

EMERALD ASH BORER MANAGEMENT PLAN

POTTSVILLE, PA

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Management Plan created by Diana Beausang and Joseph Orlowsky,
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This plan uses the West Chester EAB Management Plan as a template.

This plan was made possible by the Pottsville iTree Street Tree Inventory. Ellen Roane with DCNR, Kutztown University Professor Christopher Sacci, Kendra McMillin (Project Intern with Pennsylvania Urban and Community Forestry Council), and the students of Kutztown University worked together to complete this inventory.



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DEPARTMENT OF CONSERVATION
AND NATURAL RESOURCES



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ADMINISTRATION

The City of Pottsville Emerald Ash Borer Management Plan is administered by the chairman of the Pottsville Street Tree Commission. The EAB Manager reports to the City Administrator. Borough residents are encouraged to contact the EAB Manager for any questions or concerns related to this plan.

James T. Muldowny, Mayor
Thomas A. Palamar, City Administrator
Joseph Orłowsky, Shade Tree Commission Chairman

City Hall
401 North Centre Street
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Figure 1 Photos by Frank Snyder, EAB Discovery in Pottsville

EXECUTIVE SUMMARY

As per the city code (<http://www.city.pottsville.pa.us/html/code.htm> Chapter 183 Chapter 183: Shade Trees <http://ecode360.com/11589396>), the Pottsville Shade Tree has been charged with the following responsibilities:

1. To guide and regulate the orderly growth and development of vegetation on or near public area in accordance with long-term objectives, principles and standards deemed beneficial to the interest and welfare of the people of the city.
2. To protect the character and the social and economic value of both private and public property.
3. To preserve and enhance the visual character and natural beauty of the city.
4. To restore, insofar as is possible, a healthy natural environment, including but not limited to photosynthesis, underground water stability, surface runoff stability, the reduction of noise, the filtration of pollutants and the propagation of animal life.
5. To restore, insofar as is possible, the original natural beauty of Pottsville's tree-lined streets.

The decline of the ash tree population threatens the visual character and the natural beauty of the city. It also threatens the health of the complex habitats of the city. To this end, the Tree Commission is proposing to treat those ash trees that show the greatest hope of survival. Not only are we interested in the long-term health of the specific trees, but we also strive to maintain varied populations of tree species in our city.

Because we have few trees to be treated, we are proposing to use the Tree-age method to protect our selected Ash. These Ash trees show a landscape value of \$9,202, as determined by the Purdue University Landscape Tree Appraisal (Appendix 1)

AUTHORITY

As per the city code (<http://www.city.pottsville.pa.us/html/code.htm> Chapter 183 Chapter 183: Shade Trees <http://ecode360.com/11589396>), the Pottsville Shade Tree Commission has the following authority:

It shall be the duty of the owner of property abutting the right-of-way of any street or public right-of-way or other public place to maintain and care for all trees and shrubs abutting such right-of-way. The Shade Tree Commission or its officer shall have the power to require any such property owner to perform such maintenance on any tree or shrub on the right-of-way abutting such owner's property as may be necessary. The Shade Tree Commission or its officer shall further have the power to require any property owner to trim, remove or protect any tree or shrub on such owner's property as may project beyond the property line onto or over the right-of-way abutting the property. The Shade Tree Commission or its officer shall cause a notice requiring such work to be performed to be served upon the property owner in accordance with § 183-17 of this chapter, and such work shall be done within the reasonable time specified in this notice. Nothing in this chapter shall be construed as requiring the owner of property to trim any trees or shrubs when such trimming is required because of city utility lines or traffic control devices or signs, and it shall be the duty of the city to do any trimming required for such utilities or traffic control devices or signs.

Dead or hazardous trees

Should any shade tree die or in any other manner present a hazard to the public, it shall be declared a public nuisance by the Shade Tree Commission, and the elimination of the hazard or the tree shall be effected pursuant to § 183-17. Notification to the Commission that a hazardous condition exists shall be the responsibility of the property owner except that if the hazardous condition exists on a public right-of-way such notification shall be the responsibility of the owner of the property nearest the hazardous condition. Failure to notify the Commission, in writing, shall subject the person charged with the responsibility to notify the Commission to liability for any damages attributable to such hazard.

