

AGENDA
CASCADE CHARTER TOWNSHIP
REGULAR BOARD MEETING

Wednesday, April 12, 2017

7:00 P.M.

Cascade Branch of the Kent District Library, Wisner Center
2870 Jacksmith, S.E.

Expected Meeting Procedures

1. During public comments you may speak on any item not noted on the agenda for a public hearing.
2. Please limit comments to 3 minutes per person and the Board may or may not choose to respond.
3. Please limit your comments to a specific issue.
4. Please turn OFF cellular phones.

- Article 1. Call to Order, Roll Call**
- Article 2. Pledge of Allegiance to the Flag**
- Article 3. Approval of Agenda**
- Article 4. Presentations/Public Comments (limit comments to 3 minutes)**
Chris Becker, Kent County Prosecuting Attorney – re: Medical Marijuana Legislation
- Article 5. Approval of Consent Agenda**
- a. Receive and File Various Meeting Minutes
 1. Regular/Closed Session Township Board Minutes for 3/22/17.
 2. Regular Planning Commission Minutes for 3/6/2017.
 - b. Receive and File Communications
 1. Letter to Steven Warren, Kent County Road Commission – re: Cascade Road and Thornapple River Drive Intersection.
 2. Letters from Charter Communications – re: Channel Lineup
 3. Letter from Regis – re: Rebate Check
 - c. Education Requests
 1. Jeff Knowles – Columbia Southern University – Legal Aspects of Safety and Health.
 - d. Receive and File Reports
 1. DDA 2016 Annual Report
 2. Treasurer’s Report for January 2017.
- Article 6. Financial Actions**
- a. Consider Approval of March, 2017 Payroll, Payables and Transfers.
 - b. Consider Pay Draw #1 for the Thornapple River Dr. Utility Extension Project.
 - c. Consider Pay Draw #1 for the Thornapple Hills Drain.
- Article 7. Unfinished Business**

- Article 8. New Business**
017-2017 Consider Request for Additional Use of Burton Park Entranceway Easement.
- 018-2017 Consider Approval of Contract with Hamilton Helicopter Inc. for Gypsy Moth Suppression Services.**
- Article 9. Public Comments on any other matters. (limit comments to 3 minutes)**
- Article 10. Manager Comments**
- Article 11. Board Member Comments**
- Article 12. Adjournment**

**MINUTES OF THE
CASCADE CHARTER TOWNSHIP
REGULAR BOARD MEETING**

Wednesday, March 22, 2017
7:00 P.M.

Article 1. Supervisor Beahan called the meeting to order.
Present: Supervisor Beahan, Trustee Koessel, Shipley, MacDonald, Lewis, Clerk Slater and Treasurer Peirce.
Absent: None
Also Present: Manager Swayze, Deputy Clerk Biegalle, DDA/ED Director Korhorn, Kevin Krauss/Terry Tobias/Ron Neil Township Attorneys/Investigator and those listed on Supplement #1.

Article 2. Supervisor Beahan led the Pledge of Allegiance to the Flag.

Article 3. Motion was made by Trustee Lewis and supported by Trustee Koessel to approve the agenda as presented. Motion carried unanimously.

Article 4. Presentations/Public Comments (limit comments to 3 minutes)
Diane Cutler, KDL Librarian addressed the Board regarding a special series of programs being offered at the Library.
Scott VanSolkema, 2570 Orange Ct. addressed the Board regarding the suspension of the Fire Chiefs.
Deputy Ryan Roe, Kent County Sheriff Department gave an update to the Board on the happenings in Cascade Township.

Article 5. Approval of Consent Agenda

- a. Receive and File Various Meeting Minutes
 - 1. Regular Township Board Minutes for 3/08/17.
 - 2. Regular Planning Commission Minutes for 2/6/2017.
 - 3. Regular Zoning Board of Appeals Minutes for 1/10/2017.
 - 4. Regular Downtown Development Minutes for 1/17/2017.
- b. Receive and File Reports
 - 1. Fire Department Monthly Report for February, 2017.
 - 2. Treasurer's Report for 2016 Tax Collections.
- c. Education Requests
 - 1. Doug Poolman – Michigan – IAAI Annual Arson School – Bay City, MI – May 23-26, 2017.

Motion was made by Trustee Lewis and supported by Trustee Koessel to approve the Consent Agenda as presented. Motion carried unanimously.

Article 6. Financial Actions

- a. **Consider Approval of January/February, 2016 General/Special Funds.**
Motion was made by Trustee MacDonald and supported by Trustee Shipley to approve the January/February, 2016 General/Special Funds. Motion carried unanimously.
- b. **Consider Approval of February, 2017 Payroll, Payables and Transfers.**
Motion was made by Clerk Slater and supported by Trustee Shipley to approve the February, 2017 Payroll, Payables and Transfers. Motion carried unanimously.

Article 7. Unfinished Business

Article 8. New Business

015-2017 Discuss and Consider Holiday Decorations for the Village and Tassell Park.

DDA/ED Director Korhorn presented DDA request for the Holiday Decorations for the Village and Tassell Park. Discussion followed. Motion was made by Trustee Koessel and supported by Trustee MacDonald to approve the DDA expenditure of \$15,000 to purchase new holiday decorations. Motion carried unanimously.

016-2017 Consider Approval of a Request from KDL for Music Programming Funding.

Township Manager Swayze introduced Librarian Cutler to review the request for funding. Motion was made by Trustee Koessel and supported by Trustee Shipley to approve \$3,500 to Support the Music Programming at the Cascade Library. motion carried unanimously.

Article 9. Closed Session

- Pursuant to Open Meetings Act 15.268(h) - To consider material exempt from discussion or disclosure by state or federal statute.
- To Discuss an Attorney's Legal Opinion.

Motion was made by Trustee Koessel and supported by Trustee Lewis to move into closed session. Motion carried unanimously by roll call vote. Motion was made by Trustee Koessel and supported by Treasurer Peirce to reconvene into regular session. Motion carried unanimously by roll call vote.

Article 10. Public Comments on any other matters. (limit comments to 3 minutes)

Scott VanSolkema, 2570 Orange Ct. questioned why he could not ask question during agenda Item 015-2017. Also questioned closed session attendees and several other items.

Nick Katsavelas, 2985 Burrwick Dr., S.E., also inquired about how questions from the audience got addressed.

Article 11. Manager Comments

Manager Swayze offered the following comments:

- Have had a couple of Economic Development conversations over the past couple of weeks. Had a chance to meet with the owners of Paragon, they are looking at putting a big expansion on their facility. Also working with The Right Place on a project.
- We did have dumpsters that were put behind Station 1 for storm damage.
- We are getting ready to launch a MEDC project. (Redevelopment Ready Communities)
- Chris Becker will be coming to talk about the Medical Marijuana laws in April.

Article 12. Board Member Comments

Trustee Shipley offered the following comments:

- Thanked everyone for staying tonight.
- Great the Township provided the dumpsters out back, once again we lack the ability to communicate.

Trustee Koessel offered the following comments:

- Received information today regarding the last power outage. I read it but confused regarding the pocket that always goes out.
- Addressed a couple of items brought up at meeting by resident.

Treasurer Peirce offered the following comments:

- Compliment Diane Cutler on the World Affairs Council speakers.

Clerk Slater offered the following comments:

- Addressed “tree” questions from resident in audience.

Trustee Lewis offered the following comments:

- We have grown very well and we are very proud on where Cascade has been and where we are going.

Trustee MacDonald offered the following comments:

- Addressed “issues” from the resident in the audience.

Supervisor Beahan offered the following comments:

- Reviewed the Public Comment section of Agenda.

Article 13. Adjournment

Motion was made by Treasurer Peirce and supported by Trustee Lewis to adjourn. Motion carried unanimously.

Meeting adjourned at 7:52 p.m.

Respectfully submitted,

Denise M. Biegalle
Deputy Clerk

Approved by:

Susan B. Slater, Clerk

Robert S. Beahan, Supervisor

MINUTES

Cascade Charter Township
Planning Commission
Monday, March 6, 2017
7:00 P.M.

ARTICLE 1. Chairman Waalkes called the meeting to order at 7:00 P.M.
Members Present: Katsma, Lewis, Mead, Pennington, Rissi, Robinson, Sperla and Williams
Members Absent: none
Others Present: Community Development Director, Steve Peterson and those listed on the sign in sheet.

ARTICLE 2. Pledge of Allegiance.

ARTICLE 3. Approve the current Agenda.

Motion was made by Member Robinson to approve the Agenda. Supported by Member Lewis. Motion carried 9 to 0.

ARTICLE 4. Approve the Minutes of the February 6, 2017 Meeting.

Motion was made by Member Sperla to approve the Minutes. Supported by Member Pennington. Motion carried 9 to 0.

ARTICLE 5. Acknowledge visitors and those wishing to speak to non-agenda items.

No one came forward.

ARTICLE 6. Case #17:3367 Cascade One LLC

Property Address: 1701 Spaulding Ave SE

Requested Action: The Applicant is requesting a Basic Plan Review to Rezone the P.U.D. to allow for a 31 lot plat.

Director Peterson stated that Applicant is requesting a Basic Plan Review in order to rezone approximately 36 acres for a new Planned Unit Development called Cascade One. This rezoning request is for 31 single-family lots.

This project is similar to the project they applied for in 2014. At that time, the project was proposed for 27 single-family lots. Due to the increase in the number of lots and the numerous layout changes, it was determined this should move forward as a new project rather than just an update of the old one. The developer will be required to provide all new information for this new project.

The Applicant is requesting to cluster the homes in an open space concept with the development on the upland areas of the property.

The subdivision includes the use of new private roads. This is a change from the old project. The main reason for the change is the Kent County Road Commission (“KCRC”) design standards could not be met while still meeting the drainage requirements (However, as late as March 1, 2017, the KCRC still thinks that their design can be met.). The Township’s private road design standards will still have to be met. There is a section of the road that exceeds the 6% limit. Our engineer has the ability to recommend up to 8% grade. The road names will need to be approved by KCRC.

The development is proposed to be served by both public sewer and public water. The utility plans will need to be approved by the Township Engineer.

The Township Engineer will also need to review and approve the storm water plan for this project.

This project does include access to Spaulding and Abbeydale. As a private street development, Cascade Township does require a second access point to a public street after 19 home sites. With private streets, the new development may wish to use gates to restrict access. A connection from Abbeydale to Spaulding is desirable for not only the new subdivision, but also those in the existing subdivision. It would make sense to restrict the ability of the developer to cut off access and allow access from Abbeydale to Spaulding Avenue.

The plan does include a pedestrian connection to our path from Spaulding using the new private roads. It will need to be decided whether or not to allow the connection using the private roads or if a new sidewalk should be built. This connection is important, but discussion is needed about the best way to make the connection and the long term maintenance plan for the path. According to the City of Kentwood, the Kent County Drain Commission (“KCDC”) and the designing engineers of the subdivision in Kentwood, the stub street was designed to connect to this property in Cascade. This would provide an excellent connection from Cascade into Kentwood.

The plans do not include sidewalks, which is a requirement of our subdivision ordinance. A separated sidewalk similar to Manchester/Stoneshire and Watermark that would connect from Spaulding Avenue to the walk going to Kentwood should be included.

