AGENDA
CITY OF MAPLEWOOD
ENVIRONMENTAL AND NATURAL RESOURCES COMMISSION

Monday, April 18, 2022
7:00 p.m.
Maplewood City Council Chambers
1803 County Road B East

1. Call to Order

2. Roll Call

3. Approval of Agenda

4. Approval of Minutes:

    a. March 21, 2022

5. New Business

    a. Friends of Maplewood Nature
    b. Emerald Ash Borer Management Plan

6. Unfinished Business

    a. Annual Report
        1) Solid Waste
        2) Sustainability

7. Visitor Presentations

8. Commissioner Presentations

9. Staff Presentations (oral reports)

    a. Environmental Commission Conference – April 30
    b. Arbor Day Event – May 14
    c. Spring Clean Up – May 21
    d. Harvest Park Native Seed Garden Pollinator Planting - May 24
    e. Waterfest – June 4
    f. May ENR Meeting – Climate Action Financing and Project Priorities

10. Adjourn

MINUTES
CITY OF MAPLEWOOD
ENVIRONMENTAL AND NATURAL RESOURCES COMMISSION
MONDAY, MARCH 21, 2022
7:00 P.M.
(THIS MEETING WAS HELD REMOTELY VIA ZOOM AND CONFERENCE CALL)

1. CALL TO ORDER

Chairperson Dosser called a meeting of the Environmental and Natural Resources Commission to order at 7:00 p.m.

2. ROLL CALL

Emma Broadnax, Commissioner	Present
Rebecca Bryan, Vice Chairperson	Present
Kayla Dosser, Chairperson	Present
Benjamin Guell, Commissioner	Absent
Mollie Miller, Commissioner	Present
Ann Palzer, Commissioner	Present
Ted Redmond, Commissioner	Present

Staff Present

Shann Finwall, Environmental Planner

3. APPROVAL OF AGENDA

Commissioner Miller moved to approve the agenda.

Seconded by Vice-Chair Bryan — Ayes – All

The motion passed.

4. APPROVAL OF MINUTES

Commissioner Miller moved to approve the February 22, 2022, ENR Commission meeting minutes.

Seconded by Vice-Chair Bryan — Ayes – Bryan, Dosser, Miller, Palzer, Redmond

Abstain - Broadnax

The motion passed.

5. NEW BUSINESS

a. Tennis Sanitation Recycling Collection Annual Review

DRAFT

1) 2021 Recycling Collection Year End Report
2) 2022 Recycling Collection Work Plan

Environmental Planner Finwall introduced the report.

Willie Tennis, Owner and Angela Vaudich, City Liaison introduced themselves and described the 2021 annual recycling report and 2022 work plan.

The Commission discussed the following:

- Changes to the recycling education tags.
- Recycling markets.
- Reductions in recycling tonnages.
- Environmental impact analysis.

The Commission thanked Tennis Sanitation representatives for their annual report.

b. Republic Services Trash and Yard Waste Collection Annual Review

1) 2021 Trash and Yard Waste Collection Year End Report
2) 2022 Trash and Yard Waste Collection Work Plan

Environmental Planner Finwall introduced the report.

Beverly Mathiason, Municipal Manager and Samahra Hallada, Municipal Services Administrator introduced themselves and described the 2021 annual trash and yard waste report and 2022 work plan.

The Commission discussed the following:

- Food scrap recycling.
- Call center.
- Biogas collection at landfills.
- Increase in trash tonnages.

The Commission thanked Republic Services representatives for their annual report.

6. UNFINISHED BUSINESS

7. VISITOR PRESENTATIONS

None.

8. COMMISSIONER PRESENTATIONS

None.

9. STAFF PRESENTATIONS

Environmental Planner Finwall updated the Commission on the following events:

DRAFT

a. ENR Commission Meeting Format – In Person Beginning April
b. Arbor Day Event – May 14
c. Spring Clean Up – May 21
d. Harvest Park Native Seed Garden Pollinator Planting - May 24
e. Waterfest – June 4

10. ADJOURNMENT

Commissioner Miller made a motion to adjourn the meeting.

Seconded by Commissioner Broadnax Ayes – All

The motion passed.

Chairperson Dosser adjourned the meeting at 8:15 p.m.

DRAFT

ENVIRONMENTAL & NATURAL RESOURCES COMMISSION STAFF REPORT
Meeting Date April 18, 2022

REPORT TO:	Environmental and Natural Resources Commission
REPORT FROM:	Shann Finwall, AICP, Environmental Planner
PRESENTER:	Shann Finwall, AICP, Environmental Planner
AGENDA ITEM:	Friends of Maplewood Nature

Action Requested: ☐ Motion ✓ Discussion ☐ Public Hearing
Form of Action: ☐ Resolution ☐ Ordinance ☐ Contract/Agreement ☐ Proclamation

Policy Issue:

The Friends of Maplewood Nature was formed in 2007 as a nonprofit 501(c)(3). Their mission is to protect and enhance the Maplewood Nature Center and preserves.

Recommended Action:

Representatives of the Friends of Maplewood Nature will be present at the April 18, 2022, Environmental and Natural Resources Commission to introduce the Commission to their work and discuss possible partnerships.

Fiscal Impact:

Is There a Fiscal Impact? ✓ No ☐ Yes, the true or estimated cost is $.00

Financing source(s): ☐ Adopted Budget ☐ Budget Modification ☐ New Revenue Source ☐ Use of Reserves ☐ Other: n/a

Strategic Plan Relevance:

✓ Community Inclusiveness ✓ Financial & Asset Mgmt ✓ Environmental Stewardship
✓ Integrated Communication ✓ Operational Effectiveness ☐ Targeted Redevelopment

The Friends of Maplewood Nature complements tax dollars spent on management of Maplewood natural areas and the Nature Center's educational programs. Their mission is to:

- Connect children with nature, and offer adults practical environmental classes.
- Model nature resources and invasive species management, and provide habitat for native plants, trees, and animals.
- Attract prospective home buyers, and attract regional visitors who patronize local businesses.
- Provide space for outdoor activities, and provide space to sit quietly with nature.

Background:

The Environmental and Natural Resources Commission ordinance outlines that the Commission will actively participate and support the mission and goals of the Maplewood Nature Center and Neighborhood Preserves by promoting environmental awareness through educational programs,

communications, and co-sponsored activities. The Maplewood Nature Center was established in 1979 to provide natural history and environmental programs for the citizens of Maplewood. It also serves as the gateway to Maplewood's neighborhood preserves, 14 properties totaling over 300 acres, which offer visitors places to explore Maplewood's natural heritage. The mission of the Nature Center is to enhance awareness of land, water, and wildlife resources, and to empower the community to become stewards of the environment.

In 2020 the Nature Center was closed due to Covid-19 concerns. In 2021 the City formed the new Parks and Natural Resources Department made up of park and environmental staff. The new department is housed out of the Nature Center and is working with various partners to offer environmental education and events at the Nature Center. Now more than ever the Friends of Maplewood Nature are a key element to the City's environmental education and outreach.

Attachments:

1. Friends of Maplewood Nature Brochure
2. Parks and Natural Resources Department Brochure

Links:

1. Friends of Maplewood Nature: www.friendsofmaplewoodnature.com
2. Maplewood Nature Center Programs and Events: www.maplewoodmn.gov/971/programs-events

JOIN TODAY!

Two easy ways to give:

1) Online at https://friendsofmaplewoodnature.com/membership/

2) Fill out the following form and mail with a check

Annual Membership Form

_ $15 Single Membership
_ $25 Household Membership
_ Amount of Your Choice
_ Gift Membership

Name:_____
Address:_____
_____
Phone:_____
Email:_____

Please include this form with your check made payable to:

FRIENDS OF MAPLEWOOD NATURE
P.O. BOX 28442

OAKDALE, MN 55128

Thank you!

GET INVOLVED

Protecting, supporting, and promoting Maplewood's beautiful open spaces begins with each of us. There are many ways you can support the Friends – become a member today, serve as a board member, or volunteer to help at a Friends sponsored event! Anyone can be a member. You do not need to live in Maplewood to join.

CONTACT US

MAPLEWOODNATURE@GMAIL.COM

FRIENDS OF MAPLEWOOD
NATURE P.O. BOX 28442
OAKDALE, MN 55128

www.friendsofmaplewoodnature.com

Find us on: facebook

FRIENDS OF MAPLEWOOD NATURE

PROMOTE, SUPPORT, AND ENHANCE THE GROWTH OF MAPLEWOOD NATURE CENTER AND PRESERVES

Attachment 1

WHO WE ARE WHAT WE DO

The Friends of Maplewood Nature is an all-volunteer, nonprofit organization that amplifies the impact of the Maplewood Nature Center and Preserves. The Friends complements tax dollars dedicated to management of Maplewood's natural areas and the Maplewood Nature Center's educational programs.

The Friends of Maplewood Nature was created in 2007 by a group of caring and dedicated individuals who believed in the mission and work of the Maplewood Nature Center (MNC). In 1993, the Center expanded its mission when the citizens of Maplewood overwhelmingly voted for a five million dollar referendum to purchase open spaces. The Neighborhood Preserve system now has 14 sites.

Your membership in the Friends generates immediate impact, including: connecting youth with nature, providing environmental education for adults, and modeling natural resource and environmentally sustainable management practices.

VISIT

In a busy metropolitan area, a place to connect with nature close to home is vital. Visit the Maplewood Nature Center and Preserves and you can't help but want to join us in our mission to promote and support the management of these precious natural areas. For more information on the nature center and descriptions of the preserves, please visit: https://maplewoodmn.gov/984/Neighborhood-Preserves

PROJECTS

Projects funded through memberships, grants, and donations include:

- Snowshoes and outdoor equipment for family and youth programming
- Development of a natural play area for children
- Native plant and rain garden workshops to help home owners become better backyard stewards
- A series of videos about birding and nature in Maplewood, publicly available on YouTube
- A Gnome Challenge which attracted many children and families to the nature center trails for an enjoyable winter activity .

How You Can Help

Become a member today! Tax deductible donations are simple to make using the enclosed form or via givemn.org.

Maplewood

PARKS & NATURAL RESOURCES

The Parks and Natural Resources Department includes 10 full time staff that work in two different locations and have duties that cover park planning and maintenance, forestry, special events, environmental education and more.

MAPLEWOOD NATURE CENTER

2659 East 7th St

PARK MAINTENANCE BUILDING

1810 County Rd B E

Highlights of What We Do Include:

- Park and open space improvement projects
- Facilitate recreation programming with community partners
- Special events
- Facility and field rentals
- Manage the City's residential solid waste program
- Coordinate Green Step Cities
- Climate and energy planning
- Manage Edgerton Community Gardens
- Review and inspect developments for environmental compliance
- Coordinate EAB boulevard ash tree replacement plantings
- Coordinate deer removal program –USDA and Metro Bowhunters
- Natural resources and environmental educational programs
- Staff liaisons to the ENR and PRC Commissions
- Maintain fields, rinks and park facilities including mowing, repairs, inspections, snow removal, field lining, and construction
- Pick up trash weekly throughout the parks system

Maplewood

PARKS & NATURAL RESOURCES

Fun Facts!