Control of disease or infestation of trees

Upon the discovery of any destructive or communicable disease which endangers the well-being of the shade trees of the community (such as Dutch Elm disease), the Shade Tree Commission shall cause written notice to be served upon the property owner or the owner of property abutting the right-of-way where such tree is located which shall require the property owner to remove the tree or control the condition within a reasonable time specified in the notice, pursuant to § 183-17.

Responsibility for costs

The cost of furnishing, planting, transplanting or removing any shade tree(s) or the necessary suitable guards, curbs or grading for the protection thereof and the replacing of any pavement or sidewalk necessarily disturbed in the execution of such work shall be paid by the owner of the property on which such tree(s) are located or, if located in a

public right-of-way, by the owner of property nearest such tree(s), except that part of the cost may be certified by the Shade Tree Commission to the Council and to the City Treasurer as a charge to be paid by the city. The amount each property owner is to pay shall be determined by the Commission and certified to the Council and to the City Treasurer.

Damage to shade trees

Should any shade tree be damaged by any person, the city may charge the person causing such damage for repairs to the tree and/or its devaluation. Should any shade tree be destroyed by any person, the city may charge the person causing such destruction for the appraised value of the tree plus the cost of its removal and replacement. Should any shade tree be damaged or felled by a storm or other natural occurrence, such trees shall be repaired or removed, including stump, by the owner of property on which the tree stands or stood or, if located on a public right-of-way, by the owner of the property nearest the point at which the tree stands or stood. Replacement of such tree shall be made at the discretion of the Shade Tree Commission and at the expense of the owner of the property on which the tree is located or, if located on a public right-of-way, at the expense of the owner of the property nearest such tree, except that part of such cost may be certified by the Commission to the Council and to the City Treasurer as a charge to be paid by the city.

Shade trees as public nuisances

Any shade tree that, in the opinion of the Shade Tree Commission, endangers the life, health, safety or property of the public or which is afflicted with any contagious disease or insect infestation shall be declared a public nuisance by the Commission, except that when such shade tree presents a clear and present danger to the life, health or safety or property of the public, such declaration may be made by the Council, the Chief Building Inspector or the Parks Administrator. The owner of the property on which such tree is located or, if located on a public right-of-way, the owner of property nearest the tree shall be notified, in writing, of the existence of a nuisance and be given reasonable time to effect abatement of such nuisance or removal of such tree at his own expense. If the owner does not cause the nuisance to be corrected or removed within the time specified, the city shall cause the nuisance to be corrected or removed and the cost thereof shall be assessed to the owner as provided by law.

INTRODUCTION

Pottsville is a beautifully wooded treasure, nestled in the coal region of Pennsylvania. Many of the streets of Pottsville are tree-lined. The tree canopy provided by the many species of trees affords cooling pockets of air and respite from harsh glare. Pottsville is the county seat and the home of the Yuengling Brewery. The Charles Baber Cemetery is located in the heart of Pottsville. "The Baber cemetery plays a unique but intricate role in the community. It is a cemetery within the setting of a garden park. As a cemetery it offers a "union with nature" through its in-ground burial plots shaded and sheltered with an amazing variety of trees and shrubs."(babercemetery.org) Pottsville also has many city parks. These parks play an important role in providing safe, shaded and non-shaded play spaces for the children of the town. Pottsville hosts many important dignitaries and tourists throughout the year. The trees are a signature of this lovely town.

The emerald ash borer (*Agrilus planipennis*) is an effective killer. Adult females lay their eggs under the bark. Emerging larva destroy the cambial region as they feed and mature. Without treatment, virtually all infected trees (99%) will die within 3-5 years of the initial infestation. (Kovacs et al. 2010)

There are various EAB treatment options available. Due to the small number of trees to be treated, and concerns for tree ecosystems, Tree-age injections are the treatment of choice for Pottsville.

The EAB management plan is will protect the high value ash trees that are in Baber Cemetery and along the streets. The removal aspect of the plan strives to protect the public from the dangers of dead and dying trees. The replanting phase of the plan strives to maintain the tree canopy over the streets of Pottsville.