The path crosses Martin Beek Drain. The KCDC will have to permit the work in the drainage easement. Their input will be needed to ensure that they would allow the sidewalks.

The Applicant is also proposing to connect to the Abbeydale subdivision to the south. This was contemplated when Abbeydale was constructed in the late 80’s and early 90’s. Due to the topography issue, the developer does not plan to connect the north for future development of that area.

The developer is choosing to develop the project under our subdivision ordinance using the 25% open space method. This allows lot sizes as small as 25,000 sq. ft. with public sewer and water. Since they are seeking approval with lots less than that they are requesting P.U.D. rezoning. The developer will need to submit a test plan showing how

they could do the same 31 lots without needing P.U.D. rezoning approval. This plan will need to be evaluated to ensure that the number of lots they are proposing is actually possible.

The site is impacted by some small wetland areas which should be evaluated for need of any MDEQ permits.

The Applicant is attempting to use the 25% open space development technique for this project. The open space or common areas need to be clearly identified on the plan, along with a plan showing how they calculated the density to make sure it fits with the township subdivision ordinance.

The plan includes an area about 3.8 acres in size that they are leaving out of the project. This area has direct connection to Cavalcade Drive in Kentwood. This area would be able to accommodate two parcels. Similar to the subdivision portion, it appears that the connection is being made using a driveway rather than a separated sidewalk. Staff would prefer a connected sidewalk.

Given the topography and the fact that the property is close to wetlands areas, the soil erosion control plan will be very critical.

The Applicant has indicated the subdivision will have light poles and street trees in the development. The Township subdivision ordinance requires them in every subdivision.

Director Peterson recommends the following from the Applicant before proceeding to the Preliminary Development Plan Review:

1. Review by KCRC, including the possibility of utilizing public streets;
2. Provide a test plan;
3. Revise the plans to show a sidewalk connecting from Spaulding Avenue to the walk going to Kentwood, including the exception area;
4. Address storm water, sanitary sewer and public water supply issues with the Township Engineer;
5. Have plans reviewed by the KCDC;
6. Provide comments from MDEQ regarding the need for any permits from the State of Michigan; and
7. Provide comments from the City of Kentwood regarding your connection to Cavalcade.

Chairman Waalkes asked the Applicant to come forward with any comments.

Mr. Ed Pynnunen, the developer, came forward and addressed several of the concerns outlined by staff.

Discussion followed.

As no action is required of the Planning Commission at this time, Chairman Waalkes advised Applicant to work with Staff on the issues as outlined by Staff to get to the next step in the process.

ARTICLE 8. Any other business.

No other business was presented.

Next meeting of the Planning Commission will be March 20, 2017.

ARTICLE 9. Adjournment.

Motion was made by Member Mead to adjourn. Supported by Member Rissi. Motion carried 9 to 0. The meeting was adjourned at 7:45 p.m.

Respectfully submitted,
Scott Rissi, Secretary



CASCADE CHARTER TOWNSHIP

2865 Thornhills SE Grand Rapids, Michigan 49546-7140

April 13, 2017

Mr. Steven Warren
Executive Director
Kent County Road Commission
1500 Scribner Avenue NW
Grand Rapids, MI 49504

Re: Cascade Road and Thornapple River Drive Intersection

Dear Mr. Warren:

We are writing to you regarding the “No Turn on Red” sign that is currently placed at the intersection of Cascade Road and Thornapple River Dr for drivers traveling southwesterly on Thornapple River Drive. Through Traffic Safety Engineer Tim Haagsma, the Township has learned that this sign was installed at this intersection in response to a pedestrian/car accident at this intersection in 2014, as well as two other previous incidents. We appreciate the Road Commission’s attentiveness to pedestrian safety, but feel that the installation of the sign has caused other unintended consequences.

Since the installation of the sign, the Township has witnessed the following issues:

- Heavy traffic back-ups onto Thornapple River Drive, especially at peak traffic times.
- Increase in vehicles not adhering to the “No Turn on Red” at this intersection.
- Increase of traffic on Peace Street and Orange Court attempting to avoid intersection congestion.

Since the above referenced incident, the Township has taken proactive measures to improve visibility at this intersection, including the removal of overgrown landscaping that may have impaired drivers’ ability to see pedestrians at this intersection.

We appreciate Mr. Haagsma’s willingness to investigate the intersection and the moderate steps he has taken with light timing to help improve the situation, but we feel that there are other options that should be considered:

- A lighted “No Turn on Red” sign that is actuated whenever the pedestrian signal button is pushed.
- A modified “No Turn on Red Sign” to allow for red-turn movements during peak congestion times.
- A modified “No Turn on Red Sign” to read “No Turn on Red When Pedestrian are Present”

These are solutions that we have seen in various contexts in other Kent County areas and think they should be fully explored as an option at this intersection. The Township would be willing to participate in any improvements that may be cost prohibitive for the Road Commission to undertake on its own.

The Township Board truly appreciates our partnership with the Kent County Road Commission and your willingness to take our request into consideration. Should you have any questions or need further clarification, inquiries can be directed to Township Manager Ben Swayze at 616-949-1500 or bswayze@cascadetwp.com.

On behalf of the Township Board,

Cascade Charter Township
Rob Beahan, Supervisor



March 31, 2017



T4 P1 Y 529 *****AUTO**ALL FOR AADC 493
 Cascade Township
 2865 Thornhills Ave. SE
 Grand Rapids, MI 49546-7195

Dear Franchise Official:

Charter Communications ("Charter") is making changes to our channel lineup for customers in Cascade Township. Effective on or after May 2, 2017 the following networks will move to a new channel position in Charter Basic Service:

- QVC on Basic channel 9 will relocate to channel 137.
- Home Shopping Network on Basic channel 6 will relocate to channel 155.
- Evine LIVE on Basic channel 19 will relocate to channel 121.
- Jewelry Television on Basic channel 78 will relocate to channel 162.

As always, please feel free to contact me by phone at (616) 607-2377 should you have any questions on this matter.

Sincerely,

Marilyn Passmore
 Director, State Government Affairs, Michigan
 Charter Communications



March 13, 2017



T4 P1 570 *****AUTO**ALL FOR AADC 493
Cascade Township
2865 Thornhills Ave. SE
Grand Rapids, MI 49546-7195

Dear Franchise Official:

Charter Communications ("Charter") is making changes to our channel lineup for customers in Cascade Township.

Charter has been notified that the following networks will soon cease their video operation. As a result, on or after April 25, 2017 the following channels will no longer be available:

- Chiller on channel 125
- Esquire Network on channel 67 & 756 (HD)

As always, please feel free to contact me by phone at (616) 607-2377 should you have any questions on this matter.

Sincerely,

A handwritten signature in blue ink that reads "Marilyn Passmore".

Marilyn Passmore
Director, State Government Affairs, Michigan
Charter Communications



REGIONAL GEOGRAPHIC INFORMATION SYSTEM AGENCY

AN AGENCY OF THE GRAND VALLEY METROPOLITAN COUNCIL

ADA TOWNSHIP • ALPINE TOWNSHIP • BYRON TOWNSHIP • CANNON TOWNSHIP • CASCADE CHARTER TOWNSHIP • CITY OF CEDAR SPRINGS • CITY OF EAST GRAND RAPIDS • GAINES CHARTER TOWNSHIP • GRAND RAPIDS CHARTER TOWNSHIP • CITY OF GRANDVILLE • CITY OF HUDSONVILLE • INTERURBAN TRANSIT PARTNERSHIP • CITY OF LOWELL • KENT COUNTY ROAD COMMISSION • CITY OF KENTWOOD • PLAINFIELD CHARTER TOWNSHIP • CITY OF ROCKFORD • VILLAGE OF SPARTA • CITY OF WALKER • CITY OF WYOMING

Date: 3/3/2017

Cascade Township Board
2865 Thornhills Ave. SE
Grand Rapids, MI 49546

Dear Cascade Township Board,

In the spring of 2015, a reorganization of Grand Valley Metro Council's (GVMC) Regional Geographic Information System Agency (REGIS) took place. A full evaluation of REGIS operations resulted from this reorganization. All components of REGIS were reviewed: staffing, hardware, and software. REGIS also formed an Advisory Committee with the goal of increasing member participation and involvement in steering REGIS into the future. This new advisory committee was very involved with both major hardware and software update projects that resulted from the review.

In 2015, the most extensive program and equipment update in the history of REGIS was completed at the REGIS Data Center. Through the use of cutting edge software to create virtual servers, outdated equipment was replaced, thereby reducing the amount of servers in the room. This resulted in a 70% reduction in energy consumption, and a 34% reduction in hardware maintenance costs. Most importantly, no unscheduled system downtime has occurred since the project was completed in the fall of 2015. User feedback on system speed has been very positive.

With a stable system in place, REGIS then moved on to evaluating and upgrading its current database environment. A preliminary study found that REGIS would achieve \$170,000 in savings over a 6-year period by completing a migration from Oracle to Microsoft SQL Server (SQL). The new SQL database would also be easier to manage and would facilitate cooperation with other GIS organizations throughout West Michigan.

REGIS has implemented the migration and now has a system that is stable and functions at optimal levels. More importantly, this full system upgrade has REGIS well-positioned for future. IMAGIN, a state-wide GIS professional development organization, featured a full account of the system upgrade in their newsletter. The article is enclosed.

The results of the reorganization have produced a surplus in the REGIS budget for the first time in several years. Because of this surplus, I am pleased to enclose a REGIS rebate check for \$5,497.43. The rebate was recommended by both the REGIS Executive committee and REGIS Board of Directors and approved by the GVMC Board on Thursday March 2, 2017.

We thank you for your continued support for all GVMC programs.

Sincerely,

A handwritten signature in blue ink, appearing to read "John Weiss", is written over a blue horizontal line.

John Weiss
Executive Director
Grand Valley Metro Council

IMAGIN PRESENTS:

SPECIAL POINTS OF INTEREST:

IMAGIN's 2017 Annual Conference will be held June 4-6, in beautiful downtown Traverse City!

Call for Presentations! Submit your abstracts for our 2017 Annual Conference online at www.imagin.org/Call_for_Presentations/

IMAGIN Social Meet-Ups are happening in your area! Read more about IMAGIN Social Meet-Ups in our next issue.