- We maintain over 930 acres of parks, preserves and open space year round with 36 parks and 15 preserves/open space
- We use 2,500 gallons of field striping paint per season
- We maintain 15 soccer fields, 23 baseball/softball fields, 8 tennis courts, 7 basketball courts, 5 hockey rinks with 8 pleasure rinks, 2 volleyball courts and a rugby court
- During our Celebrate Summer events we give out around 1800 hotdogs
- We issue 650+ field rental permits, 100+ picnic shelter permits, 90+ Wakefield building rentals, and 1200+ hours of gym usage each year
- We will be using goats for invasive plant management around City Hall in 2022
- The Green Heron trail loop at the Nature Center is just shy of 1 mile long
- If you're lucky, you may spot a river otter at the Nature Center
- The City took in 216 mattresses and box springs at the 2021 Spring Clean Up Event

ENVIRONMENTAL & NATURAL RESOURCES COMMISSION STAFF REPORT
Meeting Date April 18, 2022

REPORT TO:	Environmental and Natural Resources Commission
REPORT FROM:	Carole Gernes, Natural Resources Coordinator
PRESENTER:	Carole Gernes, Natural Resources Coordinator
AGENDA ITEM:	Emerald Ash Borer Management Plan

Action Requested: ✓ Motion ☐ Discussion ☐ Public Hearing

Form of Action: ☐ Resolution ☐ Ordinance ☐ Contract/Agreement ☐ Proclamation

Policy Issue:

The City's Emerald Ash Borer Management Plan banned the use of chemical treatments to prevent infestation of high value specimen trees on City property. More information is now available to support the use of selected chemicals on a limited number of specimen ash trees on City property.

Recommended Action:

Motion to recommend an update to the Emerald Ash Borer Management Plan, allowing the limited use of specific pesticides for specimen ash trees on City property.

Fiscal Impact:

Is There a Fiscal Impact? ✓ No ☐ Yes, the true or estimated cost is $.00

Financing source(s): ☐ Adopted Budget ☐ Budget Modification ☐ New Revenue Source ☐ Use of Reserves ☐ Other: n/a

Strategic Plan Relevance:

☐ Community Inclusiveness ☐ Financial & Asset Mgmt ✓ Environmental Stewardship
☐ Integrated Communication ☐ Operational Effectiveness ☐ Targeted Redevelopment

Adding the use of chemicals to preserve specimen ash trees on a limited basis will preserve a tree on site until a newly planted tree can grow to take its place. It will also preserves the ash tree until EAB numbers and threat has been reduced.

Background:

In 2011 the City adopted the Emerald Ash Borer (EAB) Management Plan. The plan states "high value ash trees can be preserved from EAB with consistent treatments over time." However, the use of chemical treatments as a tool for managing EAB on Maplewood property was banned. Details outlining toxicity of Imidacloprid, a neonicotinoid, and Emamectin benzoate, a non-neonic pesticide were outlined in the document, but a second non-neonic, Azadirachtin (TreeAzin) was not discussed.

The City currently employs all other management tools recommended in the plan for our EAB infestation. Staff has completed a tree inventory, actively monitors and inspects ash trees, removes infested or declining trees, has partnered with the Minnesota Department of Agriculture for EAB Biocontrol releases, and has secured funding for EAB management.

The Parks and Recreation Commission identified a large green ash near the Wakefield Park Community Building as a specimen tree worthy of saving. Adding careful chemical treatment to our EAB management toolbox would allow treatment of the Wakefield Park ash tree.

Staff recommends adding non-neonic chemical treatment to the management toolbox for limited specimen trees on City property, to be used away from water and under an abundance of caution.

Attachments:

1. Emerald Ash Borer Management Plan
2. Risk to Bees from TreeAzin® Systemic Insecticide Injections for Emerald Ash Borer

Emerald Ash Borer Management Plan

City of Maplewood, Minnesota

April 18, 2022 ~~May 3, 2011~~

I. Purpose

The purpose of this management plan is to address and plan for the eventual invasion of Emerald Ash Borer (EAB) into Maplewood urban forests. The goal of this plan is to slow the spread of the infestation through education, inspection, and strategic management. By defining and beginning management now we hope to lessen disruption to our urban forest, stretch the management costs associated with EAB over a longer period of time, and create an atmosphere of EAB awareness to detect an infestation as early as possible.

II. Applicability

This plan is applicable to all public land in Maplewood and all private properties where EAB may negatively impact public areas or generally threaten the overall health of Maplewood's urban forest.

III. Administration

Maplewood's City Forester and Natural Resources Coordinator will be responsible for implementing this program, with support from Parks and Recreation Department and Public Works Department.

IV. EAB Background

Emerald Ash Borer (EAB) is a non-native beetle that causes widespread decline and death of ash trees. The larval stage of EAB feeds on the tissue between the bark and the sapwood, disrupting the transport of nutrients and water in the trees. If infestation is high enough in an individual tree, the damage will be severe enough to kill the tree. EAB has destroyed millions of ash trees in other states. (See Appendices A, B, and C for more information.)

V. EAB Status in Minnesota

In 2009, EAB was found in southern Minnesota and in St. Paul. The infestation in St. Paul was in the St. Anthony area and on the University of Minnesota St. Paul Campus. Subsequently EAB was found in Minneapolis, in the Tower Hill and Prospect Park areas. The metro infestations are about 1 mile apart. The Minnesota Department of Agriculture (MDA), Minnesota Department of Natural Resources and University of Minnesota have helped coordinate the response to the infestation and education. In St. Paul this included ash tree removal in the infested areas as well as preemptive removal of ash in selected neighborhoods. In 2010, the MDA released biological control agents (three species of wasps) at the site of the southern MN infestation. The MDA plans to do a release in the metro area in 2011.

VI. EAB Management Strategies

When EAB was first found in Minnesota, it was believed that we would eventually lose all ash trees in Minnesota. But EAB may spread differently in Minnesota than it has in other states, since it appears that we have found it relatively early in the infestation. SLAM (Slow Ash Mortality) is an approach to EAB that focuses on slowing ash tree mortality through integrated management strategies. It may involve a combination of monitoring for EAB, preemptive removal of ash trees, insecticide treatment, and biological control. Slowing the spread of EAB and slowing ash tree mortality enables us to spread management costs over a longer time period. In addition, with biological control now a possibility, the outlook for ash in Minnesota could be different than initially predicted.

VI – 1 EAB Management: Tree Inventory

A tree inventory is the foundation of an EAB plan and provides the baseline data for a city's urban forestry program. The data can also be used to track management of individual trees, similar to the way a city tracks infrastructure maintenance (ex: storm sewer structures).

In 2010, Maplewood hired S&S Tree Specialists to conduct a complete inventory for park (not preserve) trees including location, species, diameter, and health. Only manicured areas of parks were inventoried. Maplewood parks have 2507 trees, 484 of which are ash (19.3%). In 2010, staff inventoried a sampling of boulevard trees. The protocol being used requires we inventory a minimum of 2000 boulevard trees in order to estimate how many trees we have on boulevards. This sampling will be completed in 2011.

The boulevard sampling and the complete park tree inventory provide data that enables us to understand the potential financial, aesthetic, and ecological impacts of EAB in Maplewood. But a complete boulevard tree inventory, with information on the health of each tree, is required for the city to strategically target individual trees for treatment or removal, and to make planting decisions that ensure tree diversity.

It is strongly recommended that the city hire a contractor to do a complete inventory of boulevard trees. In addition, it is recommended that staff conduct informal inventories on a few natural areas in the city to obtain some basic information about the ash population in forested areas.

VI – 2 EAB Management: Inspection, Detection, and Monitoring

The goal of detection is to find infestations as early as possible. Once an infestation center is found, we need to determine the duration and outer boundaries of the infestation. Many people should be involved in detection.

1. **City Forester.** Maplewood contracts a part-time forester to inspect properties for oak wilt and Dutch Elm Disease. The forester's contract should be expanded to include EAB detection and inspection. In addition, the City Forester should be the person responsible for delineating the infestation boundaries.
2. **City Staff**. City staff need to be key players in detecting EAB. It is recommended that staff at the nature center and parks and public works crew members undergo EAB training so they can help monitor the ash trees in the areas where they work. In addition, it is recommended that EAB training be provided for all employees interested in learning about the insect and its threat.
3. **Residents and the Maplewood Tree Hotline.** Residents will often be first to detect EAB on private lands. If they have a tree with suspected EAB, they are encouraged to review EAB information online and/or call the Maplewood Tree Hotline. The city forester responds to all calls and does a site check if he can't rule out EAB during the phone conversation.
4. **Arrest-The-Pest-Hotline.** The state maintains an Arrest-the-pest-hotline. Citizens can call the hotline to report a suspected incidence of EAB.
5. **Minnesota Forest Pest First Detector Network.** The first detector network is the state's early warning system for invasive tree pests. First detectors can help verify the presence of EAB.
6. **Minnesota Tree Care Advisors**. The tree care advisor program is a network of trained, community-based volunteers who promote urban and community forestry to all residents of Minnesota. This program is run by the University of Minnesota's Department of Forestry.

7. **Citizen-monitoring program**. Some Maplewood residents have expressed interest in learning more about Emerald Ash Borer and its potential impact to the city and the landscapes around their homes. The city should encourage interested residents to participate in the Forest Pest First Detector program or the Minnesota Tree Care Advisor program so they can help the city watch for EAB. The city should consider paying the tuition for residents in these programs if they commit to volunteering hours for inspecting sites in the city for EAB.
8. **Purple Traps**. In 2010, the Minnesota Department of Agriculture set purple traps throughout the state, including in Maplewood. The purpose of the traps is to help the MDA better determine the extent of the EAB infestation. The city should continue working with the MDA to have these traps set in Maplewood.

VI – 3 EAB Management -- Tree Removal

When ash trees die or decline they become hazards near boulevards, buildings, and play areas. Most dead trees and hazard trees will need to be removed. But strategic removal of trees before they die, whether they are infested or not, should also be a part of the city's EAB management strategy. Strategic removal helps spread out removal and replanting costs and may help slow the spread of EAB. The city should use four removal strategies:

1. ***Remove trees that die.*** Some trees may not be detected early in the infestation process so they will be removed when they die. On boulevards and in landscaped area of parks, all dead ash trees should be removed. In natural areas, it will not be feasible to remove all dead ash trees and deadfall should be addressed on a site-by-site basis. On private sites, owners should remove dead trees that are hazardous to people or structures.
2. ***Remove trees that are infested.*** A good detection program must be in place to use this removal strategy. Typically infestation centers are not detected for 3-5 years after insects arrive due to subtleties of initial signs in the tree. When an infested tree is identified, surrounding trees will need to be surveyed to determine the extent of infestation and the number of trees that will need to be removed. The city should consult with the MDA when infestations are initially identified.
3. ***Remove trees preemptively based on health.*** Selective removal of public ash trees based on health condition should be a part of the city's EAB strategy. In order to use this strategy the city will have to complete a boulevard tree inventory, including health information for each tree. The city has this data for park trees. The ash trees that would be considered for removal include:
    a. Unhealthy trees—inventoried trees that have a condition rating of four or less (out of ten).
    b. Trees that are unsafe due to poor health or structure and are located where they are likely to damage people and/or property (hazard trees).
    c. Trees that are in conflict with utilities.
    d. Trees that are poorly located and/or require excessive maintenance.