The ten-year outlook for Pottsville's ash population is grim. The Pottsville Tree Commission will continue to update our iTree inventory with a program called i-Tree, i-Tree - Tools for Assessing and Managing Community Forests (<http://www.itreetools.org>), and thus track the decline of the ash population and its EAB infection. The Commission will work with the City of Pottsville and local property owners to locate and remove dead or dying trees. The Commission will consult with DCNR for the best practice recommended for removal of the infected wood. The Commission will implement the Tree-age treatments through certified technicians. The Commission will replace removed trees with non-host trees, which in time will grow to replace the lost canopy. The Commission will work with the community by hosting public information sessions. The Commission will make appropriate literature available to property owners and concerned citizens.

THE ASH RESOURCE

In 2014, through the joint efforts of Ellen Roane, Christopher Sacci, Kendra McMillin, Tom Palamar, and Professor Sacci's Kutztown University students, Pottsville completed an i-Tree street tree inventory. This report and further investigations have identified 46 ash trees along the streets and in the parks of Pottsville. The locations of these trees are shown below in figure 2.

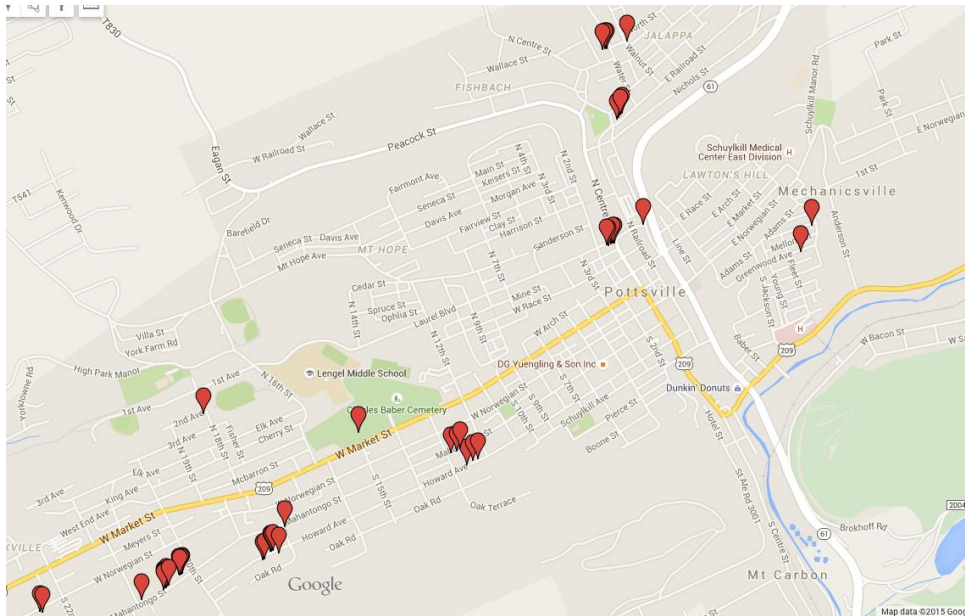


Figure 2 ash street trees in Pottsville, PA 2015 Google Maps

The DBH and condition of these trees is shown in Table 1. These trees range in diameter from 5 to 41 inches at diameter breast height (DBH). Four percent of the trees are less than 10 inches in diameter. Seventy-six percent of the trees are between 10 and 25 inches in diameter. Thirteen percent of the trees are between 26 and 35 inches in diameter. Seven percent of the trees are between 36 and 50 inches in diameter. The landscape appraisal value of these trees is \$9,202. (Dana, Landscape Tree Appraisal (http://www.hort.purdue.edu/ext/HO_201.pdf))

TABLE 1. DBH and Condition of Street and Park Ash Trees

Condition/DBH	<10 in	10 – 25 in	26 – 35 in	36 – 50 in	Total
Excellent	0	1	1	0	2
Good	2	6	0	1	5
Fair	0	10	2	2	14
Poor	0	18	3	0	21
Total	2	35	6	3	46

There are uncounted ash trees on private properties in Pottsville. As this epidemic takes hold, property owners will become increasingly more involved in identifying their own specimens of ash trees. During the public information sessions, property owners will be

counseled as per the available options for treating and removing their diseased trees. For further assistance, the public is invited to contact the EAB manager at Pottsville City Hall (phone: 570-622-1234). Additionally, the public may contact the Pennsylvania Department of Agriculture EAB hotline: 1-866-253-7189.