INSIDE THIS ISSUE:

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IMAGINews

AUTUMN 2016



Grand Valley Metropolitan Council



GVMC

Allegan, Barry, Benzie, Branch, Montcalm, and Ottawa Counties

With any GIS program, having proper Information Technology (IT) infrastructure is crucial to a successful GIS system. However, the field of IT is in a constant state of flux due to its ever-changing technology. Year after year, one of the most difficult challenges that GIS and IT managers face is to keep abreast of the litany of latest patches, system upgrades, software releases, and hardware enhancements. Yet, all of this must be done in order to keep operations running efficiently and effectively, all while keeping

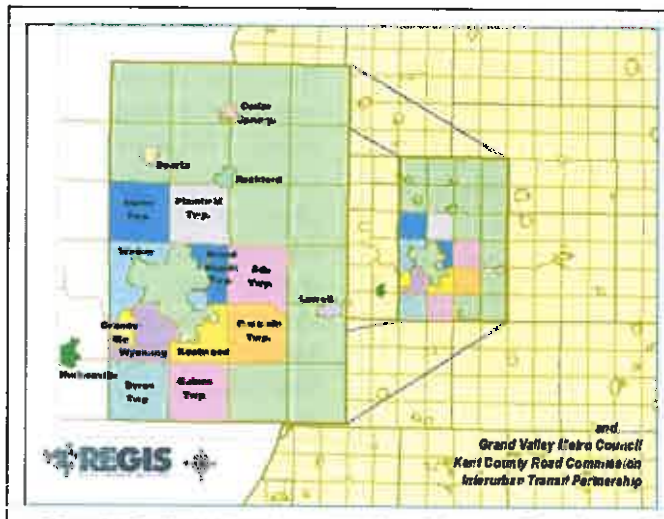
costs down to a minimum. Grand Valley Metro Council's Regional Geographic Information System (REGIS) recently took the opportunity to do just that by hiring an IT management firm out of Grand Rapids, MI called Trivalent Group to run a complete audit of the REGIS Data Center. The Data Center is located offsite at a REGIS Member community facility within the City of Wyoming.

REGIS is truly a collaborative effort owned and guided by 19 participating government entities to have one shared

GIS department. Since its reorganization in the spring of 2015, REGIS has emerged as a leader in the GIS community in West Michigan by encouraging partnerships in the region; one example is the creation of a West Michigan GIS Users Group (WM GIS Group). The WM GIS Group meets on a biannual basis and discusses emerging GIS topics.

This article outlines the REGIS Data Center audit process and follows the steps that management took to bring the REGIS Data Center in line with IT industry standards, reduce operational costs, and improve system efficiency.

Before undertaking what would be the largest single system-wide upgrade in REGIS history, management needed to form a project team and establish a set of project goals. The project team consisted of numerous individuals from REGIS staff, Trivalent, and REGIS Advisory Committee



(Continued on page 2)

"The REGIS Data Center went from 3 racks of servers to just one rack, which reduced the energy cost by 70% from Jan 2015 to Jan 2016."

GVMC-REGIS

stakeholders. REGIS staff members were closely involved with the planning and coordination of this project and were instrumental in the success of the project. They include:

- Jing Han, REGIS System Administrator/ Programmer
- Greg Carlino, GIS Analyst
- Margaret Chappetta, GIS Technician
- Jason Moore, GIS Manager

Jing and Jason were responsible for the project management, and Greg and Margaret assisted with hardware and software testing as phases of the project were completed.

The Major goals of the project were:

- 1) Establish a system for REGIS membership that is stable, secure, and easily

- 2) Replace all equipment that was end of life and no longer covered under factory warranties
- 3) Ensure all infrastructure was functioning at optimal levels
- 4) Reduce the amount of hardware thereby reducing energy demand and hardware maintenance expenses.

The project team then setup 5 phases and gave regular project updates to all interested Grand Valley Metro County boards and committees. This article will touch on phases 1 & 3:

Phase I: Core Server environment and infrastructure upgrades

The first phase of the project began Labor Day weekend of 2015 and was completed by the first week in October of 2015. Phase I was the most involved of all the project phases. The REGIS Data Center had over 20 physical servers in the room creating heat and drawing power. There was also an aging data storage system and old tape backup library that was 'end of life', meaning that the tape backup library could no



Hardware removed from server room.



longer be covered by factory warranty or a third party warranty, even replacement parts were difficult to locate due to the age.

Audit recommendations called for REGIS to remove the physical servers and "virtualize" servers that were still needed in the production environment. This was accomplished by purchasing VM Ware which allows a data center to have server hosts that hold images of servers that were once physical servers and give them the capability to create new servers when needed. The pictures shown here tell the story of how much hardware was removed from the room.

The REGIS Data Center went from 3 racks of servers to just one rack, which reduced the energy cost by 70% from Jan 2015 to Jan 2016. A 2nd AC unit was also shut down allowing for more savings.



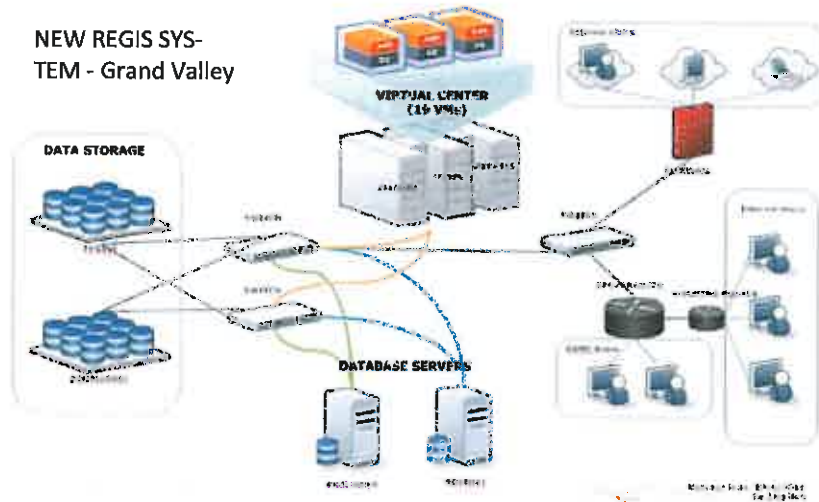
GVMC-REGIS

Since the amount of physical hardware in the room was reduced, hardware maintenance costs were slashed by 35%. The old NetApp storage area network (SAN) system and storage tape library was replaced by a new SAN manufactured by Tegile, and also utilized an existing Dell EqualLogic SAN to allow for more centralized efficient data storage and backups. In addition, REGIS is now backing up data off-site rather than dealing with storing tapes. Most importantly, REGIS now has a stable data center and enterprise GIS system for all of its users. Since the upgrade project completed in October of 2015, there has been no unplanned system down time.

Phase 3: Migrate the GIS backend database from Oracle to Microsoft SQL Server

This new virtualized environment also allowed REGIS to start a GIS backend database migration from Oracle to Microsoft SQL server which will save about \$170,000 over the next 5 years. REGIS was one of the few GIS organizations in West Michigan using Oracle for the backend GIS database. Using VMWare, a virtual database

NEW REGIS SYSTEM - Grand Valley



server was spun up in less than a week and was ready for the migration project to begin in June of 2016.

REGIS then contracted with Infogeographics of Traverse City, MI to work with the REGIS Team mentioned above in accomplishing this migration, and will be wrapping up the project in October of 2016.

Approximately 240 vector and raster data layers (comprising over 2 terabytes of data) have been migrated to various data editing and publishing databases for use by REGIS members as well as other interests throughout the region.

With technology constantly advancing, it is crucial to keep hardware and software current. The server room

overhaul, along with the database migration, will ensure the REGIS system functions dependably and effectively for all users. By reducing the amount of hardware and moving to a new database management system, REGIS will save on energy cost and maintenance fees. More importantly, this upgrade has REGIS well-positioned for future endeavors and system expansion.

For more information, contact Jason Moore, GIS Manager, REGIS, an Agency of the Grand Valley Metro Council, (616)776-7732, moorej@gvmc.org

MEMBERSHIP RENEWAL

Annual Dues

2016 Memberships expire on December 31st, and **2017 membership renewals are due January 1, 2017.** Current members should have received an electronic invoice the first week of October and paper invoices will be mailed the first week of November. If you have any questions or need to make changes to your membership, feel free to contact the business office at 517-338-3035 x 709 or info@imagin.org.

State of Michigan Parcel Repository

“...authoritative data related to properties in Michigan is created and maintained by counties, cities, townships, and villages throughout the State.”

Screenshot of the AGOL parcel viewer

The State of Michigan, Department of Technology, Management, & Budget (DTMB), Center for Shared Solutions (CSS) has undertaken a project that will enable the creation of a statewide parcel layer.

As we all know, authoritative data related to properties in Michigan is created and maintained by counties, cities, townships and villages throughout the state. A statewide parcel repository is an opportunity to bring together data that will enable authoritative analysis and accurate reporting of information at a geographic scope that is currently impossible to produce.

Currently known as the Community Parcel Repository, the parcels are stored on secure servers at the State of Michigan. One copy is stored in an SDE (ESRI's Spatial Database

Engine) environment and is accessible by State employees. A second copy is stored in the CSS ArcGIS Online (AGO) server portal and is accessible by staff from communities who have voluntarily contributed data to the repository.

Initial discussions for a statewide parcel repository began in 2015 between CSS and Matt Woolford, Equalization Director for Kent and Montcalm counties, and at that time, President of the Michigan Association of Equalization Directors (MAED).

Use cases for local data users and state agencies were established and it was decided to move forward with a pilot. Kent, Muskegon, and Ottawa counties volunteered and were instrumental in helping setup the initial repository.

A data schema was

established with the attributes necessary to meet the goals of the project. David Kirwin from BS&A software worked with CSS and pilot county staff to develop a CAMA data export routine.

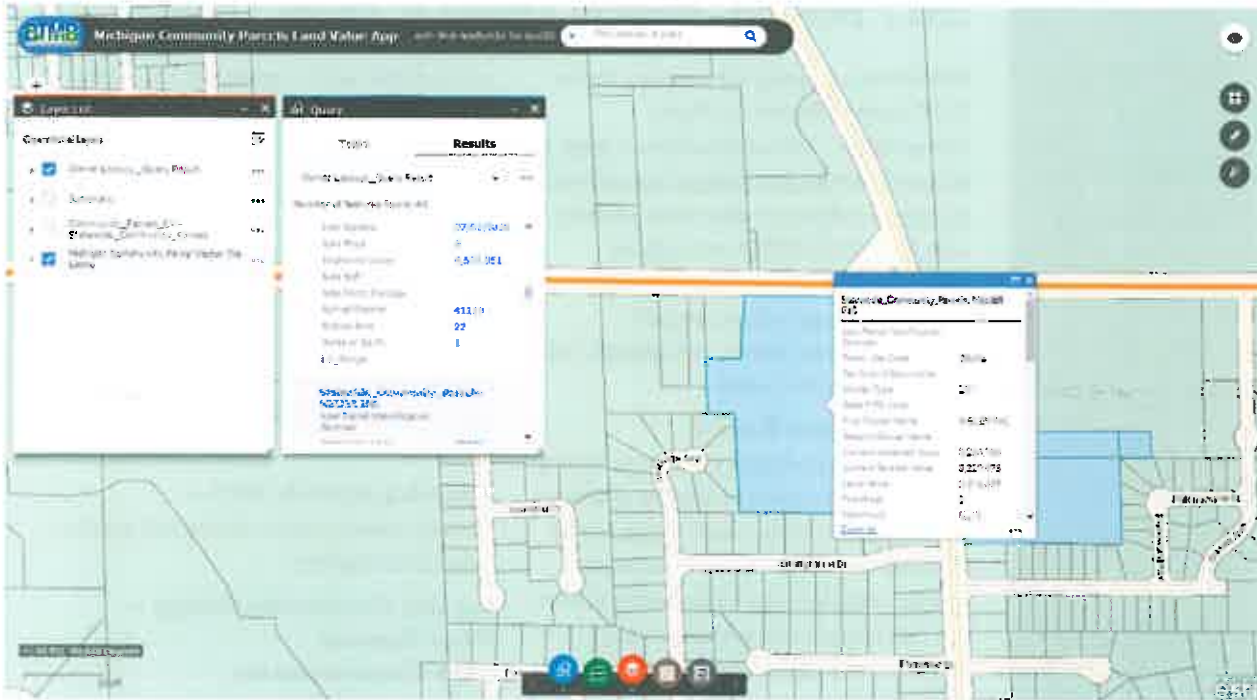
ESRI was engaged and provided technical support with map templates and server settings for the large volume of data to be hosted.