    If several trees will be removed preemptively from a park or a neighborhood, the full site impacts should be considered prior to removal.
4. ***Remove trees preemptively in an area***. Preemptive removal by area may be appropriate in situations such as:
    a. When a large population of ash trees is near an existing infestation and there are a significant number of trees in poor condition.
    b. In conjunction with a public works project if the health of ash trees on a street would be negatively impacted by the project and make them more susceptible to EAB.
    c. In conjunction with adjacent cities or regional strategies to manage EAB.

A priority removal list should be developed and revised regularly. In targeting trees for removal, the following should also be considered:

1. Proximity of ash tree removals to current infestation centers and their anticipated spread.
2. The number of trees in poor condition that are located near each other.
3. Spreading out removal costs over several years.

VI – 4 EAB Management: Pesticide Treatment

Insecticides are available for managing EAB. When timed appropriately, these treatments can create a toxic environment for the Emerald Ash Borer, killing dispersing adults as well as eggs and larvae. High value ash trees can be preserved from EAB with consistent treatments over time. There are two primary methods of pesticide application for EAB: soil drenching and trunk injection. In soil drenching, the insecticide is applied to the soil under the tree canopy and the tree roots take it in. In trunk injection, a hole is drilled into the tree trunk and the chemical is injected into the tissues under the bark. With either method, the chemical is dispersed throughout the tree. Emerald ash borers (and other insects) feeding on the tree ingest the chemical and are killed.

The city has determined that it will ~~not~~ permit the use of pesticides to control Emerald Ash Borer on city land, including the right-of-way, ~~due to negative environmental and health impacts.~~ on a limited basis for selected specimen trees. Approved non-neonictiod chemicals may be used via the injection method only. Appendix C includes references on EAB insecticides. Appendix D contains a memo and documentation from Maplewood's Environmental and Natural Resources Commission regarding the impacts of EAB insecticides.

The city shall encourage property owners to carefully evaluate environmental impacts before using pesticides to treat EAB on private property. Owners that decide to use EAB pesticides are urged to use trunk injection rather than soil drenching, which will help reduce pesticide drift and reduce impacts to groundwater and surface water.

VI-5

EAB Management: Biological Control

The Minnesota Department of Agriculture considers biological control the best option of cost-effective, long-term management of EAB. In 2010, the MDA released wasps that kill EAB eggs or larvae in Houston County, in southeast Minnesota. This release will be monitored to determine its efficacy. The MDA plans to do a release in spring 2011 near the infestation in Minneapolis and St. Paul. Appendix E contains information on biological control for EAB. If biological control for EAB proves effective, the city should coordinate with the MDA for release of these biocontrol agents in Maplewood.

VI – 6 EAB Management: Wood Disposal and Utilization

EAB can spread through transportation of ash wood—in logs, tree waste, chips or fire wood. Restricting the movement of ash wood can help slow the spread of EAB. Ramsey County and selected counties in Minnesota are under an ash quarantine which prohibits movement of ash out of the county. The quarantine restricts movement of firewood of all deciduous species. Businesses that need to move the restricted items across county lines may apply for Compliance Agreement that indicates how they will treat the regulated articles to mitigate the spread of EAB.

If large numbers of ash die, it is essential to look for ways to dispose of or utilize ash wood. Information continues to be published on potential markets for urban wood utilization. Possible uses for ash wood include fuel (biomass energy chips), mulch, pulpwood, and sawlogs. The city should

identify local options for disposal and wood utilization. In addition, the city should seek partnerships with nearby cities for disposal and utilization.

VI – 7 EAB Management: Replanting

The loss of ash in our urban forest will have a visual and ecological impact. It is recommended that at least one tree be planted for every tree removed or lost to EAB. Increased diversity should be a key element in our replanting program. There are different models for boulevard tree diversity. For example, Dave Hanson from the University of Minnesota promotes the 10-20-30 rule: plant no more than 10% of any species, 20% of any genus, and 30% of any family. Prior to moving forward with replanting, the city should develop a Tree Master Plan that sets goals for our urban forest, ensures diversity of tree species within neighborhoods, identifies appropriate tree species, and addresses planting and care guidelines.

Maplewood's Tree Rebate program provides a cost-share match for residents to plant trees on private land. It is recommended that the city continue funding this program and, if needed, adjust the program so it supports residents in replanting after ash removal.

VII Education and Outreach

Education and outreach are essential components of the EAB Management Plan. The city shall develop an EAB education and outreach program that:

1. Educates residents so they understand the threats of EAB, know what to look for, know what to do when they find EAB or a declining ash tree, understand replanting and care of trees, and can make informed decisions for ash trees on their property.
2. Educates parks and public works staff so they can recognize signs and symptoms of EAB infestation.
3. Uses diverse forums for education including: public programs, website, articles in city publications, handouts, public service announcements, etc.
4. Provides advance notification to a neighborhood or homeowner of ash tree management that will occur in their area.
5. Provides educational and other support to residents that wish to form neighborhood groups to detect and manage EAB in their neighborhood.
6. Develops partnership with groups such as Tree Care Advisors.

VIII Ordinance and Policy

City code should be reviewed and revised to account for EAB. Two sections of code in particular may need revision:

1. Section 38, Article I. This section prohibits planting in the public right-of-way. If we have major losses of boulevard trees our ordinance should allow for and encourage replacement. Staff and Community Design Review Board should review this policy and make recommendations to council.
2. Section 38, Article II. This section covers the city's tree disease inspection program. It allows the city to control and eliminate Dutch elm disease fungus and elm bark beetles and "other epidemic diseases of shade trees." It states that the city may enter properties to inspect for epidemic tree diseases. Property owners are required to abate trees that are declared a nuisance. This ordinance shall be revised to include emerald ash borer as a tree pest. In addition, guidelines shall be developed to identify appropriate abatement actions. For example, in the early stages of EAB infestation in Maplewood, the city may need to require that homeowners remove infested ash to

help slow the spread. But, once EAB is widespread in the city, it may become impractical to require removal of all infested trees.

In addition, the city should develop a Street Tree Master Plan and policy that addresses:

1. Goals for street trees;
2. Guidelines and design templates for species diversity;
3. List of appropriate species;
4. Guidelines for planting and care.

IX Licencing/permitting

As part of EAB management, the city should review requirements for tree contractors licensed in the city and determine whether revisions are necessary.

X Funding

Funding will be needed to implement the EAB management plan. Primary costs include:

1. Boulevard tree inventory (estimate: $25,000-$32,000);
2. City forester – increased hours for detection and inspection. Maplewood's city forester is contracted for 150-170 hours per year, primarily to inspect public and private properties for oak wilt and Dutch Elm disease. We will need a significant increase in forester hours once EAB is found in Maplewood.
3. Tree removal (staff or contractors);
4. Pesticide treatment of selected trees, if approved as part of the EAB plan (staff or contractors);
5. Education and public outreach (staff and city forester);
6. Replanting (staff, contractors, volunteers).

Estimated cost for removal and replanting ash trees at Maplewood parks is $193,600 to $290,400. This is based on 484 ash trees, with removal costs of $200-$250 per tree and replanting costs of $200 to $350 per tree. While smaller trees establish well and catch up in size to larger trees in a few years, it is thought that planting larger trees on boulevards and in public places helps reduce vandalism and accidental injury of trees. When the sampling inventory of boulevard trees is completed in 2011, we will be able estimate removal and replanting costs for boulevard trees.

Maplewood will need to secure funding for EAB management.

1. **Grants.** Currently there is no long-term grant funding dedicated to assisting communities in Minnesota to manage EAB. An initial round of grants was available for EAB planning and management. Maplewood will need to stay informed on grant opportunities. To be competitive, it will be helpful to strengthen the city's urban forestry program. Having an EAB plan, a tree inventory, and a street tree policy will all be looked at in a positive light.
2. **General levy or fees.** The city will likely need to use some general operating funds for EAB management and may need to consider additional fees. St. Paul proposed a 2% surcharge on right-of-way rates dedicated to EAB management.
3. **City's tree fund.** The city's tree fund could be used to complete the boulevard tree inventory and for some tree planting. But this funding will not go far, and its purpose is not to control tree disease and pests.
4. **Tree donations.** The funding package should also consider a tree donation program. Currently Friends of the Parks and Trails (St. Paul and Ramsey County) has tree donation and Tribute Tree programs that serve cities in Ramsey County, including Maplewood. Publicizing these programs, or

creating our own donation program, will help provide plant material and funds for planting trees at parks.

XI Summary of Actions Needed

1. Conduct inventory of boulevard trees.
2. Develop details for strategic removal and re-evaluate the plan frequently.
3. Develop strategies for disposal or utilization of ash.
4. Develop and provide educational and outreach materials for residents.
5. Educate staff in parks and public works to recognize EAB.
6. Implement program for volunteers to help detect EAB in Maplewood.
7. Review and revise tree disease ordinance to include EAB as a forest pest that should be controlled on private land.
8. Develop a Tree Master Plan that includes goals for street and park trees, guidelines for species diversity, lists of appropriate species, guidelines for planting and care.
9. Secure funding for EAB management.

Appendices:

A. Pest Alert – Emerald Ash Borer
B. Do I Have EAB?
C. EAB References
D. Pesticide Impacts
E. Biological Control for EAB
F. What are other metro communities doing to manage EAB?

Appendix A

Pest Alert

United States
Department of Agriculture
Forest Service
Northeastern Area
State and Private Forestry
NA-PR-02-04
Revised September 2008

Emerald Ash Borer

A beetle from Asia, *Agrilus planipennis* Fairmaire (Coleoptera: Buprestidae), was identified in July 2002 as the cause of widespread ash (*Fraxinus* spp.) tree decline and mortality in southeastern Michigan and Windsor, Ontario, Canada. Larval feeding in the tissue between the bark and sapwood disrupts transport of nutrients and water in a tree, eventually causing branches and the entire tree to die. Tens of millions of ash trees in forest, rural, and urban areas have already been killed or are heavily infested by this pest.

A. planipennis has been found throughout Michigan, across much of Ohio, and in parts of Indiana, Illinois, Maryland, Missouri, Pennsylvania, Virginia, West Virginia and Wisconsin. Infestations have also been found in more areas of Ontario and in the province of Quebec. The insect is likely to be found in additional areas as detection surveys continue. Evidence suggests that *A. planipennis* is generally established in an area for several years before it is detected.