MANAGEMENT OPTIONS – as originally stated in EAB Management Proposal of West Chester, PA.

Trees are valuable natural resources in urban communities (Dwyer et al. 1992, Nowak et al. 2002), with compensatory values on shade, air quality, storm water discharge, heating/cooling costs, and aesthetic or property value. With the arrival of EAB, all communities will be forced to respond to the infestations in some degree, regardless of the strategies they choose to adopt. Dead trees on streets and in community parks present real threats to public safety. Removing ash from the local ecosystem will permanently alter the natural habitats for related species. Sudden changes in urban canopy cover may result in negative impacts to local communities. Addressing some or all of these concerns requires a well-conceived management plan with specific goals and implementable mechanisms. There are four management options a community can choose from, each with its own pros and cons:

Option A. No Special Actions. The result will be that most ash trees will be killed by the end of the infestation.

Option B. Preemptive Management. In this option, ash trees on streets and in the parks will be re- moved preemptively and replaced with non-host species. No EAB survey activity will be conducted. As a result, treatment areas will contain no ash trees, with no concerns over EAB in the future either. The initial cost of this option could be very high because of expenses associated with tree removal and replacement. Streets and parks also need to deal with major canopy gaps temporarily at the beginning before replacement trees become well established. However, no annual cost will be incurred after the completion of the project.

Option C. Aggressive Management. In this option, all ash trees in the community will be managed actively with all available management tools. EAB survey activities will be carried out on both road- ways, parks and in yards. Information from the surveys will be used to determine proper management actions across the Borough. Chemical control will be actively pursued to protect the maximum portion of ash trees and their canopy. Only dead or dying ash trees will be replaced with non-host species. As a result, most high value ash trees will be saved from EAB damage, whereas a small portion will be replaced with non-host species. Community suffers the least socially and environmentally from the infestation, with less risk of losing urban canopy cover.

Option D. Selective Management. In this option, high-value ash trees in selected areas (streets and parks) within the community will be managed actively, whereas those in other private property will be left alone. Ash trees will be monitored for their health and levels of EAB infestation. Chemical control and tree removal will be applied wherever

appropriate in a cost-effective manner. Tree replacement (2:1) will be done. As a result, most ash trees in yards will be killed by the end of the infestation, whereas a large portion of high-value ash trees are protected for future generations to enjoy. Monitoring of tree health and for the beetle will be done as needed.

Pottsville has selected a selective management option, using Tree-äge injections to treat the chosen trees.

EAB INFESTATION

EAB infection has been identified in Pottsville.

MANAGEMENT APPROACHES

Tree-äge injected treatment, removal and replacement will begin as soon as possible.

Chemical treatment

High Value Ash trees in the city will be treated with Tree-äge (Figure 3). This treatment has been found to be effective and of minimal impact to the environment.

http://www.fs.fed.us/foresthealth/pesticide/pdfs/052-23-03b_Emamectin-benzoate.pdf

(appendix 1)