With the completion of the upload of the data from the 3 pilot counties to CSS, an aggregation routine was run resulting in a single parcel layer. Server settings were refined and a vector tile cache was created for use at larger viewing scales. Evaluation and testing was completed and the repository was ready for expansion.

Participation is voluntary and to date, 9 counties have joined creating a parcel layer with over 750,000 records. Partners can now query the entire dataset and analyze property values and property information well beyond their boundaries. For example, a query of 'owner' = 'Meijer Inc.' returns 40 results available for analysis. Values for fields such as; Assessed Value, Taxable Value, Land Value, FrontFoot, PriceSqFt, etc. can be statistically analyzed, mapped, and provide a user with a much larger data sample than might be available from their own County or Municipality parcel dataset.



State of Michigan Parcel Repository



Also available within the repository are web maps and web apps developed by CSS staff displaying local parcels with specific symbolization for 'land value' or 'improved structures'.

State of Michigan authoritative layers of geography have been combined with parcels for viewing as well. Prototype apps have been created displaying parcels with roads symbolized by PASER (Pavement Surface Evaluation and Rating) rating, local parcels with DNR owned parcels, and school buildings displayed with local parcels.



Of interest within the school building application is a widget that can create a selected set of parcels that are within a specified distance (for example 1000') of the school parcel boundary. The selected set can then be exported for further review and analysis.

As described, State of Michigan staff with ArcGIS desktop will have access to a separate secure copy of the parcels stored in SDE. After completing an acceptable use agreement, employees will be able to bring local parcels into their ArcMap projects.

Examples of use cases that have come out of meetings with state agencies include: boundary verification of school districts, voter precincts, city or village boundaries; tracking of homestead and non-homestead properties across the State; land sale comparisons across adjoining counties; economic development and the marketing of available properties;

Communities that have partnered with the parcel project to date

Screenshot showing an example of an Ownership search

emergency management for incidents that cross multiple jurisdictions; management of hazardous sites; property analysis for road projects; relationship of State owned and managed lands to adjacent property owners; as well as many others.

It's been a long process and there is much work yet to do. Additional counties have expressed interest in partnering and we expect to experience growth at a steady rate over the next year. It will take time, but the foundation is in place that may someday provide access to a statewide layer of parcels for Michigan.

Questions regarding the parcel repository may be directed to Everett Root, Center for Shared Solutions, 517-335-7180, root@micichigan.gov

Save the Date!
 April 6, 2017
**IMAGIN Student
 Poster and Paper
 Competition**

IMAGIN urges its membership to attend the competition. Mark your calendars now and see what the future of GIS looks like!

See our website for more information:
http://www.imagin.org/sppc_2017

2017 IMAGIN Student Poster & Paper Competition

IMAGIN is accepting submissions for its 2017 Student Poster and Paper Competition. This competition is open to all enrolled Michigan college and university students studying or otherwise working with GIS, GNSS (GPS), and related technologies. This competition gives students the opportunity to gain professional experience, recognition, cash awards, and other prizes.

Undergraduate Posters

Undergraduates submit posters to be in a competition designed to display, promote, and critique students work against other students work from around the state. Posters must be based upon original work and completed as an undergraduate. Submittal of projects done for class is encouraged.

Graduate Papers (Must Present in Person)

Graduates present their research to a panel of judges for critique and feedback. Graduates compete for scholarships and

other prizes against graduates from around the state.

Prizes:

Poster Competition—\$1000 purse available for poster winners

Paper Competition—\$1000 scholarship and IMAGIN conference presentation slots available

Friday, March 31, 2017—Graduate papers and under-graduate digital posters are due.

Thursday, April 6, 2017—Undergraduate poster display and graduate paper presentation:

**Lansing Community College –
 West Campus
 5708 Cornerstone Dr.
 Lansing, MI 48917**

Graduate papers must be presented at the competition. Posters may be submitted digitally and students are encouraged but not required to be present at the competition.

Upcoming Events



- November 16, 2016—GIS Day! Check www.gisday.com for an event near you.

- November 18, 2016—IMAGIN Board of Directors Meeting (teleconference)
- December 9, 2016—IMAGIN Board of Directors Meeting (teleconference)
- January 13, 2017—IMAGIN Board of Directors Meeting (teleconference)

- January 27, 2017—UP GIS Users Group (Web Meeting)
- June 4-6, 2017—IMAGIN Annual Education Conference, Hagerty Center, Traverse City, MI

Have an upcoming GIS related event you want to advertise? Send the date, time, and place to communication@imagin.org

IMAGIN Conference 2017, June 4-6, Traverse City



Hagerty Center

The IMAGIN Conference team was well into planning the 2017 annual conference, when a planned construction project at the Park Place Hotel in Traverse City was unexpectedly moved from 2018 to 2017, essentially demolishing the space for the general session. Through the efforts of the Park Place Hotel and with a conference team excited to embrace change, the 2017 conference general session and breakouts will be held at the Hagerty Center, with sleeping rooms remaining at the Park Place Hotel.

Having the host hotel physically separated from conference facilities will be a new experience for IMAGIN but one with opportunities never before experienced. Keep an eye on the IMAGIN website for all conference details. Want more information on the Hagerty Center?

Visit their website at

www.nima.edu/resources/hagerty-center

See you June 4 -6, 2017 in Traverse City!

Park Place Hotel



Call for Presentations!

Submit your abstract for our 2017 Conference online here:
www.imagin.org/Call_for_Presentations/

Suggested Topics include:
 Assessing & GIS
 Data & Database Management
 Drones/UAV in GIS
 Geospatial Data
 LIDAR

Local Government GIS Management
 Mobile & Web GIS
 Natural Resources GIS
 Open Source GIS
 Public Safety
 Surveying
 Transportation GIS
 Utilities/Asset Management



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**Improving Michigan's Access to
Geographic Information Networks**

Thomas VanBruggen, IMAGIN President & Coeditor
**Sarah Merz, IMAGIN Vice President, Communications
Team Lead, and Coeditor**
Lori Schultz, Coeditor
Michael Woods, Coeditor
Maryellen Jansen, Coeditor
Brodey Hill, Coeditor
Andrew Giguere, Coeditor

AUTUMN 2016

IMAGIN is a non-profit professional development organization committed to providing opportunities for its members to network with professionals who are using, creating, or maintaining spatial resources within Michigan. IMAGIN serves as a crossroads for spatial information users/developers at all levels of government, business, and non-profit organizations by providing its members partnership opportunities to recognize, share, and create spatial data resources for both traditional and new applications.

IMAGINews publishes original, timely, and innovative articles and news items that advance knowledge regarding GIS, related technologies, and their use within Michigan. IMAGINews welcomes submissions from IMAGIN members and others. Please send article submissions in Microsoft Word format to communication@imagin.org.

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Cascade Charter Township
Education Reimbursement Request

Conditions for Reimbursement:

- Individual courses or courses that are part of a degree, licensing or certification program must be related to the employee’s current job duties or a foreseeable – future position in the organization in order to be eligible for educational assistance.
- Cascade Charter Township will reimburse employees for approved registration and tuition for work related courses taken through college or schools accredited by regional accreditation associations.
- Some electives that an employee may be required to complete for a degree may be unrelated to their particular job or government in general, and are therefore not cover by this assistance policy.

This form must be completed by the employee and approved by the Township Board before the course is taken in order to qualify for reimbursement.

Name: JEFFERY KNOWLES

Application Date: 3-22-17

Name of Educational Institution: COUNTRIA SOUTHERN UNIVERSITY

Name of Proposed Course:
LEGAL ASPECTS OF SAFETY AND HEALTH (BOS3525)

Cost of Tuition: \$660

Your Signature: [Signature]

Account #: _____

Approvals:
Department Head: [Signature] Date: 3-22-17

Township Manager: [Signature] Date: 3-22-17

Clerk’s Signature: _____ Date: _____
(Showing Township Board approval)

Original to personnel file
1 copy to applicant
1 copy to Accounting



CASCADE CHARTER TOWNSHIP

Cascade Downtown Development Authority

2016 Annual Report

Municipality Name Authority type (DDA/LDFA/TIFA/CIA, etc.)	TIF Plan #	For CY taxes
	1	FY2016

Annual Report on Status of Tax Increment Financing Plan

A Revenue:

Tax Increment Revenues February FY2016	\$ 280,305
Tax Increment Revenues September FY2016	\$ 320,831
Property taxes - from DDA levy	\$ -
Interest	\$ 6,321
Other income	\$ 35,436
Total	\$ 642,893

B Bond Reserve

\$ -

C Expenditures

Community Development	\$ 285,011
28th St Sidewalk (project #1)	\$ 27,386
Village Road Projects (project #2)	\$ 38,645
Museum Gardens (project #3)	\$ 68,457
Lease	\$ -
Debt Service - Bond 1	
Principal	\$ 91,000
Interest	\$ 16,711
Bond Fees	\$ -
Debt Service - Bond 2	
Principal	\$ -
Interest	\$ -
Bond Fees	\$ -
Debt Service	
Principal	\$ -
Interest	\$ -
Bond Fees	\$ -
Total	\$ 578,076

(use data from your TIF plan)

D Outstanding bonded indebtedness

Principal	\$ 394,000
Interest	\$ 34,560
Total	\$ 428,560

The yellow box is for local unit use—it is not required

E CAPTURED VALUES

	E ₁ Current Taxable Value	E ₂ Initial (base year) Assessed Value	F (E ₁ - E ₂) Captured Value	Overall Tax rates captured by TIF plan TIF Revenue
Ad valorem PRE Real	\$ 159,952,305	\$ 108,951,112	\$ 49,601,882	0.0000000 \$0.00
Ad valorem non-PRE Real	\$ -	\$ -	\$ -	0.0000000 \$0.00
Ad valorem Industrial personal	\$ -	\$ -	\$ -	0.0000000 \$0.00
Ad valorem commercial personal	\$ -	\$ -	\$ -	0.0000000 \$0.00
Ad valorem utility personal	\$ -	\$ -	\$ -	0.0000000 \$0.00
Ad valorem other personal	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility real property, 0% SET exemption	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility real property, 50% SET exemption	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility real property, 100% SET exemption	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility personal property on industrial class land	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility personal property on commercial class land	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT New Facility personal property, all other	\$ -	\$ -	\$ -	0.0000000 \$0.00
CFT New Facility	\$ -	\$ -	\$ -	0.0000000 \$0.00
IFT Replacement Facility (frozen values)	\$ -	\$ -	\$ -	0.0000000 \$0.00
CFT Restored Facility (frozen values)	\$ -	\$ -	\$ -	0.0000000 \$0.00
Total			\$ 49,601,882	\$0.00 Total TIF Revenue

G Tax Increment Revenues Received

(there may be a timing difference from item A revenue)

From local school districts—operating	\$ -
From local school districts—debt	\$ -
From intermediate school districts	\$ -
From State Education Tax (SET)	\$ -
From state share of IFT and other specific taxes**	\$ -
From counties	\$ 280,280
From municipalities (city, twp, village)	\$ 165,188
From libraries (if levied separately)	\$ 59,993
From community colleges	\$ 93,281
From special or regional authorities (fire, park, EMS, etc.)	\$ -
Total	\$ 604,728

These lines should show who would have received the revenue if it had not gone to the authority, regardless of whether the property was subject to ad valorem or specific taxes. See "Normal form of K-12 taxes" worksheet to help measure this.