The broad distribution of this pest in the United States and Canada is primarily due to people inadvertently transporting infested ash nursery stock, unprocessed logs, firewood, and other ash commodities. Federal and state quarantines in infested states now regulate transport of these products.

Identification

Adult beetles are generally larger and brighter green (Fig. 1) than the native North American *Agrilus* species. Adults are slender, elongate, and 7.5 to 13.5 mm long. Males are smaller than females and have fine hairs, which the females lack, on the ventral side of the thorax. Adults are usually bronze, golden, or reddish green overall, with darker, metallic emerald green wing covers. The dorsal side of the abdomen is metallic purplish red and can be seen when the wings are spread (Fig. 2). The prothorax, the segment behind the head and to which the first pair of legs is attached, is slightly wider than the head and the same width as the base of the wing covers.

Figure 1. Adult emerald ash borer.

Larvae reach a length of 26 to 32 mm, are white to cream-colored, and dorso-ventrally flattened (Fig. 3). The brown head is mostly retracted into the prothorax, and only the mouthparts are visible. The abdomen has 10 segments, and the last segment has a pair of brown, pincer-like appendages.

Figure 2. Purplish red abdomen on adult beetle.

Biology

A. planipennis generally has a 1-year life cycle. In the upper Midwest, adult beetles begin emerging in May or early June. Beetle activity peaks between mid June and early July, and continues into August. Beetles probably live for about 3 weeks, although some have survived for more than 6 weeks in the laboratory. Beetles generally are most active during the day, particularly when it is warm and sunny. Most beetles appear to remain in protected locations in bark crevices or on foliage during rain or high winds.

Throughout their lives beetles feed on ash foliage, usually leaving small, irregularly shaped patches along the leaf margins. At least a few days of feeding are needed before beetles mate, and an additional 1 to 2 weeks of feeding may be needed before females begin laying eggs. Females can mate multiple times. Each female probably lays 30-60 eggs during an average lifespan, but a long-lived female may lay more than 200 eggs. Eggs are deposited individually in bark crevices or under bark flaps on the trunk or branches, and soon darken to a reddish brown. Eggs hatch in 7 to 10 days.

Figure 3. Second, third, and fourth stage larvae.

After hatching, first instar larvae chew through the bark and into the phloem and cambial region. Larvae feed on phloem for several weeks, creating serpentine (S-shaped) galleries packed with fine sawdust-like frass. As a larva grows, its gallery becomes progressively wider (Fig. 4). Beetle galleries often etch the outer sapwood. The length of the gallery generally ranges from 10 to 50 cm. Feeding is usually completed in autumn.

Prepupal larvae overwinter in shallow chambers, roughly 1 cm deep, excavated in the outer sapwood or in the bark on thick-barked trees. Pupation begins in

Figure 4. Gallery of an emerald ash borer larva.

Figure 5. D-shaped hole where an adult beetle emerged.

Figure 6. Jagged holes left by woodpeckers feeding on larvae.

Figure 7. Ash tree killed by emerald ash borer. Note the serpentine galleries.

Figure 8. Epicormic branching on a heavily infested ash tree.

late April or May. Newly eclosed adults often remain in the pupal chamber or bark for 1 to 2 weeks before emerging head-first through a D-shaped exit hole that is 3 to 4 mm in diameter (Fig. 5).

Studies in Michigan indicate 2 years may be required for *A. planipennis* to develop in newly infested ash trees that are relatively healthy. In these trees, many *A. planipennis* overwinter as early instars, feed a second summer, overwinter as prepupae, and emerge the following summer. In trees stressed by physical injury, high *A. planipennis* densities, or other problems, all or nearly all larvae develop in a single year. Whether a 2-year life cycle will occur in warmer southern states is not yet known.

Distribution and Hosts

A. planipennis is native to Asia and is found in China and Korea. It is also reported in Japan, Mongolia, the Russian Far East, and Taiwan. In China, high populations of *A. planipennis* occur primarily in *Fraxinus chinensis* and *F. rhynchophylla*, usually when those trees are stressed by drought or injury. Other Asian hosts (*F. mandshurica* var. *japonica*, *Ulmus davidiana* var. *japonica*, *Juglans mandshurica* var. *sieboldiana*, and *Pterocarya rhoifolia*) may be colonized by this or a related species.

In North America *A. planipennis* has attacked only ash trees. Host preference of *A. planipennis* or resistance among North American ash species may vary. Green ash (*F. pennsylvanica*) and black ash (*F. nigra*), for example, appear to be highly preferred, while white ash (*F. americana*) and blue ash (*F. quadrangulata*) are less preferred. At this time all species and varieties of native ash in North America appear to be at risk from this pest.

Signs and Symptoms

It is difficult to detect *A. planipennis* in newly infested trees because they exhibit few, if any, external symptoms. Jagged holes excavated by woodpeckers feeding on late instar or prepupal larvae may be the first sign that a tree is infested (Fig. 6). D-shaped exit holes left by emerging adult beetles may be seen on branches or the trunk, especially on trees with smooth bark (Fig 5). Bark may split vertically over larval feeding galleries. When the bark is removed from infested trees, the distinct, frass-filled larval galleries that etch the outer sapwood and phloem are readily visible (Fig. 4 and Fig. 7). An elliptical area of discolored sapwood, usually a result of secondary infection by fungal pathogens, sometimes surrounds galleries.

As *A. planipennis* densities build, foliage wilts, branches die, and the tree canopy becomes increasingly thin. Many trees appear to lose about 30 to 50 percent of the canopy after only a few years of infestation. Trees may die after 3 to 4 years of heavy infestation (Fig. 7). Epicormic shoots may arise on the trunk or branches of the tree (Fig. 8), often at the margin of live and dead tissue. Dense root sprouting sometimes occurs after trees die.

A. planipennis larvae have developed in branches and trunks ranging from 2.5 cm (1 inch) to 140 cm (55 inches) in diameter. Although stressed trees are initially more attractive to *A. planipennis* than healthy trees are, in many areas all or nearly all ash trees greater than 3 cm in diameter have been attacked.

Resources

For more information on the emerald ash borer and related topics...

- Visit the following Web sites:
  - Multi-agency Emerald Ash Borer Web Site: www.emeraldashborer.info
  - USDA Forest Service: www.na.fs.fed.us/fhp/eab/
  - USDA Animal and Plant Health Inspection Service: www.aphis.usda.gov/plant_health/
- Contact your state Department of Agriculture, State Forester, or Cooperative Extension Office.

Published by:
USDA Forest Service
Northeastern Area
State and Private Forestry

Newtown Square, PA 19073

www.na.fs.fed.us

Federal Recycling Program
Printed on recycled paper.

Prepared by:
Deborah G. McCullough, professor, Departments of Entomology and Forestry, Michigan State University
Noel F. Schneeberger, Forest Health Program leader, and **Steven A. Katovich**, forest entomologist, Northeastern Area State and Private Forestry, USDA Forest Service

Photo credits:
David L. Cappaert and Howard Russell, Michigan State University, www.forestryimages.org
Steven A. Katovich, USDA Forest Service, www.forestryimages.org
Edward Czerwinski, Ontario Ministry of Natural Resources, www.forestryimages.org

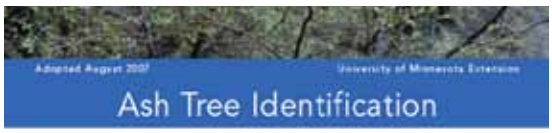
USDA is an equal opportunity provider and employer.

MINNESOTA DEPARTMENT OF AGRICULTURE
625 Robert St. N., St. Paul, MN 55155-2538
www.mda.state.mn.us

Do I Have Emerald Ash Borer (EAB)?

UNIVERSITY OF MINNESOTA EXTENSION

Minnesota DEPARTMENT OF NATURAL RESOURCES

STEP 1 **I think my ash tree may be infested with Emerald Ash Borer.** → *Go to step #3*	  
STEP 2 **I suspect I have seen an Emerald Ash Borer.** → *Go to step #5*	
STEP 3 **Is my tree an ash?** → *If yes, go to step #4* → *If no, go to step #7*	Review this guide www.mda.state.mn.us/news/publications/ext/ashtreeid.pdf 
STEP 4 **Does my ash tree have symptoms of Emerald Ash borer?** → *If yes, go to step #5* → *If no, go to step #7*	Review this guide www.emeraldashborer.info/files/E-2938.pdf 
STEP 5 **Are the symptoms or insects EAB look-alikes?** → *If yes, go to #7* → *If no, go to #6*	Review these guides www.mda.state.mn.us/news/publications/ext/eablookalikes.pdf OR www.mda.state.mn.us/sitecore/content/Global/MDADocs/pestsplants/eab/eabreference.aspx
STEP 6 **It could be EAB.** → *Contact the U of M Forest Resources Extension to find an EAB First Detector near you: treeinfo@umn.edu or 612-624-3020*	www.forestry.umn.edu/extension/index.html 
STEP 7 **It isn't EAB; so, what is it?** → *Visit the University of Minnesota Extension "What's Wrong With My Plant" website to diagnose the problem.*	www.extension.umn.edu/gardeninfo/diagnostics/deciduous/ash/index.html 

In accordance with the Americans with Disabilities Act, an alternative form of communication is available upon request. TDD: 1-800-627-3529. MDA is an equal opportunity employer and provider.

Appendix C: EAB References

General EAB information

www.emeraldashborer.info
www.extension.umn.edu/distribution/horticulture/M1242.html
www.dnr.state.mn.us/invasives/terrestrialanimals/eab/slideshow.html

Minnesota Department of Agriculture:

General: www.mda.state.mn.us/plants/pestmanagement/eab.aspx
Management strategies: www.mda.state.mn.us/plants/pestmanagement/eab/eabstrategies.aspx
Quarantine information: www.mda.state.mn.us/en/plants/pestmanagement/eab/quarantinefaq.aspx
Biocontrol: www.mda.state.mn.us/plants/pestmanagement/eab/biocontrolinsemn.aspx

Insecticides for EAB:

16-page guide: www.emeraldashborer.info/files/multistate_EAB_Insecticide_Fact_Sheet.pdf
Environmental impacts of Imidacloprid: www.sierraclub.ca/national/programs/health-environment/pesticides/imidacloprid-fact-sheet.shtml
Impacts: www.emeraldashborer.info/files/Potential_Side_Effects_of_EAB_Insecticides_FAQ.pdf
Homeowner guide: www.mda.state.mn.us/en/plants/pestmanagement/~/media/Files/plants/eab/eabtreatmentguide2.ashx

Note—Commissioner Ginny Yingling has assembled several technical articles on EAB insecticides and staff can make these available.

Appendix D: 4/18/11 Memo from Environmental and Natural Resources Commission

To: Maplewood City Council

From: Maplewood Environmental and Natural Resources Commission

Date: April 18, 2011

Re: Concerns regarding use of chemical treatment to address potential Emerald Ash Borer infestations.