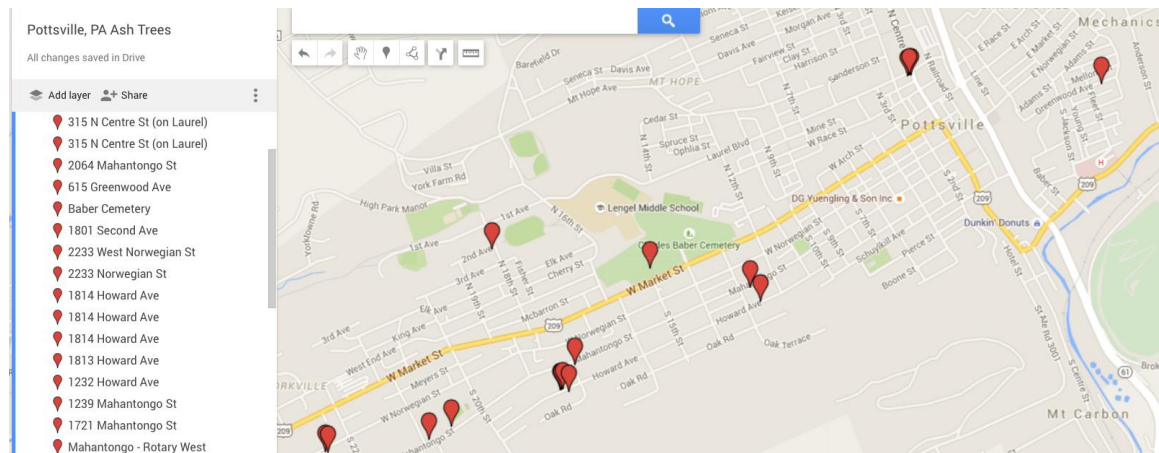


Figure 3 Pottsville Ash Trees to Treat 2015 Google Maps

A total of 17 trees will be treated with Tree-äge. Two of these trees are excellent. Seven of these trees are good. Eight of these trees are in fair condition. (Table 2)

TABLE 2. DBH and Condition of Ash Trees Recommended for Treatment

Condition /DBH	<10 in	10 – 25 in	26 – 35 in	36 – 50 in	Total
Excellent	0	1	0	1	2
Good	0	6	0	1	7
Fair	0	6	0	2	8
Total	0	13	0	4	17

Cost analysis for Tree-äge

The Tree Commission is expecting to follow a ten-year treatment plan for EAB. Since Tree-äge treatments will last for three years, the Commission plans to implement treatments during 2015, 2018, 2021 and 2024 (Table 3). The original cost for the 2015 treatment has been calculated from the DCNR XLXS spreadsheet created by PA-DCNR. A two percent annual increase was calculated by D. Beausang.

TABLE 3. Ten Year Cost Analysis for Tree-äge Treatment

Year	Total DBH (in)	Application Cost (\$)	Chemical Cost (\$)	Total Cost (\$)
2015	370	3700	2669	6369
2018	393	3927	2833	6760
2021	417	4167	3006	7173
2024	443	4432	3190	7622
Totals		\$16,226	\$11,698	\$27,924

Tree removal

EAB kills virtually all of the untreated trees that it infects. Although some of the ash trees in Pottsville are very small and will be removed easily, others will pose an expensive burden to the town and the citizenry. Urgency in removal is required because the infection has been identified in Pottsville. Therefore, a 3-year plan of removal is proposed. The estimated combined expense for tree removal is \$14,400 (Table 4). This expense will be shared by the City as well as individual property owners. The distribution of the trees that are scheduled for removal is shown on Figure 4. The anticipated schedule of removal and the expense of removing these trees is shown in Table 4.

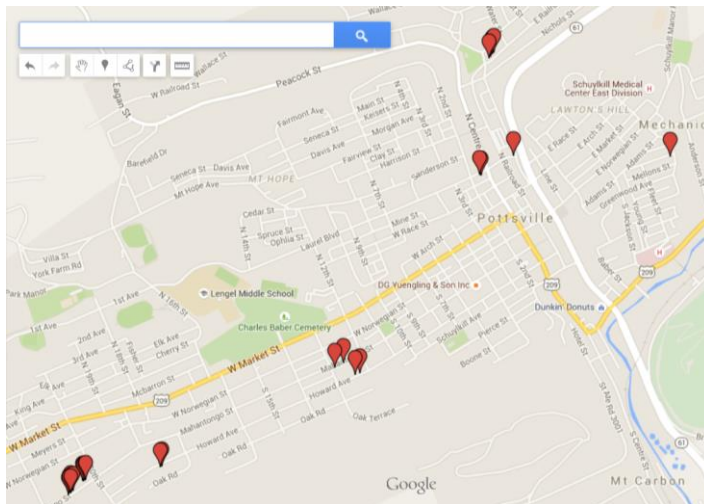


Figure 4 ash street trees to be removed, 2015 Google Maps

TABLE 4. Ash Trees to be removed (* City Removal)