Note: Amounts in Section G should include both ad valorem and specific (IFT, CFT, etc.) taxes. Do not put PA 166 and PA 256 taxes on a separate line; include specific taxes captured on the lines describing the jurisdictions from which they were captured.

** This is the school operating mills and SET mills used to calculate the IFT and other specific taxes

H Number of Jobs Created

Unknown

I Additional Information

J Corridor Improvement Authorities only:

Type and cost of capital improvements in development area

\$ -
\$ -
\$ -

	Current Taxable Value	Initial (base year) Assessed Value	Captured Value	Tax Rate	Tax Revenue	Base Revenue to taxing jurisdictions	TIF Revenue to TIF district (if > 0)
Ad valorem PRE Real	159,652,995	109,961,113	49,691,882	0.0000	\$0.00	\$0.00	\$0.00
Ad valorem non-PRE Real	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
Ad valorem non-PRE personal industrial	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
Ad valorem non-PRE personal commercial	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
Ad valorem utility personal	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
Ad valorem other personal	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) real property, 0% SET exemption	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) real property, 50% SET exemption	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) real property, 100% SET exemption	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) personal on industrial class land	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) personal on commercial class land	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT New (post 1993) personal, all other	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
CFT New	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
IFT Replacement (frozen values)	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
CFT Restored (frozen values)	0	0	0	0.0000	\$0.00	\$0.00	\$0.00
Total	159,652,995	109,961,113	49,691,882		\$0.00	\$0.00	\$0.00

If Total Base Revenue exceeds Total Tax Revenue, taxing jurisdictions get all tax revenue, but TIF plan does not have to make up "negative capture". There is simply no TIF revenue.

Cascade Charter Township
DDA District

	Base DDA Value	2015 Taxable Value	2015 Caputure Value	Cascade Tax Collections	Mills	Village Collections	Interchange Area	Centennial Park	Total
Village	36,500,800	75,344,314	38,843,514	Grand Rapids Community College	-	-	-	-	-
Interchange Area	50,275,739	58,301,952	8,026,213	Kent County Operating	4.2803	-	-	Opt Out	-
Centennial Park	23,184,574	19,768,824	(3,415,750)	Kent County Jail	0.7893	30,659.19	6,335.09	Opt Out	36,994.28
				Kent County Senior	0.5000	19,421.76	4,013.11	Opt Out	23,434.86
				Kent County Veterans	0.0500	1,942.18	401.31	Opt Out	2,343.49
				Kent County Zoo/Museum	-	-	-	Opt Out	-
				Kent District Library	1.2800	49,719.70	10,273.55	-	59,993.25
				Cascade Charter Township Operating	0.9716	37,740.36	7,798.27	-	45,538.63
				Fire	1.3152	51,086.99	10,556.08	-	61,643.06
				Police	0.4591	17,833.06	3,684.83	-	21,517.89
				Library	0.1500	5,826.53	1,203.93	-	7,030.46
				Pathway	0.3985	15,479.14	3,198.45	-	18,677.59
				Open Space	0.2300	8,934.01	1,846.03	-	10,780.04
						238,642.90	49,310.64	0	287,953.54
								Refunds	1,195.18
									2863.55
									283,894.81

	Base DDA Value	2016 Taxable Value	2016 Capature Value	Cascade Tax Collections	Mills	Village Collections	Interchange Area	Centennial Park	Total
Village	36,500,800	78,492,375	41,991,575	Grand Rapids Community College	1.7865	75,017.95	19,457.79	-	94,475.74
Interchange Area	50,275,739	61,167,309	10,891,570	Kent County Operating	4.2803	179,736.54	46,619.19	Opt Out	226,355.73
Centennial Park	23,184,574	19,993,311	(3,491,263)	Kent County Jail	0.7893	-	-	Opt Out	-
				Kent County Senior	0.5000	-	-	Opt Out	-
				Kent County Veterans	0.0500	-	-	Opt Out	-
				Kent County Zoo/Museum	-	-	-	Opt Out	-
				Kent District Library	1.2800	-	-	-	-
				Cascade Charter Township Operating	0.9716	-	-	-	-
				Fire	1.3152	-	-	-	-
				Police	0.4591	-	-	-	-
				Library	0.1500	-	-	-	-
				Pathway	0.3985	-	-	-	-
				Open Space	0.2300	-	-	-	-
						254,754.49	66,076.98	0	320,831.46

TREASURER'S DEPARTMENT

CASCADE CHARTER TOWNSHIP

TAX ACCOUNTS

JANUARY 2017

BANK BALANCES

BANK AMOUNT

CHEMICAL BANK

TAX CHECKING \$1,605,512.75

CHEMICAL BANK

DELINQUENT TAX \$2,898.75

CHEMICAL BANK

TAX WIRE ACCT \$0.37

GRAND TOTAL \$1,608,411.87

Oxana Sourine 3/22/2017

Submitted by
OXANA SOURINE
DEPUTY TREASURER

Date

TOWNSHIP BALANCES

REGISTER AMOUNT

CHEMICAL BANK

TAX CHECKING \$1,605,512.75

CHEMICAL BANK

DELINQUENT TAX \$2,898.75

CHEMICAL BANK

TAX WIRE ACCT \$0.37

GRAND TOTAL \$1,608,411.87

Kenneth B. Peirce 3/22/2017

Reviewed by
KENNETH B. PEIRCE
TREASURER

Date

CASCADE CHARTER TOWNSHIP
 TREASURER'S OFFICE REPORT
 January 2016

FUND	INSTITUTION	DEMAND DEPOSIT		CDs			SECURITIES			TOTALS	
		\$	%	\$	%	DATE	\$	%	DATE	\$	%
101 GENERAL FUND	CHEMICAL	1,362,386.27	0.05								
	KENT CTY POOL	3,974,772.82	0.82								
	INDEPENDENT			312,032.12	1.20	9/27/2019					
	MERCANTILE			510,599.72	0.90	7/20/2018					
	FLAGSTAR			261,087.90	1.00	5/22/2018					
	HUNTINGTON			514,670.13	0.91	9/13/2017					
	TALMER BANK			500,000.00	1.00	6/16/2017					
	CONSUMERS CU			255,959.76	0.80	7/8/2019					
	MACATAWA			256,761.60	1.20	11/21/2018					
	FLAGSTAR			505,780.89	1.00	9/12/2018					
	COMERICA SECUR./JPM						500,000.00	1.10	8/16/2018		
	COMERICA SECUR./WFF						500,000.00	1.00	9/25/2017		
	TOTAL GENERAL FUND		5,337,158.89	0.62	3,116,892.12	0.99		1,000,000.00	1.05		9,454,051.01
151 CEMETERY	LMCU	97,394.30	0.40	-						97,394.30	0.40
206 FIRE FUND	CHEMICAL	1,116,356.67	0.05								
	LMCU	712,933.42	0.50								
	LMCU			536,265.51	1.40	10/25/2017					
	COM CHOICE CU			250,000.00	1.27	3/18/2017					
	FNBA			531,427.61	1.50	7/24/2018					
	HUNTINGTON			259,925.13	0.55	11/17/2017					
	ADVENTURE CU			250,005.00	0.75	3/24/2017					
TOTAL FIRE FUND		1,829,290.09	0.23	1,827,623.25	1.20		-			3,656,913.34	0.71
207 POLICE FUND	FLAGSTAR	816,453.99	0.50								
	NORTHPOINTE BANK			257,566.39	1.30	10/8/2018					
	PRIVATE BANK			750,000.00	1.15	9/25/2017					
TOTAL POLICE FUND		816,453.99	0.50	1,007,566.39	1.19		-			1,824,020.38	0.88
208 HAZMAT FUND	LMCU	36,258.87	0.35							36,258.87	0.35
209 OPEN SPACE	CHEMICAL	67,785.71	0.05								
	LMCU (HOMEYER)	354,788.72	0.50								
	FLAGSTAR			300,000.00	0.50	4/12/2017					
	CWCU			200,000.00	0.90	10/15/2018					
TOTAL OPEN SPACE		422,574.43	0.43	500,000.00	0.66					922,574.43	0.55
211 DAM REPAIR	LMCU	238,637.24	0.50								
	LMCU			311,935.86	1.30	3/10/2017					
TOTAL DAM REPAIR		238,637.24	0.50	311,935.86	1.30		-	-		550,573.10	0.95
216 PATHWAY FUND	MACATAWA	248,840.08	0.25								
	PRIVATE BANK			500,000.00	0.80	10/17/2017					
	ADVENTURE CU			524,327.53	1.10	10/8/2018					
TOTAL PATHWAY FUND		248,840.08	0.25	1,024,327.53	0.95		-			1,273,167.61	0.82
246 PUBLIC UTILITY	CHEMICAL BANK	155,989.02	0.05								
	IRF	1,013,093.22	0.50								
	TALMER			500,000.00	0.95	6/29/2018					
TOTAL PUBLIC UTILITY		1,169,082.24	0.44	500,000.00	0.95		-	-		1,669,082.24	0.59
248 DDA FUND	LMCU	17,225.06	0.30								
	CHEMICAL BANK	280,811.46	0.10								
	ADVENTURE CU			200,005.00	0.75	3/24/2017					
TOTAL DDA FUND		298,036.52	0.11	200,005.00	0.75		-	-		498,041.52	0.37
249 BLDG. INSPECTION	CHEMICAL BANK	396,265.20	0.05								
	CHEMICAL BANK R.	28,524.00									
	CONSUMERS CU			300,025.00	0.70	3/10/2017					
	TALMER BANK			400,000.00	0.75	4/28/2017					
	FNB OF AMERICA			100,879.52	1.40	12/18/2017					
	FNB OF AMERICA			208,934.50	1.60	9/18/2019					
	FNB OF MI			511,395.83	1.15	10/11/2018					
	FIRST COMMUNITY B.			250,000.00	1.00	5/27/2018					
	INDEPENDENT BANK			310,211.97	1.40	6/16/2019					
	CHEMICAL BANK										
TOTAL BLDG. INSPECT.		424,789.20	0.05	2,081,446.82	1.08					2,506,236.02	0.91
270 LIBRARY FUND	UNITED BANK	490,866.78	0.40								
	LMCU			832,967.83	1.30	3/20/2017					
	WMCB			254,471.21	0.85	6/1/2018					
	NORTHPOINTE BANK			533,905.65	1.30	4/7/2018					
TOTAL LIBRARY FUND		490,866.78	0.40	1,621,344.69	1.23		-			2,112,211.47	1.04
701 T & A	CHEMICAL BANK	117,800.31	0.05							117,800.31	0.05
701 JAMES TIMMONS	CHEMICAL BANK			12,400.00	1.60	3/21/2017				12,400.00	1.60
701 JACK SMITH INV.	CHEMICAL BANK	22,817.88	0.05							22,817.88	0.05
701 HENRY KRAMER	CHEMICAL BANK	15,176.73	0.05							15,176.73	0.05
TOTAL		11,565,177.55	0.46	12,203,541.66	1.07		1,000,000.00	1.05		24,768,719.21	0.79