At its March 2011 meeting, the Maplewood Environmental and Natural Resources Commission passed a resolution strongly urging the City Council not to allow the use of chemical treatments on ash trees owned by the city as part of its Emerald Ash Borer (EAB) strategy. This decision was based on several lines of reasoning:

1. Such treatments, once begun, must continue for the life of the tree, at potentially considerable expense to the city.
2. Damage to the trees as a result of injecting the chemicals (the environmentally "preferred" approach) is likely to reduce the life of the trees anyway.
3. Financial resources used for treatment would be better spent in mitigation strategies, such as thinning of ash trees on city property and boulevards to reduce the overall coverage of this species (thereby making the larger forest "less attractive" for EAB) and pre-emptive replacement with other tree species.
4. Chemical treatments may postpone, but ultimately likely will not prevent the loss of many ash trees; but chemical treatments come with potentially high environmental costs.

It is these environmental costs that we have outlined in greater detail for you below (and describe in even greater detail with supporting documentation in the attached document). The two most likely chemicals to be used against EAB are imidacloprid (IM) and emamectin benzoate (EB). Both of these chemicals are highly toxic to various beneficial insects and have known and potential environmental consequences that, in our opinion, make them undesirable for use in our city:

Imidacloprid (IM)

1. IM is extremely toxic to honeybees and high concentrations of IM are found by researchers in sap, pollen, and nectar of treated plants. Short-term exposure to as little as 5 nanograms (one-billionth of a gram) results in 50% mortality among honeybees.
2. While pollination by bees is not important for ash trees, in the upper Midwest the pollen from ash trees constitute nearly 40% of bees' pollen source in April, when other sources are not yet available.
3. Studies linking IM to collapse of honeybee populations in Europe has led Italy, France and Germany to ban it and the EU to schedule it's phasing out.
4. IM is also very toxic to beneficial predator insects such as ladybird beetles and lacewings, to aquatic insects such as mayflies and caddisflies, and to earthworms.

5. Studies suggest IM's use in trees may actually promote infestations by unwanted insects, such as spider mites. These studies indicate such infestations are due not only to the elimination of beneficial insects that prey on the mites, but also as a result of the chemicals causing greater egg production by the mites themselves.
6. Leaves from systemically treated ash and maple trees were found to inhibit feeding of decomposer organisms, such as earthworms and aquatic invertebrates.
7. IM is highly soluble so it is found in runoff from agricultural fields, in streams, and groundwater throughout North America.
8. At concentrations found in the environment, aquatic insect communities show reduced populations and biodiversity.
9. Once applied to a tree, either by soil drench or injection, IM is quickly detectable in leaves, sap, and pollen, where non-target species may be exposed to significant concentrations.
10. The breakdown products, or metabolites of IM, are often more toxic than IM itself.

Emamectin benzoate (EB)

1. EB is extremely toxic to butterflies and moths and does not distinguish between "good" and "bad" species. Studies have shown it is 20- to 64,000-times more toxic to butterfly and moth catepillars than other pesticides used on the same crops as EB.
2. EB is used in agriculture as a topical (spray) treatment on a variety of crops because it has been found to be relatively less toxic to non-target insects than other pesticides (other than moths and butterflies). However, when sprayed onto plants, EB degrades rapidly in sunlight limiting exposure of non-target species. No studies were found evaluating EBs toxicity as a systemic pesticide, so it is not known what kind of exposures or affects would be experienced by non-target species when EB is used in this manner.
3. EB is also used to kill parasitic sea lice in fish farms. Studies indicate it may act as an endocrine disruptor, causing early induction of molting in lobsters and other crustaceans. Would the same be true in crawfish? There is no information.
4. EB appears to be moderately toxic to freshwater fish such as bluegill, trout and fathead minnow.
5. EB is very toxic to marine copepods, but there is no information regarding how it would affect freshwater invertebrates.
6. EB tends to bind to soil or sediment particles, making it less likely to leach to groundwater, but also making it very persistent in soil. Also, runoff carrying soil particles could carry EB to surface waters.
7. The biggest concern is the lack of information about EB as a systemic pesticide and its potential impacts in terrestrial and freshwater ecosystems.

Pesticides such as IM and EB have gained favor because of their apparent low toxicity to mammals, including humans. We believe this is short-sighted. Our health and quality of life depends upon the integrity of the ecosystems in which we live. From our perspective the loss of certain insect species may seem inconsequential; from the perspective of the larger system it can be devastating. Upsetting the delicate balance between predator and prey, plants and pollinators, detritus and decomposers is often considered by us to be a regrettable, but remote effect on the "lowest orders" of the animal world. In fact, it is akin to chipping away at the foundation of our home.

Given the potential impacts of these chemicals on our environment (and in the case of EB the gaping holes in our knowledge regarding its potential impacts), we urge the city council to not allow the use of them on trees in our city. While chemical treatments may provide a short-term fix to the EAB problem, we believe the city would be better served by taking a holistic view of our environment that considers the indirect consequences of these toxic chemicals and adopt a long-term, preventative approach through strategic management of our forests.

Environmental Fate and Ecological Toxicity of Chemicals Proposed for Emerald Ash Borer Treatments

Prepared for the Maplewood Environmental and Natural Resources Commission

by commission member, Ginny Yingling. April 17, 2011.

Imidacloprid

Imidacloprid (IM) is a nicotine mimic that produces toxicity by binding to and over-stimulating certain neuron receptors, disrupting the nervous system. It binds much more readily to these receptors in invertebrates than vertebrates, giving it a higher margin of safety for humans. In insects, the disruption of the nervous system results in modified feeding behavior, paralysis and subsequent death (Mullins, 1993). IM is used against a wide variety of insect pests, including Asian longhorn beetles (maple trees), potato beetle, cockroaches, fleas on domestic pets (Advantage®), termites, turf insects, etc. While it only moderately toxic to mammals and fish, it is extremely toxic to non-target beneficial organisms, such as honeybees and earthworms (Zang, et al., 2000; Luo, 1999), and important predator insects, including ladybird beetles and lacewings (Kaakeh, et al., 1996; Mizell and Sconyers, 1992). Some studies have also shown that treatment with IM may result in infestations by other, unwanted insects, such as spider mites (James and Price, 2002; Raupp, et al., 2004; Sclar, et al, 1998). These infestations are promoted not only by the reduction or elimination of beneficial predator insects, but also by increased spider mite egg production resulting from their exposure to IM (James and Price, 2002).

IM is highly water soluble and does not bind readily to soil particles (Fossen, 2006), so it may readily leach into groundwater. It is quite persistent in the environment, degrading quite slowly in water (half-life[1] = 31-46 days; Kidd and James, 1991; Tomlin, 1997) and soil (half-life = 69 – 997 days; Sarkar, et. al., 1999; Gupta, et al., 2002; Roberts and Hutson, 1999). However, when exposed to sunlight IM has a short (3 hour) half-life in surface water (Moza, et al, 1998; Wamhoff, et al., 1999), so it is less likely to be found in surface waters than groundwater. Yet, despite its rapid degradation in sunlight, investigators report detecting concentrations of 0.2, 0.4, and 1.0 parts per billion (ppb) in streams in New York, New Brunswick and Florida, respectively. Concentrations as high as 11.9 ppb have been detected in runoff from agricultural fields in Canada (CCME, 2007). IM has been detected in the groundwater in New York at concentrations up to 6.69 ppb (US EPA, 2003). Several IM breakdown products have been shown to be of equal or greater toxicity than the parent compound (Nauen et al, 1998).

Despite its environmental persistence and presence in waters, very little is known about IM's long-term chronic and short-term "pulse" effects on non-target aquatic organisms. However, in studies by Kreutzweiser,

[1] A half-life is the time it takes for half of the mass of a contaminant to degrade.

et al. (2007 and 2008), leaves from ash and maple trees treated with IM at typical field rates contained 0.8 – 1.3 and 3-11 parts per million (ppm) IM, respectively. The leaves were then added to aquatic and forest microcosms to evaluate the effect on leaf-shredding insects. While there appeared to be no effect on the invertebrates' survival rates, the 1.3 ppm and higher concentrations caused significant feeding inhibition among aquatic insects and earthworms, as well as measurable weight loss in the earthworms. IM applied directly to the water of the aquatic microcosms, to simulate leaching from soils, was at least 10-times more toxic to aquatic insects than the IM in the leaves, with high mortality at 0.13 ppm and significant feeding inhibition at 0.012 ppm. Pestana, et al. (2009) found that both the abundance and biodiversity of aquatic bottom-feeding invertebrates was reduced by exposure to IM at concentrations of 2 and 20 ppb. They also note that IM is toxic to other aquatic insects, such as caddisflies and mayflies. Mayflies are particularly sensitive with 50% of the mayflies dying within 24- and 96-hrs of being exposed to 2.1 and 0.65 ppb IM, respectively. Premature maturation and emergence of mayflies, and impaired reproductive fitness, occurred when they were exposed to pulses of IM at concentrations of as little as 0.1 ppb (Alexander, et al., 2007 and 2008).

IM rapidly moves through plant tissues after applications and can be present in detectable concentrations in the leaves, vascular fluids (sap) and pollen. Studies have shown plants grown from seeds treated with IM can have significant concentrations (up to 15 ppm in leaves of young seedlings, up to 13 ppb in pollen) of IM in their sap, pollen, flowers, and leaves (Laurent and Rathahao, 2003; Rouchaud, et al, 1994; Bonmatin, et al., 2005; Westwood, et al, 1998). As a result, many non-target insects, such as honey bees, parasitic wasps, and predaceous ground beetles sensitive to IM may be exposed as they forage for sap, pollen and nectar or feed on other insects that have been exposed.

Bees are particularly sensitive to IM. Pollen constitutes the only protein source for a beehive, and its contamination can induce both contact- and oral-intoxication. Fifty percent of bees will die if they ingest just 5 nanograms[2] (ng) of IM over a short period of time (acute exposure), or just 0.01 – 1 ng over a longer period of time (chronic exposure). These values are often referred to as the LD-50, or the amount of a toxin that is a "lethal dose" (LD) to 50% of the exposed organism (Suchail, et al, 1999). When bees forage for nectar, they often become coated with pollen. The LD-50 for simply coming into contact with IM contaminated pollen is 24 ng of IM (Suchail, et al, 1999). Even if the use of IM is of short duration (spring applications), the exposure for bees in chronic, as both bees and their larvae feed on the stocked contaminated pollen and nectar, especially in the winter and early spring (Bonmatin, et al., 2005). Low doses of IM and IM-metabolites also negatively affect honeybee foraging and learning behavior (Decourtye et al, 2003 and 2004).

Perhaps the most compelling evidence for the toxicity of systemic IM on honeybees is an online video at http://www.youtube.com/watch?v=e8Nsn4KvjwM . In this video, researchers compare the effects on

[2] A nanogram is one billionth of a gram

honeybees of feeding them sap expressed from the blade tip of corn seedlings grown from IM-treated and untreated seeds. The bees fed the sap from the treated seedlings died within 2 to 5 minutes.