Year	# Trees	Unit Price (\$)	Total (\$)	Location
2015	6	300	1800	Rotary Park *
2015	4	400	1600	Jalappa Park *
2015	1	600	600	1819 Howard
2015	1	900	900	1819 Howard
2016	2	900	1800	Laurel @ Centre
2016	1	900	900	201 Laurel
2016	2	900	1800	1200's Howard
2016	1	300	300	1200's Mahantongo
2016	1	500	500	1200's Mahantongo
2016	5	300	1500	Rotary Park *
2017	1	200	200	Edwards
2017	3	500	1500	Water
2018	1	1000	1000	Walnut
TOTAL	29		14,400	

Estimating the cost of tree removal is very difficult because as the trees sicken, the cost can rise more than the 2% expected. Also, the schedule for removal is tentative, pending discovery of rapidly dying trees. The estimate for removing ash trees in the city parks is low due to the expectation of the city completing the work “in-house.” The city parks with identified ash trees are Rotary Park and Jalappa Park.

Replanting

Ash trees will be removed, but their stumps will remain. Tree replacement will progress as possible with a 2:1 replacement ratio. Two new trees will be planted for each ash that is removed. Both trees may not be in the same location due available space restrictions. The Tree Commission will contact property owners in a timely manner and aid in the replacement process.

COMMUNITY OUTREACH

As pertains to the EAB epidemic, appropriate information, will be made available to the public by the Shade Tree Commission in coordination with the City and the local news media. The public will be informed about the spread of the disease and the resulting need for tree removal, chemical treatment and/or replanting.

The responsibility for caring for diseased trees rests with the property owner. The Shade Tree Commission will be available to help with contacting knowledgeable technicians and government agencies. The public is invited to contact Pottsville City Hall (phone 570-622-1234) for assistance. Additionally, the public may contact the Pennsylvania Department of Agriculture EAB hotline: 1-866-253-7189.

REPLANTING

Every year the Shade Tree Commission strives to plant an abundance of trees. It is not unusual for 50 to 60 new bare-root trees to be planted each year. With community and City and DCNR support, the Commission will continue to do this throughout the duration of this program. The City often helps with digging holes for the new trees. This is an important and significant contribution. Replacing the 29 trees at a ratio of 2:1 means that 58 new trees will need to be planted in the next 4 years. At one hundred dollars a tree, this will require a budget of \$5800. Tree planting is done by volunteers, with the invaluable supervision and assistance of Frank Snyder, DCNR Forester.

COMPREHENSIVE FISCAL PLANNING

It is not expected that the City will need to buy the delivery system for Tree-age. Licensed technicians will complete this phase of the program. The ten-year financial outlook for treatment, removal and replacement of ash trees due to the EAB will be no less than \$48,000. As shown in Table 3, the total cost of treatment and application will be in excess of \$27,000. As shown in Table 4, removal costs will be approximately \$15,000. Anticipated replacement costs for the known trees will be approximately \$5800. Unfortunately, over time, it is inevitable that additional ash trees will be identified. These ash trees will put an additional burden on the budget. With a conservative estimate of \$1,000 per year for tree removal, and \$200 per year for tree replacement, an additional \$7200 expense will quite probably be incurred due to the infection of shade trees that have yet to be identified. The red parenthetical numbers on this chart provide estimates for the removal of one unidentified tree per year from 2019 to 2024. This is a conservative estimate. It does not include trees that are not under the jurisdiction of the Pottsville Shade Tree Commission.

TABLE 5. Long Term Financial Expectation

YEAR	Treatment Cost (\$)	Removal Cost (\$)	Replacement Cost (\$)	Total \$\$
2015	6,369	4,900.00	2,400.00	13,669.23
2016		7,300.00	2,400.00	9,700.00
2017		1,700.00	800.00	2,500.00
2018	6,760	1,000.00	200.00	7,959.10
2019		(1,000)	200.00	
2020		(1,000)	200.00	
2021	7,173	(1,000)	200.00	7,172.77
2022		(1,000)	200.00	
2023		(1,000)	200.00	
2024	7,622	(1,000)	200.00	7,611.79
Total	\$27,924			48,612.89
TOTAL	WITH	EXTRA	ASH LOSS	(55.812.89)

COST/BENEFIT ANALYSIS

Due to the catastrophic results of EAB infection, there are really no choices about the prohibitive cost of removing dead trees. By choosing a small collection of trees to represent the ash population, Pottsville will continue to have a varied scope of tree species. The cost of removing trees is significant, therefore treatment is essential to stave off the overwhelming cost of simultaneous population collapse.