Submitted by Oxana Sourine Deputy Treasurer

Date

Oxana Sourine 3.28.17

Reviewed by Ken Peirce Treasurer

Date

Ken Peirce 3/29/17

04/04/2017 CHECK DISBURSEMENT REPORT FOR CASCADE CHARTER TOWNSHIP
CHECK DATE FROM 03/01/2017 - 03/31/2017
MARCH 2017 PAYABLES, PAYROLL, AND TRANSFERS

Check Date	Bank	Check #	Invoice	Payee	Description	Account	Dept	Amount
FUND 101 - GENERAL FUND								
03/03/2017	GENS	65449*#	000616896964	MUTUAL OF OMAHA INSURANCE	DEPENDENT LIFE W/H GF MARCH	231-220	000	15.60
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	DEPENDENT LIFE W/H FIRE MARCH	231-220	000	23.40
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	DEPENDENT LIFE W/H BLDG MARCH	231-220	000	3.90
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	ADDITIONAL LIFE W/H GF MARCH	231-221	000	203.10
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	ADDITIONAL LIFE W/H FIRE MARCH	231-221	000	454.20
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	ADDITIONAL LIFE W/H BLDG MARCH	231-221	000	50.00
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	ADDITIONAL LIFE W/H VLIFE FIRE MARCH	231-221	000	30.00
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	ADDITIONAL LIFE W/HVLIFE E 2X GENERAL MA	231-221	000	11.00
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	SHORT TERM DISABILITY W/H GF MARCH BEATO	231-222	000	(16.51)
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	SHORT TERM DISABILITY W/H FIRE MARCH NOR	231-222	000	(30.50)
					CHECK GENS 65449 TOTAL FOR FUND 101:			744.19
03/09/2017	GENS	65480	REPLACE PR CHK 7833	FAZIO, SARA	REIMBURSEMENTS/FAZIO REPLACE PR CHK 7833	671-683	000	101.58
03/09/2017	GENS	65488	REFUND VANDERPLOEG	KENT COUNTY TREASURER - TAX	REFUNDS VANDERPLOEG PP# 411902104110	671-683	000	400.00
03/23/2017	GENS	65531*#	MCDONALD	FIRST BANKCARD	REIMBURSEMENTS/FLORAL SEE REC 201704354	671-683	000	98.57
					Total for department 000:			1,344.34
Department: 101 TOWNSHIP BOARD								
03/16/2017	GENS	65520*#	9781300743	VERIZON WIRELESS	TRUSTEE CELL PHONES TABLET	924-100	101	64.13
					Total for department 101:			64.13
Department: 171 SUPERVISOR/MANAGER								
03/03/2017	GENS	65434	MILG 2/8-2/24 & CELL	ROBERT S BEAHAN	SUP/MGR/DEPT MILEAGE BEAHAN 144 MILES	860-000	171	77.04
03/03/2017	GENS	65434	MILG 2/8-2/24 & CELL	ROBERT S BEAHAN	MANAGER CELL PHONE BEAHAN CELL ALLOWANCE	925-000	171	50.00
					CHECK GENS 65434 TOTAL FOR FUND 101:			127.04
03/03/2017	GENS	65444*#	SWAYZE 2017	FIRST BANKCARD	SUP/MGR MEMBERSHIPS AND DUES SWAYZE MML	723-000	171	110.00
03/03/2017	GENS	65444	7236025508417	FIRST BANKCARD	EDUCATION SWAYZE LODGING MME CONF	724-000	171	348.99
03/03/2017	GENS	65444	42242	FIRST BANKCARD	EDUCATION SWAYZE MML CONF	724-000	171	275.00
03/03/2017	GENS	65444	MME CONF 2/2	FIRST BANKCARD	EDUCATION SWAYZE MME CONF MEAL	724-000	171	23.56
03/03/2017	GENS	65444	419189	FIRST BANKCARD	EDUCATION SWAYZE CONF PARKING	724-000	171	36.00
03/03/2017	GENS	65444	MML CONF LUNCH	FIRST BANKCARD	EDUCATION SWAYZE MML CONF LUNCH MTG	724-000	171	7.30
03/03/2017	GENS	65444	00005087	FIRST BANKCARD	SUP/MGR/DEPT MILEAGE SWAYZE PARKING	860-000	171	10.00
03/03/2017	GENS	65444	MGRS LUNCH	FIRST BANKCARD	MANAGER EXP ACCT SWAYZE MGR LUNCH MTG	862-550	171	10.02
					CHECK GENS 65444 TOTAL FOR FUND 101:			820.87
03/03/2017	GENS	65458	MILG 2/8-2/22	SWAYZE, BENJAMIN	EDUCATION SWAYZE MME CONF 124 MILES	724-000	171	66.34
03/03/2017	GENS	65458	MILG 2/8-2/22	SWAYZE, BENJAMIN	SUP/MGR/DEPT MILEAGE SWAYZE 304 REG MIL	860-000	171	162.64
					CHECK GENS 65458 TOTAL FOR FUND 101:			228.98
03/16/2017	GENS	65517	CELL ALLOW FEB 2017	SLATER, SUE	MANAGER CELL PHONE SLATER CELL ALLOW FEB	925-000	171	50.00
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	MANAGERS CELL PHONE FEB	925-000	171	62.84
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	MANAGERS CELL PHONE TABLET	925-000	171	32.07
					CHECK GENS 65520 TOTAL FOR FUND 101:			94.91
03/23/2017	GENS	65531*#	A7/1	FIRST BANKCARD	MANAGER EXPENSE ACCT SWAYZE CDD MTG	862-550	171	33.03
03/23/2017	GENS	65531	2493929-RX	FIRST BANKCARD	MANAGER PUBLICATIONS BUSINESS JOURNAL	901-000	171	99.00
					CHECK GENS 65531 TOTAL FOR FUND 101:			132.03
03/30/2017	GENS	65560	ELEC EQUIP MTG	SLATER, SUE	SUP/MGR/DEPT MILEAGE MEAL SLATER ELECTIO	860-000	171	17.76
03/30/2017	GENS	65560	ELEC EQUIP MTG	SLATER, SUE	MANAGER CELL PHONE SLATER CELL ALLOW	925-000	171	50.00
					CHECK GENS 65560 TOTAL FOR FUND 101:			67.76
					Total for department 171:			1,521.59
Department: 215 CLERK								

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03/03/2017	GENS	65444*#	229693	FIRST BANKCARD	EDUCATION SLATER CONF MEAL	724-000	215	7.41
03/03/2017	GENS	65444	24	FIRST BANKCARD	ED SLATER CONF MEAL	724-000	215	10.14
03/03/2017	GENS	65444	24	FIRST BANKCARD	ED SLATER CONF MEAL CR	724-000	215	(0.41)
				CHECK GENS 65444 TOTAL FOR FUND 101:				17.14
03/09/2017	GENS	65471	MILG 2/23-3/06	DENISE M BIEGALLE	CLERK MILEAGE 136 MILES	860-000	215	72.76
03/16/2017	GENS	65520*#	9781300743	VERIZON WIRELESS	CLERK CELL PHONE TABLETS	925-000	215	32.07
03/30/2017	GENS	65555	20034	FIRST BANKCARD	EDUCATION SLATER ELECTIN MTG	724-000	215	24.14
				Total for department 215:				146.11
Department: 253 TREASURER								
03/03/2017	GENS	65444*#	QUICKBOOKS 2017	FIRST BANKCARD	TREASURER SERVICE CONTRACTS QUICKBOOKS	939-000	253	370.95
03/03/2017	GENS	65456	MILG 1/6-2/24	SOURINE, OXANA	TREASURER MILEAGE SOURINE 91 MILES	860-000	253	48.69
03/16/2017	GENS	65520*#	9781300743	VERIZON WIRELESS	TREASURER'S CELL PHONES TABLET	924-100	253	16.03
03/23/2017	GENS	65531*#	10000135287023CR	FIRST BANKCARD	TREASURER SERVICE CONTR CR INV QUICKBOOK	939-000	253	(21.00)
				Total for department 253:				414.67
Department: 257 ASSESSING								
03/03/2017	GENS	65435	2326011-R1	BUSINESS JOURNAL	ASSESSING MEMBERSHIPS AND DUES BUS JOURN	723-000	257	99.00
03/03/2017	GENS	65447	259060	KENT COMMUNICATIONS INC.	ASSESSING PRINTING AND PUBLIS ASSESSMENT	900-000	257	286.57
03/03/2017	GENS	65447	258735	KENT COMMUNICATIONS INC.	ASSESSING PRINTING AND PUBLISH ASSESSMEN	900-000	257	971.89
				CHECK GENS 65447 TOTAL FOR FUND 101:				1,258.46
03/16/2017	GENS	65510	49527	FALCON PRINTING INC	ASSESSING PRINTING & PUB GENTER BUS CARD	900-000	257	48.00
03/16/2017	GENS	65520*#	9781300743	VERIZON WIRELESS	CELL PHONES/DATA TABLET	924-100	257	16.03
03/23/2017	GENS	65535	IAAO FORUM 932	KENT COUNTY ASSESSOR'S ASSOC	EDUCATION GENTER IAAO FORUM 932	724-000	257	50.00
				Total for department 257:				1,471.49
Department: 265 BUILDING AND GROUNDS								
03/03/2017	GENS	65433	2016343	B & B TRUCK EQUIPMENT INC	BLDG & GRDS VEHICLE MAINT LOW BEAM BULB	863-000	265	66.30
03/03/2017	GENS	65440*#	50542339	COMCAST	COMPLEX PHONES	924-000	265	148.78
03/03/2017	GENS	65440	50542339	COMCAST	COMPLEX PHONES B&G	924-000	265	28.30
				CHECK GENS 65440 TOTAL FOR FUND 101:				177.08
03/03/2017	GENS	65444*#	R1326301305	FIRST BANKCARD	SMALL EQUIPMENT/FURNITURE IPAD CASE	981-000	265	104.94
03/03/2017	GENS	65444	MGQL2LLA	FIRST BANKCARD	SMALL EQUIPMENT/FURNITURE CREDIT ON R132	981-000	265	(5.94)
				CHECK GENS 65444 TOTAL FOR FUND 101:				99.00
03/03/2017	GENS	65451*#	68850685	PAETEC	COMPLEX PHONES B&G	924-000	265	52.65
03/03/2017	GENS	65451	68850685	PAETEC	COMPLEX PHONES ADMIN	924-000	265	133.17
				CHECK GENS 65451 TOTAL FOR FUND 101:				185.82
03/03/2017	GENS	65454*#	0240006501952	REPUBLIC SERVICES	COMPLEX MAINTENANCE RECYCLE MARCH	931-000	265	620.61
03/03/2017	GENS	65454	0240006501952	REPUBLIC SERVICES	COMPLEX MAINTENANCE B&G RECYCLE MARCH	931-000	265	76.46

