Replacement tree costs	$ 19,950	$ 42,450	$ 50,928	$ 61,483	$ 77,896	$ 48,020	$ 35,028	$ 19,736	$ 8,125	$ 2,102	$ -	$ -	**$ 365,718**	**$ 1,817**	**$ 367,535**
Total costs	$ 39,191	$ 83,490	$ 99,963	$ 119,261	$ 157,294	$ 96,168	$ 71,255	$ 40,450	$ 16,425	$ 3,714	$ -	$ -	**$ 727,210**	**$ 3,486**	**$ 730,697**
Cumulative costs	$ 39,191	$ 122,681	$ 222,644	$ 341,906	$ 499,199	$ 595,367	$ 666,622	$ 707,071	$ 723,496	$ 727,210	$ 730,697	$ 730,697			
ATP Plan															
Preemptive removals	60	116	116	116	116								**$ 525**	**$ -**	**$ 525**
Ash trees eligible for treatments	410	410	409	408	406	402	400	398	398	398	392	386	**$ 4,038**	**$ 3,911**	**$ 7,950**
Treatments	137	137	136	136	135	134	133	133	133	133	78	77	**$ 1,346**	**$ 889**	**$ 2,235**
Replacement trees	60	116	117	117	118	3	2	1	1	0	1	1	**$ 537**	**$ 12**	**$ 549**
Costs:															
Removal costs	$ 19,241	$ 38,482	$ 39,813	$ 44,477	$ 49,945	$ 1,459	$ 1,098	$ 628	$ 252	$ 49	$ 523	$ 570	**$ 195,444**	**$ 5,277**	**$ 200,722**
Replacement trees	$ 18,960	$ 37,581	$ 39,074	$ 43,694	$ 48,378	$ 6,018	$ 3,698	$ 1,862	$ 668	$ 87	$ 358	$ 358	**$ 200,019**	**$ 3,622**	**$ 203,641**
Treatments	$ 8,887	$ 9,232	$ 9,568	$ 10,793	$ 12,048	$ 13,223	$ 12,957	$ 12,464	$ 12,061	$ 11,864	$ 8,085	$ 9,175	**$ 113,098**	**$ 92,370**	**$ 205,468**
Other costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000	$ 2,000	**$ -**	**$ 20,000**	**$ 20,000**
Total costs	$ 47,088	$ 85,295	$ 88,456	$ 98,964	$ 110,372	$ 20,700	$ 17,753	$ 14,954	$ 12,981	$ 12,000	$ 10,966	$ 12,103	**$ 508,561**	**$ 121,270**	**$ 629,831**
Cumulative costs	$ 47,088	$ 132,383	$ 220,839	$ 319,803	$ 430,174	$ 450,874	$ 468,627	$ 483,580	$ 496,562	$ 508,561	$ 571,604	$ 629,831			
Subsidy Program for Private Tree Removals	$ -	$ 3,330	$ 12,006	$ 17,318	$ 38,347	$ 60,789	$ 45,738	$ 26,152	$ 10,479	$ 2,036			**$ 216,196**	**$ 2,107**	**$ 218,303**
Totals for City Trees and Public Subsidies	$ 47,088	$ 88,625	$ 100,462	$ 116,282	$ 148,719	$ 81,489	$ 63,490	$ 41,106	$ 23,460	$ 14,036	$ 10,966	$ 12,103	**$ 724,757**	**$ 123,377**	**$ 848,134**
Cumulative costs	$ 47,088	$ 135,713	$ 236,175	$ 352,457	$ 501,176	$ 582,664	$ 646,155	$ 687,261	$ 710,721	$ 724,757	$ 789,907	$ 848,134			
Individual Tree Comparison															
Remove and replace in Year 6:															
Cumulative costs	$ -	$ -	$ -	$ -	$ -	$ (714)	$ (19)	$ (21)	$ (24)	$ (27)	$ -	$ -	**$ (805)**	**$ (29)**	**$ (834)**
Cumulative tree value	$ 170	$ 177	$ 181	$ 186	$ 191	$ 14	$ 17	$ 20	$ 24	$ 27	$ 54	$ 84	**$ 1,007**	**$ 573**	**$ 1,580**
Treat:															
Cumulative costs	$ (65)	$ -	$ -	$ (73)	$ -	$ -	$ (81)	$ -	$ -	$ (89)	$ (103)	$ (119)	**$ (308)**	**$ (222)**	**$ (530)**
Cumulative tree value	$ 170	$ 347	$ 528	$ 714	$ 905	$ 1,100	$ 1,300	$ 1,504	$ 1,713	$ 1,926	$ 3,056	$ 4,292	**$ 10,207**	**$ 31,924**	**$ 42,131**