TIME TABLE

As mentioned in the above comments, the more time elapses, the less sure the cost analysis will be. As the community awareness increases and the infestation increases, the scope of the crisis will increase.

DATA COLLECTION AND REPORTING

The identification of infected ash trees will be an ongoing process. Community awareness and increasing communication among all involved agencies and people will help to identify the diseased trees as they emerge. Throughout the process, detailed notes will be collected. These notes will include: newly identified trees, trees that have been removed, trees that have been treated and replacement trees that have been planted. Each year a formal report will be prepared on the current status of the EAB infection. At the close of the program, a final report will be presented.

CONTACTS AND INFORMATION

Pennsylvania Department of Conservation and Natural Resources
(<http://www.dcnr.state.pa.us/forestry/insectsdisease/eab/index.htm>)

Penn State College of Agricultural Sciences, Emerald Ash Borer
(<http://ento.psu.edu/extension/trees-shrubs/emerald-ash-borer>)

Google Maps (<http://www.google.com>)

Emanectin benzoate: Human Health and Ecological Risk Assessment
(http://www.fs.fed.us/foresthealth/pesticide/pdfs/052-32-03b_Emanectin-benzoate.pdf)

Pennsylvania Department of Agriculture EAB hotline: 1-866-253-7189 or Pennsylvania State University Extension

i-Tree - Tools for Assessing and Managing Community Forests
(<http://www.itreetools.org/>)

EAB Cost Calculator (<http://extension.entm.purdue.edu/treecomputer/index.php>)
also found as: National Tree Benefit Calculator
(<http://extension.entm.purdue.edu/treecomputer/index.php>)

Baber Cemetery Information (www.babercemetery.org)

Pottsville City Code: <http://www.city.pottsville.pa.us/html/code.htm>
Chapter 183: Shade Trees <http://ecode360.com/11589396>

REFERENCES

PRIMARY SOURCE: WEST CHESTER EAB MANAGEMENT PLAN

(www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20027908.pdf)

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We would like to acknowledge and extend our gratitude to the following persons and agencies that have made the completion of the Emerald Ash Borer Management Plan possible:

Extensive information and grant funding supported through the USDA Forest Service and the Pennsylvania Urban & Community Forestry Council. Technical assistance and Emerald Ash Borer Management Plan template provided through the Pennsylvania Department of Conservation & Natural Resources, Bureau of Forestry.

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West Chester University President Greg Weisenstein and Dean Lori Vermeulen for making Kendra McMillin and Gerald Hertel available for this project.

Donald Eggen Forest Health Manager, Department of Conservation and Natural Resources for his contribution to Kendra McMillin and Gerald Hertel's success.

Kendra McMillin for her many hours of consultation, support and instruction towards the completion of this management plan.

Mayor James Muldowney and City Administrator Thomas Palamar for their continued concern and support towards keeping and maintaining Pottsville as a city made more beautiful by her trees.

Frank Snyder, DCNR Forester, for his enduring care and concern and labor towards maintaining Pottsville as a Tree City and for the first photographs of the EAB infestation in Pottsville.

Appendix – 1

General Considerations

Emanectin benzoate: Human Health and Ecological Risk Assessment

(http://www.fs.fed.us/foresthealth/pesticide/pdfs/052-32-03b_Emanectin-benzoate.pdf)

Emamectin benzoate is used for control of the emerald ash borer (*Agrilus planipennis* Fairmaire, commonly abbreviated as EAB), an insect pest of ash trees (*Fraxinus* spp.). This document provides human health and ecological risk assessments to support an assessment of the environmental consequences of using this pesticide in Forest Service programs. Emamectin benzoate is an insecticide that acts by adversely affecting the nervous system. This insecticide is registered for national use on a variety of agricultural commodities. The anticipated uses of emamectin benzoate in Forest Service programs is limited to one formulation of emamectin benzoate, Tree-äge, and one application method, tree injection. Relatively little information is available on the transport of emamectin benzoate in trees following tree injection and uncertainties with the movement of emamectin benzoate in ash trees following tree injection is a dominant factor in the current Forest Service risk assessment in terms of adequately assessing exposures to humans and other nontarget species.