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CHECK GENS 65454 TOTAL FOR FUND 101:								697.07
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100000285161 2865 THORNHILLS AVE FEB	921-000	265	2,115.65
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012762959 2990 BUTTRICK AVE SE FE	921-000	265	297.58
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012052419 6569 THORNBROOK ST SE	921-000	265	22.57
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	103019008525 2800 THORNAPPLE RIV DR	921-000	265	7.96
CHECK GENS 3856(A) TOTAL FOR FUND 101:								2,443.76
03/09/2017	GENS	3857(A)	27798	CENTRAL INTERCONNECT INC	PHONE REPAIR EDGE & MESSAGING	931-000	265	143.00
03/09/2017	GENS	65479*#	457268600022 2/2017	DTE ENERGY	COMPLEX HEATING FEB	923-000	265	960.91
03/09/2017	GENS	65479	457268600048 2/2017	DTE ENERGY	COMPLEX HEATING FEB	923-000	265	176.84
CHECK GENS 65479 TOTAL FOR FUND 101:								1,137.75
03/09/2017	GENS	65484*#	WS2059561 NV-FEB17	GRAND RAPIDS CITY TREASURER	COMPLEX WATER-SEWER B&G NOV-FEB	927-000	265	39.64
03/09/2017	GENS	65484	WS2059560 NV-MAR17	GRAND RAPIDS CITY TREASURER	COMPLEX WATER-SEWER B&G NOV-MAR FIRE PRO	927-000	265	16.71
CHECK GENS 65484 TOTAL FOR FUND 101:								56.35
03/16/2017	GENS	3865(A)*#	84941	ENVIRO-CLEAN	CLEANING TOWNSHIP HALL FEB	802-200	265	462.00
03/16/2017	GENS	3866(A)	345337	NAPA AUTO PARTS	BLDG & GRDS VEHICLE MAINTENANCE HALOGEN	863-000	265	63.98
03/16/2017	GENS	3866(A)	344631	NAPA AUTO PARTS	BLDG & GRDS VEHICLE MAINT SMALL TOOLS	863-000	265	40.86
03/16/2017	GENS	3866(A)	346983	NAPA AUTO PARTS	BLDG & GRDS VEHICLE MAINT CR INV 345337	863-000	265	(63.98)
CHECK GENS 3866(A) TOTAL FOR FUND 101:								40.86
03/16/2017	GENS	3868(A)*#	197492	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINTENANCE FILTERS	863-000	265	66.50
03/16/2017	GENS	3868(A)	197528	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINTENANCE TAPE	863-000	265	0.99
03/16/2017	GENS	3868(A)	197575	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT HEDGE BLADES	863-000	265	105.00
03/16/2017	GENS	3868(A)	197581	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT BLOWER FAN	863-000	265	53.99
03/16/2017	GENS	3868(A)	197596	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT FUSES	863-000	265	10.79
03/16/2017	GENS	3868(A)	197615	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT BOLTS & WASHER	863-000	265	2.59
03/16/2017	GENS	3868(A)	197621	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT SCREWS & WASHE	863-000	265	7.05
03/16/2017	GENS	3868(A)	197639	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT CLAMPS & KEYS	863-000	265	9.53
03/16/2017	GENS	3868(A)	197640	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT CHAIN SHARPEN	863-000	265	6.00
03/16/2017	GENS	3868(A)	197512	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT PUTTY	863-000	265	5.38
03/16/2017	GENS	3868(A)	1976252	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINTENANCE FORD KEY	863-000	265	4.04
03/16/2017	GENS	3868(A)	197489	KINGSLAND'S ACE HARDWARE	BLDG & GRDS VEHICLE MAINT CLEANING SUPPL	863-000	265	14.91
03/16/2017	GENS	3868(A)	197538	KINGSLAND'S ACE HARDWARE	COMPLEX MAINTENANCE 10W LED LINEAR	931-000	265	25.19
CHECK GENS 3868(A) TOTAL FOR FUND 101:								311.96
03/16/2017	GENS	3870(A)*#	48910755	WEX BANK	BLDG & GRDS VEHICLE FUEL FEB	864-000	265	630.51
03/16/2017	GENS	65501	2016341	B & B TRUCK EQUIPMENT INC	BLDG & GRDS VEHICLE MAINT AUTO PARTS	863-000	265	167.10
03/16/2017	GENS	65505*#	301-02736 FEB 2017	CINTAS CORP #301	2017 RUG CLEANING SERVICE COMPLEX/BLDG	931-000	265	199.56
03/16/2017	GENS	65505	301-02736 FEB 2017	CINTAS CORP #301	2017 RUG CLEANING SERVICE BLDG	931-000	265	130.08
CHECK GENS 65505 TOTAL FOR FUND 101:								329.64
03/16/2017	GENS	65518*#	24690	SUPERIOR PEST CONTROL INC	PEST CONTROL - TWP HALL FEB	931-000	265	16.00
03/16/2017	GENS	65518	24689	SUPERIOR PEST CONTROL INC	PEST CONTROL - B&G	931-000	265	16.00
CHECK GENS 65518 TOTAL FOR FUND 101:								32.00
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	BLDG AND GROUNDS CELL PHONES FEB	924-100	265	132.14
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	BLDG AND GROUNDS CELL PHONES TABLET	924-100	265	16.03
CHECK GENS 65520 TOTAL FOR FUND 101:								148.17
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- BUILDING	931-000	265	78.78
03/23/2017	GENS	3875(A)	201364	QUALITY AIR	MONTHLY MAINTENANCE- COMPLEX	931-000	265	157.54

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03/23/2017	GENS	3875(A)	201364	QUALITY AIR	MONTHLY MAINTENANCE- B&G	931-000	265	50.97
				CHECK GENS 3875(A) TOTAL FOR FUND 101:				287.29
03/23/2017	GENS	65528*#	51389354	COMCAST	COMPLEX PHONES MAR	924-000	265	148.78
03/23/2017	GENS	65528	51389354	COMCAST	COMPLEX PHONES B&G MAR	924-000	265	28.30
				CHECK GENS 65528 TOTAL FOR FUND 101:				177.08
03/23/2017	GENS	65541	474406	MINER SUPPLY COMPANY	CLEANING SUPPLIES/PAPER PRODUCTS COMPLEX	931-000	265	398.73
03/30/2017	GENS	65553*#	8529112730047816 APR	COMCAST	COMPLEX PHONES	924-000	265	260.68
03/30/2017	GENS	65553	85291127300478416FEB	COMCAST	COMPLEX PHONES FEB	924-000	265	256.94
				CHECK GENS 65553 TOTAL FOR FUND 101:				517.62
03/30/2017	GENS	65556*#	1460-103006	FISH WINDOW CLEANING	COMPLEX MAINTENANCE WINDOW CLEANING 3/27	931-000	265	114.00
03/30/2017	GENS	65559*#	0240-006530735	REPUBLIC SERVICES	COMPLEX MAINTENANCE RECYCLE APR	931-000	265	620.28
				Total for department 265:				9,243.37
Department: 276 CEMETERY								
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100012548051 5601 WHITNEYVILLE AVE	921-000	276	22.57
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012957591 7200 30TH ST SE FEB	921-000	276	85.67
				CHECK GENS 3856(A) TOTAL FOR FUND 101:				108.24
				Total for department 276:				108.24
Department: 295 ADMINISTRATIVE								
03/03/2017	GENS	3844(A)	904128	APPLIED IMAGING	SERVICE CONTRACTS CANNON IRC2550 2/20	939-000	295	114.60
03/03/2017	GENS	3845(A)	466885	FIRST CHOICE COFFEE SERVICE	COFFEE SERVICE FOR TWP. HALL	787-000	295	53.22
03/03/2017	GENS	65439	63062317N	CNA SURETY DIRECT BILL	LEGAL FEES NOTARY BOND BIEGALLE,D	826-000	295	55.00
03/03/2017	GENS	65444*#	NOTE DISCLOSURE	FIRST BANKCARD	ED- PINDER NOTE DISCLOSURE SEMINAR	724-000	295	85.00
03/03/2017	GENS	65444	217151875667	FIRST BANKCARD	OTHER EXPENSES STORAGE APP	787-000	295	0.99
03/03/2017	GENS	65444	712291	FIRST BANKCARD	PRINTING/PUBLISHING DRIVERS LICENSE GUID	900-000	295	29.95
				CHECK GENS 65444 TOTAL FOR FUND 101:				115.94
03/03/2017	GENS	65445	2271	GRAND VALLEY METRO COUNCIL	LEGAL FEES DAS TOWER CONSORTIUM	826-000	295	300.00
03/03/2017	GENS	65453*#	PETTYCASH 3/1/2017	CASH - GENERAL FUND	POSTAGE KUTCHINS MAILING	730-000	295	4.23
03/03/2017	GENS	65453	PETTYCASH 3/1/2017	CASH - GENERAL FUND	LEGAL FEES KORHOODORN REDGISTER DEEDS	826-000	295	60.00
				CHECK GENS 65453 TOTAL FOR FUND 101:				64.23
03/03/2017	GENS	65457	515571-0	SUPPLYGEEKS.BIZ	GENERAL FUND	727-000	295	75.18
03/03/2017	GENS	65457	515818-0	SUPPLYGEEKS.BIZ	GENERAL FUND OFFICE SUPPLIES	727-000	295	53.57
				CHECK GENS 65457 TOTAL FOR FUND 101:				128.75
03/09/2017	GENS	3859(A)*	365561	FISHBECK THOMPSON CARR & HUBER	ENGINEERING COSTS SITE PLANS FEB	821-000	295	2,150.20
03/09/2017	GENS	65477	704000001199	CAPITAL ONE COMMERCIAL	BREAKROOM SUPPLIES	787-000	295	258.61
03/09/2017	GENS	65482	167177	GODWIN HARDWARE & PLUMBING	OFFICE SUPPLIES SHARPEN PAPER CUTTERS	727-000	295	9.00
03/09/2017	GENS	65493	2849341	PRINTLINK	OFFICE SUPPLIES ENVELOPES	727-000	295	98.88