As use of IM as a seed-dressing formulation for various crops has increased, researchers have noted a coincidental sudden and drastic decline in honeybee populations and honey production in Europe (Colin, et al., 2004). While a conclusive link has not been made, it is suspected that IM has played a major role in these declines (Bonmatin, et al, 2005) and has led several individual nations (Italy, France, Germany) and the EU to ban or phase-out the use of IM.

It is often noted that ash trees largely pollinate by airborne dispersion of their pollen, and therefore do not rely heavily on bees for their pollination, suggesting that bee exposure to ash pollen (and any IM it may contain) may be minimal. However, ash trees are one of the earliest flowering trees in the upper Midwest and bees rely heavily on them as a source of food when they first begin foraging in the spring. In fact, in a PhD thesis from Wisconsin, Severson (1978) reports that ash pollen may constitute as much as 39% of the bee's pollen source in mid-April.

Emamectin Benzoate

Emamectin benzoate (EB) belongs to a class of pesticides called avermectins, which disrupt the transmission of nerve impulses, resulting in paralysis and death of the target organisms. Recent studies also suggest that EB has the ability to induce premature molting in insects, suggesting it is also an endocrine disruptor (Bright, et al., 2005). Avermectins are broad spectrum toxicants for nematodes and insects. EB was developed as a lepidoptericide, so it is extremely toxic to moths and butterflies. A Canadian study found EB is also toxic to green algae at relatively low concentrations (3.9 ppb; OPP, 2000). It also appears to be moderately toxic to freshwater fish, such as bluegill, trout, and fathead minnow, with LC-50[3] values of 180, 174, and 194 ppb in water, respectively (OPP, 2000). Irreversible, toxic effects on marine copepods were observed at water concentrations as low as 0.12 ppb and significant reduction in egg production was observed at 0.158 ppb (Willis and Ling, 2003). EB appears to be relatively non-toxic for birds and mammals (Bright, et al, 2005).

In the environment, EB tends to bind to soil or sediment particles (SPAH, 2002), making it less likely than IM to leach into the groundwater, but more likely to be washed into surface water with runoff carrying sediment. Studies have shown it to have a half-life in soil of 174 – 427 days (the lower the oxygen levels in the soil, the longer EB persists). EB is very stable in water, although if exposed to sunlight it has a half-life of 1.4 – 22 days (Bright, et al, 2005).

EB has been used as a topical (spray) treatment in a wide variety of agricultural crops such as cotton, tobacco, cabbage, potatoes, etc. where it is used primarily to kill "chewing and sucking pests", such as aphids, leafhoppers, tobacco budworms, southern armyworm, potato beetle, and whiteflies. Its agricultural uses have

[3] LC-50, the 50% lethal concentration, is similar to LD-50, but refers to the concentration (rather than dose) of a toxin in water, soil, or food, at which 50% of exposed organisms will die.

increased in recent years because it is relatively less harmful to beneficial insect species than other avermectins when applied as a spray (Sechser, et al., 2003; Lasota and Dybas, 1991). However, no studies were found evaluating the effects of EB when used as a systemic pesticide.

In recent years, EB has been used to kill parasitic sea lice which infect salmon in fish farms. Studies have indicated that the high doses found in fish feed and feces beneath the fish pens may have adverse effects on the molting cycle and reproductive success of lobsters (Waddy, et al., 2010). This may have implications for the development and subsequent reproduction of other crustaceans (such as freshwater crawfish), beneficial insects, and other invertebrates, but no studies have been done to evaluate this. EB has also been detected in blue mussels up to 100 m from the fish pens, but it does not appear to persist in them once the source has been removed (Telfer, et al., 2006). No studies were found to have been conducted on freshwater bivalves to determine whether they would be similarly affected if exposed to EB.

The main concern surrounding EB is the lack of information regarding how it will behave when used as a systemic pesticide in trees (or other plants) and the general absence of information regarding its effects on freshwater organisms.

References cited:

Alexander, AC., Culp, MN, Liber, K. and Cessna, AJ (2007) Effects of insecticide exposure on feeding inhibition in mayflies and oligochaetes. Env. Toxicol. & Chem., 26:1726-1732.

Alexander, AC., Heard, KS, and Culp JM (2008) Emergent body size of mayfly survivors. Freshwater Biol., 53:171-180.

Bonmatin, JM, et al. (2005) Quantification of imidacloprid uptake in maize crops. Jour. Agric. Food Chem., 53:5336-5341.

Bright, DA and Dionne, S. (2005) Use of Emamectin Benzoate in the Canadian Finfish Aquaculture Industry: A Review of Environmental Fate and Effects. Prepared for Environment Canada. March 2005.

Burridge, L.E., et al. (2004) Acute toxicity of emamectin benzoate (SLICE) in fish feed to American lobster, Homarus americanus. Aquacult. Res., 35:713-722.

CCME (2007) Canadian Water Quality Guidelines: Imidacloprid. Scientific Supporting Document. Canadian Council of Ministers of the Environment, Winnipeg.

Conlin, M.E., et al. (2004) Qunatitative analysis of the foraging activity of honeybees: relevance to the sub-lethal effects induced by systemic insectides. Archive Environ. Contam. Toxicol., 47:387-395.

Decourtye, A., Lacassie, E. and Pham-Delegue, MH (2003) Learning performances of honeybees (*Apis mellifera L.*) are differentially affected by imidacloprid according to the season. Pest Management Sci., 59:269-278.

Decourtye, A., Devillers, J., Cluzeau, S., Charreton, M. and Pham-Delegue, MH (2004) Effects of imidacloprid and deltamethrin on associative learning in honeybees under semi-field and laboratory conditions. Exotoxicol. Environ. Safety, 57:410-419.

Fossen, M (2006) Environmental Fate of Imidacloprid. Department of Pesticide Regulation, Sacramento, CA. April 2006.

Gupta, S., et al (2002) Leaching behavior of imidacloprid formulations on soil. Bull. Environ. Contam. Toxicol., 68:502-508.

James, DG and Price, TS (2002) Imidacloprid Boosts TSSM Egg Production. Agrichem. & Env. News, Issue 189. Washington State Univ. Extension Service.

Kaakeh, N., Kaakeh, W, and Bennet, G (1996) Topical toxicity of imidacloprid, fipronil, and seven conventional insecticides to the adult convergent lady beetle (Coleoptera: Coccinellidae). Jour. Of Entomol. Sci, 31(3): 315-322.

Kidd H. and James DR (1991) The Agrochemicals Handbook, Third Ed. The Royal Society of Chemistry. Unwin Brothers Ltd., Old Woking, Surrey, UK.

Kreutzweiser, D., Good, K., Chartrand, D., Scarr, T., and Thompson, D. (2007) Non-target effects on aquatic decomposer organisms of imidacloprid as a systemic insecticide to control emerald ash borer in riparian trees. Ecotoxicol. Env. Safety, 68:315-325.

Kreutzweiser, DP, Good, KP, Chartrand, DT, Scarr, TA, and Thomspon, DG (2008a) Are leaves that fall from imidicloprid-treated maple trees to control Asian longhorned beetles toxic to non-target decomposer organisms? Jour. Env. Quality, 37:639-646.

Kreutzweiser, DP, Thomspon, DG, and Scarr, TA (2008b) Imidicloprid in leaves from systemically treated trees may inhibit litter breakdown by non-target invertebrates. Ecotoxicol. & Env. Safety, 72:1053-1057.

Kreutzweiser, et al. (2008c) Toxicity of the Systemic Insecticide, Imidacloprid, to Forest Stream Insects and Microbial Communities. Bulletin of Environmental Contaminant Toxicology, 80:211-214.

Lasota, JA and Dybas, RA (1991) Avermectins, a novel class of compounds: Implications for use in arthropod pest control. Ann. Rev. of Entomol., 36:91-117.

Laurent, FM and Rathahao, E. (2003) Distribution of C^{14} imidacloprid in sunflowers (*Helianthus annuus L.*) following seed treatment. Jour. Agric. Food Chem., 51:8005-8010.

Luo, Y. (1999) Toxicological study two novel pesticides on earthworm*, Eisenia foetida*. Chemosphere, 39:2347-2356.

Mizell, RF and Sconyers, MC (1992) Toxicity of imidacloprid to selected arthropod predators in the laboratory. Florida Entomol., 83:1806-1812.

Moza, PN, Hustert, K., Fesicht, E. and Kettrup A. (1998) Photolysis of imidacloprid in aqueous solution. Chemosphere. 36(3):497-502.

Mullins, JW (1993) Imidacloprid: A new nitroguanidine insecticide. Am. Chem. Soc. Symposium Series 5240097-6156.

Nauen, RK, Tietjen, K., Wagner, K. and Elbert, A. (1998) Efficacy of plant metabolites of imidacloprid against *Myzus persicae* and *Aphis gossypii* (Homoptera: Aphididae). Pestic. Sci., 52:53-57.

OPP, 2000 Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB). Data retrieved from USEPA Ecotox database. Office of Pesticides Program.

Pestana, J., et al. (2009) Structural and functional responses of benthic invertebrates to imidacloprid in outdoor stream mesocosms. Env. Pollution (2009).

Raupp, MJ, Webb, RE, Szczepaniec, A., Booth, D., and Ahern, R. (2004) Incidence, Abuncance and Severity of Mites on Hemlocks Following Applications of Imidacloprid. Jour. of Arboriculture, 30(2):108-113.

Roberts, TR and Hutson, DH (eds) (1999) Chlorpyrifos. In: Metabolic Pathways of Agrochemicals, Part 2. The Royal Soc. of Chem., Cambridge, UK, pp 234-242.

Sarkar, MA, et al (1999) Effect of pH and type of formulation on the persistence of imidacloprid in water. Bull. Environ. Contam. Toxicol., 63:604-609.

Rouchaud, J., Gustin F., and Wauters, A. (1994) Soil biodegradation and leaf transfer of insecticide imidacloprid applied in seed dressing in sugar beet crops. Bull. Environ. Contam. Toxicol., 53(3): 344-350.

Sclar, D.C., Gerace, D., and Cranshaw, W. S. (1998) Observations of Population increases and injury by spider mites (Acari: Tetranychidae) on Ornamental Plants Treated with Imidacloprid. Jour. Econ. Entomol., 91(1):250-255.

Sechser, B., Ayoub, S., and Monuir, N. (2003) Selectivity of emamectin benzoate to predators of sucking pests on cotton. Jour. of Plant Disease and Protection, 110(2):184-194.

Severson, DW (1978) Pollen Gathering by Honey Bees in LaCrosse County, Wisconsin. Thesis submitted to the faculty of the University of Wisconsin. September 1978.

SPAH, 2002 Potential environmental impacts of emamectin benzoate, formulated as Slice™, for salmonids. Technical Report. 36 pp. Schering-Plough Animal Health.

Suchail, A, Guez, D., and Belzunces, LP (1999) Discrepancy between acute and chronic toxicity induced by imidacloprid and its metabolites in *Apis mellifera*. Environ. Toxicol. Chem., 20(11): 2482-2486.