Human Health

In terms of potential human health effects, the most plausible exposure scenarios are those for workers applying emamectin benzoate in a manner that is consistent with labeled directions including the proper use of chemical resistant gloves. If workers handle emamectin benzoate with care and effectively use chemical resistant gloves, no substantial or significant risks to workers are anticipated. If workers fail to effectively use chemical resistant gloves or if workers do not effectively and rapidly respond to accidental exposures, adverse effects in workers, possibly including degenerative changes in nerve tissue, could occur.

Substantial exposures to members of the general public do not appear to be plausible although quantitative estimates of expected exposures and hence quantitative estimates of risks cannot be developed at this time. Based on accidental exposure scenarios associated with the spill of emamectin benzoate into a pond, the central estimates of hazard quotients are below the level of concern (HQ=1). The upper bound estimates of the hazard quotients range from 0.6 to 3. The inability to estimate exposures to members of the general public associated with the normal and expected use of emamectin benzoate –i.e., injection into ash trees – is a serious limitation in this risk assessment. Nonetheless, the upper bound HQ for all of the accidental exposure scenarios is only 3. Thus, in the normal use of emamectin benzoate, about one-third of the emamectin benzoate that is injected into an ash tree would need to be transported to surface water in order for the HQs associated with non-accidental exposures to reach a level of concern. It does not seem reasonable to assert that this level of exposure would or could occur.

Ecological Effects

As with the human health risk assessment, the ecological risk assessment for emamectin benzoate is dominated by uncertainties in the exposure assessment. Because of limited information on the transport of emamectin benzoate in trees following tree injection and the lack of information on the transport of emamectin benzoate in ash trees, reliable estimates of exposures in nontarget species associated with the injection of emamectin benzoate into ash trees cannot be made. The inability to estimate expected exposures of nontarget species limits confidence in the risk characterization for nontarget species.

Uncertainties in the exposure assessments associated with the potential contamination of surface water in the normal use of emamectin benzoate for the injection of ash trees is addressed with an accidental spill scenario. Based on the accidental spill scenario, no risks are apparent for mammals, birds, fish, aquatic plants, or tolerant species of aquatic invertebrates. The lack of risk in the accidental spill scenarios for these groups of organisms suggests that the contamination of surface water associated with the normal use of emamectin benzoate to inject ash trees is not likely to adversely impact these organisms. Risks to sensitive species of aquatic invertebrates, however, are apparent in the accidental spill scenario with an upper bound HQ of 120. Thus, in the event of an accidental spill of a significant amount of emamectin benzoate into a pond, adverse effects including mortality could be anticipated. The high hazard quotients for sensitive species of aquatic invertebrates associated with the accidental spill scenario also prevent a clear risk characterization for this group of organisms in the normal use of emamectin benzoate. At least in situations in which high doses of emamectin benzoate are used or a relatively large number of trees are treated near surface water, risks to sensitive species of aquatic invertebrates can neither be discounted nor characterized clearly.

While uncertainties associated with contaminated surface water can be addressed reasonably well, other exposure pathways are problematic. The most likely exposures for mammals or birds involve the consumption of bark, stem tissue, or seeds of ash trees as well as the consumption of herbivorous insects that may feed on ash leaves. Only the pathway involving the consumption of herbivorous insects is developed quantitatively. Under worst-case exposure assumptions, risks to mammals are marginal (an upper bound HQ of 1.1) and risks to birds are negligible (an upper bound HQ of 0.03). For herbivorous insects, however, the risk characterization is well-defined. Both tolerant and sensitive species or populations of herbivorous insects are likely to be adversely affected if they feed on ash trees injected with effective doses of emamectin benzoate.

While the risk characterization for emamectin benzoate is dominated by uncertainties in the exposure assessments, it is worth noting that the most relevant toxicity studies on aquatic organisms and birds are limited to relatively standard bioassays on relatively few species of organisms compared to other more fully studied pesticides. In addition, no data are available on reptiles, amphibians, or soil invertebrates.