Telfer, T.C., et al. (2006) Environmental effects of the anti-sea lice (Copepoda: Caligidae) therapeutant emamectin benzoate under commercial use conditions in the marine environment. Aquaculture, 260: 163-180.

Tomlin, C (1997) The pesticide manual: Incorporating the agrochemicals handbook, 10th ed. British Crop Protection Council, Farnham, Surrey, UK.

U.S. EPA (2003) Imidacloprid; Pesticide Toerances. Fed. Regist. 68:35303-35315 [Online]. Available at http://www.epa.gov/fedrgstr/EPA-PEST/2003/June/Day-13/p14880.htm (as cited in Fossen, 2006; verified 1-11-06). US EPA, Washington, DC.

Waddy. SL, Merritt, VA, Hamilton-Gibson, MN, and Aiken, DE (2010) Effect of emamectin benzoate on the molt cycle of ovigerous American lobsters *Homarus americanus* is influenced by the dosing regimen. Aquatic Biol., 11:47-52.

Wamhoff, H. and Schneider, V. (1999) Photodegradation of imidacloprid. Jour. Agric. Food Chem., 47(4):1730-1734.

Westwood, F., Bean, K., Dewar, A., Bromilow, R., and Chamberlain, K. (1998) Movement and persistence of [^{14}C] imidacloprid in sugar-beet plants following application to pelleted sugar-beet seed. Pesti. Sci., 52(2):97-103.

Willis, KJ and Ling, N. (2003) The toxicity of emamectin benzoate, an aquaculture pesticide, to planktonic marine copepods. Aquaculture, 221:289-297.

Zang, Y., et al. (2000) Genotoxicity of two novel pesticides for the earthworm*, Eisenia foetida*. Environ. Pollut., 108:271-278.

Appendix E: Biological Control

The following text is from the Minnesota Department of Agriculture website, 3/4/11:

Biological control (biocontrol) is the best option for cost-effective, long-term EAB population reduction. A variety of insecticides are available to treat individual, high-value ash trees. Cost and logistical considerations make these treatments impractical on a large scale. Biocontrol, already used successfully to fight some weed and insect pests in Minnesota, is considered the only feasible large-scale tool for combating EAB. Biocontrol reunites a target pest with the insects or diseases that control the pest in its native range. In this case, tiny, stingless wasps that control EAB in Asia are released to reduce EAB damage. Prior to their use, biocontrol organisms are thoroughly tested to ensure they will not harm humans, native plant and animal species, or the environment.

USDA rears three species of wasps as biocontrol agents for EAB. Two species kill EAB larvae. *Tetrastichus planipennisi* adults find and insert their eggs into EAB larvae. *Spathius agrili* behaves similarly except that the wasp eggs and developing wasps are attached to the outside of the EAB larvae. The developing wasps feed on and eventually kill the EAB larvae. Egg parasitoid, *Oobius agrili*, adults insert their eggs into EAB eggs on ash bark. The developing wasps feed on and destroy the eggs.

Appendix F: What Are Other Metro Communities Doing to Combat EAB?

Below are notes compiled in March 2011 regarding what nearby communities are doing to manage EAB.

Saint Paul

- Removed all infested ash trees from initial infestation
- Created trap trees to monitor EAB population (destructive sampling of ash)
- Structured removal of full blocks of declining ash
- 2011: some pesticide treatment in infested areas
- 2011: residents will be allowed to hire licensed contractors to treat boulevard trees via trunk injection

Minneapolis

- Removed all infested trees
- Trunk injection of select park trees
- 2011: release of biological near infestation

Ramsey County

- Removing 300 trees
- Trunk injection of 1600 trees in county parks/golf courses

Woodbury

- EAB plan presented to council March 2011
- Ordinance will be updated to include EAB
- Not recommending chemical treatment at this time
- Council will determine whether or not to do preemptive removals

Cottage Grove

- Plans for trunk injection of 3000 blvd ash trees
- Plan calls for removal of 50-150 ash per year depending on several factors, including costs
- Plan calls for removal and replacement of approximately 1000 of their 4000 boulevard ash trees over 12 years
- Possible structured removal of poorer quality public ash trees depending on funding

Roseville

- City council approved EAB plan in fall of 2010
- $100,000 budgeted for EAB, plus received $50,000 grant
- Each year will remove some ash that are in poor condition
- Will treat some ash trees considered significant
- Residents may treat boulevard ash trees if they apply for a permit and use a licensed city contractor
- Updating disease ordinance to include ash

North Saint Paul

- Allowing residents to register boulevard ash trees they would like to have treated with the city
- Planning on some structured removal

BioForest

Risk to Bees from TreeAzin® Systemic Insecticide Injections for Emerald Ash Borer

The risk to bees from any emerald ash borer insecticide can be determined by how toxic the insecticide is to bees and the degree of exposure bees have to the insecticide: **Risk = Toxicity X Exposure**

Toxicity

The active ingredient in TreeAzin Systemic Insecticide is azadirachtin, an extract from the neem seed. As a measurement of toxicity, the LD_{50} of azadirachtin for honey bees is 6.1 µg/bee (Naumann and Isman 1996). By EPA's scale for rating toxicity (EPA et al. 2014), azadirachtin is moderately toxic to bees. In contrast, other active ingredients used for emerald ash borer (EAB) treatments, namely imidacloprid, dinotefuran, and emamectin benzoate, are all highly toxic to bees.

Emerald Ash Borer treatment options	Toxicity	Contact LD_{50} (ug/bee)
Azadirachtin	Moderate	6.1[a]
Dinotefuran	High	0.024 – 0.061[b]
Imidacloprid	High	0.0179 – 0.24[b]
Emamectin benzoate	High	0.0035[c]

Sources: a. Naumann and Isman 1996; b. Hoowood et al. 2012; c. EPA et a., 1992

Exposure (i.e. likelihood of bees coming into contact with EAB insecticides)

- **Environmental persistence:** The longer an insecticide persists in the environment, the greater the likelihood that bees could come into contact with that insecticide
  - Foliar half-life of azadirachtin: 5.1 to 12.3 days (Kleeberg 1992; Grimalt et al. 2011).
  - Following summer injections, azadirachtin degrades to near undetectable limits in autumn shed leaves (Grimalt et al. 2011).
  - Azadirachtin in autumn-shed leaves poses no measurable risk of harm to terrestrial or aquatic decomposer invertebrates (Kreutzweiser et al. 2011).
  - Imidacloprid can persist in woody plants for more than a year (Bonmatin et al. 2014).
  - Autumn-shed leaves from imidacloprid treated trees can contain residues that pose risk of harm to terrestrial or aquatic invertebrates (Kreutzweiser et al. 2007, 2008, 2009).
  - Azadirachtin is a promising alternative to neonicotinoid insecticides because of its non-persistent environmental profile (Furlan and Kreutzweiser 2014).
- **Ash pollen:** Bees forage for ash pollen (Johnson 2015).
  - Stem injections occur long after trees have flowered, so possibility of exposure in year of treatment should be minimal (Hahn et al. 2011).
- **Repellency**
  - Honey bee workers are able to detect neem seed extract (NSE) concentrations as low as 0.1 ppm of NSE in sugar syrup. This detection is manifested in a tendency to avoid NSE-treated syrup in preference to untreated syrup. Because of the small amounts of NSE acquired by foragers on flowers, and the rapid degradation of NSE in the environment, it is unlikely that enough azadirachtin could be concentrated in the nest stores to affect larval development (Naumann et al. 1994).
- **Ingestion vs. contact**
  - Azadirachtin products must be ingested to be effective (Extoxnet 1995a), whereas imidacloprid, emamectin benzoate, and dinotefuran are effective on contact or ingestion (Extoxnet 1995b, EPA 2009, and Fishel 2013, respectively).

References:

1. Bonmatin J-V, Giorio C, Girolami V, Goulson D, Kreutzweiser D, Krupke C, Liess M, Long E, Marzaro M, Mitchell E, Noome D, Simon-Delso N, Tapparo A, 2014. Environmental fate and exposure; neonicotinoids and fipronil. Environmental Science and Pollution Research 22: 35-67.
2. Extension Toxicology Network Extoxnet), 1995a. Azadirachtin, http://pmep.cce.cornell.edu/profiles/extoxnet/24d-captan/azadirachtin-ext.html
3. Extension Toxicology Network Extoxnet), 1995b. Imidacloprid, http://pmep.cce.cornell.edu/profiles/extoxnet/methoxyfoo-methylparathion/imidacloprid-ext.html
4. Fishel, M., 2013. Pesticide Toxicity Profile: Neonicotinoid Pesticides PI-80. Pesticide Information Office, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. 2pp.
5. Furlan, L., & Kreutzweiser, D. 2014. Alternatives to neonicotinoid insecticides for pest control: case studies in agriculture and forestry. Environmental Science and Pollution Research, 22(1), 135-147.
6. Grimalt, S., Thompson, D., Chartrand, D., McFarlane, J., Hobson, B., Lyons, B., & Scarr, T. 2011. Foliar residue dynamics of azadirachtin following direct stem injection into white and green ash trees for control of emerald ash borer. Pest management science, 67(10), 1277-1284.
7. Hahn, J., Herms, D. A., & McCullough, D. G. 2011. Frequently asked questions regarding potential side effects of systemic insecticides used to control emerald ash borer. University of Minnesota, Michigan State University, and The Ohio State University Extension Emerald Ash Borer Fact Sheet.
8. Hoowood, J., Vaughan, M., Shepherd, M., Biddinger, D., Mader, E., Black, S. H., & Mazzacano, C. 2012. Are Neonicotinoids Killing Bees? A review of research into the effects of neonicotinoid insecticides on bees, with recommendations for action. Xerces Society for Invertebrate Conservation, USA.
9. Johnson, R. 2015. Effects of EAB Treatment on Pollinators. Ohio Agriculture Research and Development Center. http://www.emeraldashborer.info/eab_university_ondemand.cfm#sthash.Eb40ndGT.dpuf
10. Kleeberg, Hubertus. 1992. 'The NeemAzal concept: test of systemic activity.' Practice Oriented Results on Use and Production of Neem-Ingredient: 5-16.
11. Kreutzweiser, D., Good, K., Chartrand, D., Scarr, T., & Thompson, D. 2007. Non-target effects on aquatic decomposer organisms of imidacloprid as a systemic insecticide to control emerald ash borer in riparian trees. Ecotoxicology and environmental safety, 68(3), 315-325.
12. Kreutzweiser, D. P., Good, K. P., Chartrand, D. T., Scarr, T. A., & Thompson, D. G. 2008. Are leaves that fall from imidacloprid-treated maple trees to control Asian longhorned beetles toxic to non-target decomposer organisms?. Journal of environmental quality, 37(2), 639-646.
13. Kreutzweiser, D. P., Thompson, D. G., & Scarr, T. A. 2009. Imidacloprid in leaves from systemically treated trees may inhibit litter breakdown by non-target invertebrates. Ecotoxicology and Environmental Safety, 72(4), 1053-1057.
14. Kreutzweiser, D., Thompson, D., Grimalt, S., Chartrand, D., Good, K., & Scarr, T. 2011. Environmental safety to decomposer invertebrates of azadirachtin (neem) as a systemic insecticide in trees to control emerald ash borer. Ecotoxicology and environmental safety, 74(6), 1734-1741.
15. Naumann, K., Currie, R. W., & Isman, M. B. 1994. Evaluation of the residual effects of a neem insecticide on foraging honey bees and other pollinators. The Canadian Entomologist, 126(02), 225-230.
16. Naumann, K., & Isman, M. B. 1996. Toxicity of a neem (Azadirachta indica A. Juss) insecticide to larval honey bees. American Bee Journal.
17. U.S Environmental Protection Agency. 1992. Reference Number: 344 Pesticide Ecotoxicity Database (Formerly: Environmental Effects Database (EEDB)). Environmental Fate and Effects Division, U.S.E.P.A, Washington, D.C. EPA Office of Pesticides.
18. US Environmental Protection Agency. 2009. Section 3 Registration for a New Use of the Insecticide emamectin benzoate (PC Code 122806). Environmental Fate and Effects Division, U.S.E.P.A, Washington, D.C. EPA Office of Pesticide Programs. 21pp.
19. US Environmental Protection Agency. 2014. Guidance for Assessing Pesticide Risks to Bees. Office of Pesticide Programs United States Environmental Protection Agency, Health Canada Pest Management Regulatory Agency, California Department of Pesticide Regulation. June 19, 2014. 59pp.

ENVIRONMENTAL & NATURAL RESOURCES COMMISSION STAFF REPORT
Meeting Date April 18, 2022

REPORT TO: Environmental and Natural Resources Commission

REPORT FROM: Shann Finwall, AICP, Environmental Planner

PRESENTER: Shann Finwall, AICP, Environmental Planner

AGENDA ITEM: Annual Report
1) Solid Waste
2) Sustainability

Action Requested: ✓ Motion ☐ Discussion ☐ Public Hearing

Form of Action: ☐ Resolution ☐ Ordinance ☐ Contract/Agreement ☐ Proclamation

---

Policy Issue:

The Environmental and Natural Resources Commission submits an annual report to the City Council and the community. The report includes Commission updates, and details on the City's solid waste and sustainability programs.

Recommended Action:

Recommend approval of the 2021 Solid Waste and Sustainability Annual Reports.

Fiscal Impact:

Is There a Fiscal Impact? ✓ No ☐ Yes, the true or estimated cost is $.00

Financing source(s): ☐ Adopted Budget ☐ Budget Modification ☐ New Revenue Source ☐ Use of Reserves ☐ Other: n/a

Strategic Plan Relevance:

☐ Community Inclusiveness ☐ Financial & Asset Mgmt ✓ Environmental Stewardship
✓ Integrated Communication ☐ Operational Effectiveness ☐ Targeted Redevelopment

The annual reports serve as an important method of updating the City Council and the community on the City's environmental and sustainability accomplishments and goals.

Background:

Attached to this memo is a draft of the 2021 Solid Waste and Sustainability Reports. The reports will be incorporated into the new Parks and Natural Resources Department update to the City Council, and will include the 2021 Park and Recreation Commission Report and ENR Commission Annual Report (approved by the ENR in Februrary 2022). The report will be presented to the City Council in the spring of 2022, and posted on the ENR Commission website.

Attachments:

1. 2021 Solid Waste Annual Report
2. 2021 Sustainability Annual Report

Solid Waste 2021 Annual Report

The City has been able to help limit greenhouse gas emissions and divert waste from landfills through the City's organized solid waste collection system. It's lead to lower prices, reduced truck traffic, and community control over waste management decisions. Maplewood contracts with Tennis Sanitation for residential single and multi-family recycling collection and Republic Services for residential single-family trash and yard waste collection. Following is a sampling of system changes made by the City and the haulers in 2021 to improve the City's solid waste services:

1. Trash Collection Improvements

a. Spring Clean Up: The April 17, 2021, Spring Clean Up was the first clean up covered by Republic Services at no cost to the City as part of the overall residential trash and yard waste contract. The City previously subcontracted with other haulers to manage this event. During the 2021 Spring Clean Up, the City processed the largest volume of materials in the history of clean ups. This was likely due to the 2020 Spring Clean Up being cancelled, Covid-19 shut downs and residents have ample time to clean their properties, and the new fee structure that charged per-vehicle load instead of per item. Due to the number of vehicles and the volume of materials, the City had to send many vehicles away. Republic Services and City staff are reviewing those challenges and making changes to the 2022 Spring Clean Up where necessary. A summary of materials collected during the 2021 Spring Clean Up follows:

Material Collected During the April 17, 2021, Spring Clean Up	*Increase Over Last 3-Year Average*
37 Tons of General Trash	40%
8.5 Tons of Metals	33%
249 Tires	200%
126 Appliances	29%
224 Tvs and Computers	43%
216 Mattresses	52%
73 Lawn Mowers, Snow Blowers	33%
207 HHW Drop Offs	41%

We also received a record number of food shelf donations including 243 pounds of food and $467 cash donations for Merrick Community Services.

b. Pay as You Throw Trash Rate Pricing Schedule: In 2021, the City and Republic Services negotiated the 2022 Pay as You Throw (PAYT) rate pricing structure. The goal of PAYT is to increase the percentage of price increments between trash cart sizes to encourage a reduction in trash and an increase in recycling. Trash hauling fees include the collection cost (cost to collect the trash from the residential property), disposal cost (the tipping fee charged to the hauler to dispose of the trash at the Ramsey/Washington Recycling and Energy Center), state and county taxes, and a City cart fee. The collection cost is set in the contract and increases by approximately 4% each year. The PAYT rates are

created by adjusting the disposal cost of the trash only. The 2022 monthly PAYT rates are as follows:

Cart Size	*2021 Overall Trash Rates- collection, disposal, taxes, fees*	*2022 Overall Trash Rates - collection, disposal, taxes, fees*	*2022 % Price Change From Each Cart Size*	*2022 RFP % Price Change from Each Cart Size*	*2021 to 2022 Price Change per PAYT price increments*
20 gallon every other week	$12.51	$12.45			-$.06
20 gallon every week	$13.02	$13.00	4%	37%	-$.01
35 gallon every week	$15.01	$14.05	8%	25%	-$.96
65 gallon every week	$19.44	$20.00	42%	25%	+$.56
95 gallon every week	$23.69	$25.00	25%	25%	+$1.31

2. Recycling Collection Improvements

a. Recycling cart audit: In 2014, the City converted the collection of recycling from bins to carts. Tennis Sanitation supplied the carts, originally rolling out 35-gallon carts to townhomes and manufactured homes and 65-gallon carts to single-family homes. Since that time Tennis Sanitation offers residents the choice of any size cart for the same price (35, 65, or 95-gallon recycling carts).

In 2021, Tennis Sanitation conducted a recycling cart audit to determine the number and sizes of carts at single-family homes (not including townhomes or manufactured homes). This information will be valuable as the audit is updated yearly to determine the effects of the City's Pay as You Throw trash rates. A greater number of 95 gallon recycling carts and 35 gallon trash carts will mean more recycling and less waste. The cart audit results are as follows:

- 262 - 35 gallon carts
- 8,731 - 65 gallon carts
- 268 - 95 gallon carts

b. Household count audit: Maplewood adds the recycling fee of $5.52 per household per month onto residential water bills. Tennis Sanitation invoices the City monthly for overall household recycling collection per the contract. This is the first year the City has conducted a household count audit. Previously, the recycling contracts and invoices included estimated household numbers based on the City's original roll out of recycling and City, County, and Metropolitan Council household count estimates. The household count audit results are as follows:

- 10,988 homes that can have recycling collected at the curb (including single-family, townhomes, and manufactured homes)
- 4,290 multi-family homes with recycling collected in centralized locations (including apartments, condominiums, and some townhomes)

2021 Sustainability Report

Maplewood's comprehensive plan incorporates a sustainability approach that strengthen the environmental, economic, and social dimensions of any issue. An important element of that plan is reporting on sustainability indicators. Following is a sampling of those indicators from 2021.

GreenStep Cities

As one of the first cities to sign onto the GreenStep Cities program in 2010, Maplewood has remained a leader in sustainability throughout the state. Of 146 Minnesota cities participating in the program, Maplewood is one of 29 cities that has been awarded Step 5 for measuring and making improvements on sustainability metrics. From 2019 to 2020 the City showed improvement in the following areas:

- Increase of 49 trees planted on City projects (147 trees total)
- Increased the Stormwater Management Score by 10% (62% total)
- Increased the Climate Adaptation Assessment Score by 1 (74% total)
- Increased the number of LED lights in City facilities by 6% (77% total)
- Increased the number of privately owned green certified buildings by 4 (8 green buildings total)
- Reduced the average miles per gallon for City vehicles -
    - gasoline fleet by .9 gallons (11.4 gallons total)
    - diesel fleet by .09 gallons (4.51 gallons total)
- Reduced the vehicle miles traveled per person, per day for City-wide vehicles by 1.01 miles (27.4 miles total)
- Increased the number of public electric vehicle charging stations by 22 (36 charging stations total)
- Increased the generation capacity of city-owned and private renewable energy sites by 144 kW (770 kW total)
- Reduced greenhouse gas emissions from
    - travel 2,227 tons of CO^2 (227,929 tons of CO^2 total)
    - waste by 735 tons of CO^2 (6,730 tons of CO^2 total)
    - non-transportation (buildings, etc.) by 43,101 tons of CO^2 (173,531 tons of CO^2 total)

Green Team

The Maplewood Green Team's mission statement is to promote environmentally sustainable operating practices by implementing and influencing feasible approaches to reducing emissions and pollution within the city. The Green Team is made up of representatives from each City Department and serves as the internal steering committee for the GreenStep Cities program and the Climate Adaptation Plan.

In 2021, the Green Team focused on Environmental Purchasing Policy outreach and education. The policy was adopted in December 2020 and shifts the City's purchasing to the procurement of goods and services that have a reduced effect on the natural environment and human health

when compared to competing products and services that serve the same purpose. One outreach opportunity included the Reduce Your Foodprint Trimester Challenge. The Green Team collaborated with the Wellness Committee on the Challenge that guided Maplewood employees towards purchases that have reduced effect on the natural environment and promoted healthy lifestyle choices.

Climate Adaptation Plan

The City Council adopted the Climate Adaptation Plan in May 2021. The two-year process to complete the plan was conducted by a 15-person planning team of community members, City Council and ENR Commission members, representatives of Ramsey County, Xcel Energy, Ramsey-Washington Metro Watershed District, and City staff. The plan includes an implementation framework designed to achieve community-wide goals for climate adaptation and resilience. It is organized around a unifying framework of eight sections: 1) Health and Safety, 2) Extreme Heat and Weather, 3) Air Quality, 4) Flooding and Water Quality, 5) Greenspace and Ecosystem Health, 6) Local Food and Agriculture, 7) Climate Economy, and 8) Adaptation Capacity.