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03/09/2017	GENS	65499	138165	WESTERN AMERICAN MAILERS	MAILING OF NEWSLETTERS WINTER NEWSLETTER	885-000	295	306.36
03/16/2017	GENS	65512	9003275611	KONICA MINOLTA BUSINESS SOLUTIONS	WORKROOM COPY CHARGES C452 11/28-2/27	939-000	295	1,198.74
03/16/2017	GENS	65515	52462	MUNIWEB	WEBSITE HOSTING FEB	815-000	295	228.00
03/16/2017	GENS	65515	52462	MUNIWEB	MAINTENANCE FEB	815-000	295	27.50
					CHECK GENS 65515 TOTAL FOR FUND 101:			255.50
03/16/2017	GENS	65516	910561738001	OFFICE DEPOT	OFFICE SUPPLIES PAPER	727-000	295	129.95
03/16/2017	GENS	65519*#	516666-0	SUPPLYGEEKS.BIZ	GENERAL FUND OFFICE SUPPLIES	727-000	295	81.78
03/16/2017	GENS	65520*#	9781300743	VERIZON WIRELESS	CELL PHONES/DATA TABLET	924-100	295	16.03
03/16/2017	GENS	65521*#	3755	VREDEVELD HAEFNER LLC	2016 AUDIT FINAL BILLING THROUGH FEB	807-000	295	2,400.00
03/23/2017	GENS	3871(A)	914758	APPLIED IMAGING	MONTHLY MAINT COPIER/ADM CANNON IRC2550	939-000	295	161.30
03/23/2017	GENS	3873(A)	JULY 2017 PYMT 1	FUNNY BUSINESS AGENCY INC	FIRST PAYMENT JULY 4TH CONTRACT	881-000	295	20,937.50
03/23/2017	GENS	3874(A)	3302949761	PITNEY BOWES GLOBAL	2016 POSTAGE MACHINE LEASE PAYMENT	941-000	295	675.00
03/23/2017	GENS	65527	698981	CLARK HILL P.L.C.	LEGAL FEES CARPET LANDFILL	826-000	295	800.00
03/23/2017	GENS	65531*#	167648	FIRST BANKCARD	OTHER EXPENSES PERSONEL SUBCOMMITTEE	787-000	295	27.12
03/23/2017	GENS	65531	217151875667 FEB	FIRST BANKCARD	OTHER EXPENSES ICLOUDE STORAGE PLAN APR	787-000	295	0.99
					CHECK GENS 65531 TOTAL FOR FUND 101:			28.11
03/23/2017	GENS	65537	259389	KENT COMMUNICATIONS INC.	MAILING OF 1945 ABSENTEE BALLOT APPLICAT	730-000	295	1,010.75
03/23/2017	GENS	65542	1000015084 1/2017	MLIVE MEDIA GROUP	PRINTING/PUBLISHING JAN 2017 ADV	900-000	295	661.00
03/23/2017	GENS	65544	99858	PSI PRINTING SYSTEMS INC	OFFICE SUPPLIES DEPOSIT SLIPS	727-000	295	86.03
03/23/2017	GENS	65547	2820	SABO, MARY ANN	ISSUES MANAGEMENT	967-000	295	548.05
03/23/2017	GENS	65548	517208-0	SUPPLYGEEKS.BIZ	GENERAL FUND OFFICE SUPPLIES	727-000	295	108.82
03/23/2017	GENS	65549	998079	VARNUM	LEGAL FEES FIRE DEPT	826-000	295	12,823.15
03/23/2017	GENS	65549	998078	VARNUM	LEGAL FEES GENERAL FEB	826-000	295	2,223.00
03/23/2017	GENS	65549	998077	VARNUM	LEGAL FEES ZONING FEB	826-000	295	988.00
					CHECK GENS 65549 TOTAL FOR FUND 101:			16,034.15
03/30/2017	GENS	3878(A)	472395	FIRST CHOICE COFFEE SERVICE	COFFEE SERVICE FOR TWP. HALL	787-000	295	73.50
03/30/2017	GENS	65561*#	512142-0	SUPPLYGEEKS.BIZ	GENERAL FUND OFFICE SUPPLIES	727-000	295	106.54
03/30/2017	GENS	65561	514290-0	SUPPLYGEEKS.BIZ	GENERAL FUND OFFICE SUPPLIES	727-000	295	86.65
					CHECK GENS 65561 TOTAL FOR FUND 101:			193.19
03/30/2017	GENS	65562	POSTAGE SPRING 2017	WESTERN AMERICAN MAILERS	MAILING OF NEWSLETTERS SPRING 2017	885-000	295	1,642.75

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					Total for department 295:			50,696.94
Department: 445 DRAIN								
03/23/2017	GENS	65536	2017-005	KENT COUNTY DRAIN COMMISSION	DRAIN MAINT DRAIN EXPENDITURES 2016	816-000	445	2,393.79
					Total for department 445:			2,393.79
Department: 447 YARD WASTE REMOVAL								
03/03/2017	GENS	65444*#	143720384001	FIRST BANKCARD	XMAS TREES	787-000	447	488.46
03/03/2017	GENS	65444	143720384001	FIRST BANKCARD	XMAS TREES SHREDDING	787-000	447	561.54
03/03/2017	GENS	65444	143720384001CR	FIRST BANKCARD	YARD WASTE OTHER EXPENSES CR ON INV 1437	787-000	447	(561.54)
					CHECK GENS 65444 TOTAL FOR FUND 101:			488.46
					Total for department 447:			488.46
Department: 448 STREET LIGHTS								
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100011965082 2870 JACK SMITH AVE SE F	926-000	448	121.69
03/09/2017	GENS	65476	100000373306 FEB 201	CONSUMERS ENERGY	STREETLIGHTING FEB	926-000	448	8,993.02
					Total for department 448:			9,114.71
Department: 652 TRANSPORTATION								
03/16/2017	GENS	65511	077181	HOPE NETWORK	TRANSPORTATION SERVICES FEB 2017	859-000	652	4,471.50
03/23/2017	GENS	65534*#	088816	INTERURBAN TRANSIT PARTNERSHIP	BUS SERVICE 33RD & 36TH MARCH	861-000	652	2,362.02
03/23/2017	GENS	65534	088817	INTERURBAN TRANSIT PARTNERSHIP	BUS SERVICE 28TH ST MARCH	861-100	652	23,502.77
					CHECK GENS 65534 TOTAL FOR FUND 101:			25,864.79
					Total for department 652:			30,336.29
Department: 721 PLANNING								
03/03/2017	GENS	65442	MILG 2/3-2/27	FAST, STEPHANIE	PLANNING MILEAGE- FAST 115 MILES	860-000	721	61.53
03/03/2017	GENS	65444*#	11424772679665064	FIRST BANKCARD	COMM DEV SUPPLIES IPHONE CASE	727-000	721	14.83
03/03/2017	GENS	65444	845	FIRST BANKCARD	COMM DEV SUPPLIES MEMORY CARD	727-000	721	9.00
03/03/2017	GENS	65444	6	FIRST BANKCARD	COMM DEV EXP ACCT PETERSON ZONING MTG	862-500	721	10.47
					CHECK GENS 65444 TOTAL FOR FUND 101:			34.30
03/03/2017	GENS	65452	MILG 2/03-2/24	STEVEN A PETERSON	COMM DEV MILEAGE PETERSON 59 MILES	860-000	721	31.57
03/09/2017	GENS	65495	5208313	SNELLING STAFFING SERVICES	PLANNING & ZONING MINUTES 2/26	787-000	721	69.75
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	COMM DEV CELL/DATA FEB	925-000	721	101.08
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	COMM DEV CELL/DATA TABLET	925-000	721	32.07
					CHECK GENS 65520 TOTAL FOR FUND 101:			133.15
03/23/2017	GENS	3876(A)	5210604	SNELLING STAFFING SERVICES	PLANNING & ZONING MINUTES 3/12	787-000	721	55.80
03/23/2017	GENS	65531*#	CASCAIN39571	FIRST BANKCARD	COMM DEV SUPPLIES IPHONE GUARD	727-000	721	37.09
03/23/2017	GENS	65531	00053	FIRST BANKCARD	COMM DEV EXPENSE ACCOUNT PLANNING MTG	862-500	721	19.94
					CHECK GENS 65531 TOTAL FOR FUND 101:			57.03
03/23/2017	GENS	65543	005	MICH TRANSPORTATION PLANNING A	EDUCATION PETERSON 2017 MTPA CONF	724-000	721	175.00
03/30/2017	GENS	3880(A)	5211785	SNELLING STAFFING SERVICES	PLANNING & ZONING MINUTES 3/19	787-000	721	37.20
					Total for department 721:			655.33
Department: 756 PARKS								

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03/03/2017	GENS	65440*#	50542339	COMCAST	PARK PHONES	924-000	756	21.23
03/03/2017	GENS	65451*#	68850685	PAETEC	PARK PHONES	924-000	756	39.49
03/03/2017	GENS	65454*#	0240006501952	REPUBLIC SERVICES	PARK MAINTENANCE RECYCLE MARCH	935-000	756	526.66
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100014570673 3804 THORNAPPLE RIV DR	921-000	756	90.02
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100014570889 3820 THORNAPPLE RIV DR	921-000	756	42.90
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012592265 2900 THORNAPPLE RIV DR	921-000	756	238.00
					CHECK GENS 3856(A) TOTAL FOR FUND 101:			370.92
03/09/2017	GENS	65484*#	WS2064693 NOV-FEB17	GRAND RAPIDS CITY TREASURER	PARK WATER-SEWER 2900 THORNAPPLE NOV-FEB	927-000	756	272.17
03/16/2017	GENS	3867(A)	103237	KERKSTRA PORTABLE RESTROOM SERV	PORTABLE TOILETS FOR PEACE AND MCGRAW PA	935-000	756	110.00
03/16/2017	GENS	3868(A)*#	197507	KINGSLAND'S ACE HARDWARE	PARK MAINTENANCE SUPPLIES	935-000	756	38.66
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- PARKS	935-000	756	13.90
03/23/2017	GENS	65528*#	51389354	COMCAST	PARK PHONES MAR	924-000	756	21.23
03/30/2017	GENS	65559*#	0240-006530735	REPUBLIC SERVICES	PARK MAINTENANCE RECYCLE APR	935-000	756	526.37
					Total for department 756:			1,940.63
Department: 803 HISTORICAL								
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100012592398 2839 THORNAPPLE RIV DR	921-000	803	62.39
03/09/2017	GENS	65479*#	457268600030 2/2017	DTE ENERGY	MUSEUM - HEATING/UTILITY FEB	923-000	803	120.60
03/09/2017	GENS	65484*#	WS2064703 NOV-FEB17	GRAND RAPIDS CITY TREASURER	MUSEUM WATER-SEWER NOV-FEB	927-000	803	64.87
03/16/2017	GENS	65518*#	24688	SUPERIOR PEST CONTROL INC	PEST CONTROL - MUSEUM	961-000	803	45.00
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- MUSEUM	961-000	803	27.81
					Total for department 803:			320.67
Department: 850 BENEFITS/INSURANCE								
03/03/2017	GENS	65449*#	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DIS INSURANCE BENEFITS ADD MARCH	720-000	850	24.01
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DIS INSURANCE BENEFITS LIF MARCH	720-000	850	157.88
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DIS INSURANCE BENEFITS LTD MARCH	720-000	850	443.55
					CHECK GENS 65449 TOTAL FOR FUND 101:			625.44
03/09/2017	GENS	65481*	163107829	FIDELITY SECURITY LIFE INS	VISION INSURANCE BENEFITS FEB	718-000	850	129.77
03/16/2017	GENS	65508*	RIS0001419942	DELTA DENTAL	DENTAL INSURANCE BENEFITS APR	721-000	850	1,184.51
03/16/2017	GENS	65508	RIS0001419942	DELTA DENTAL	MI CLAIMS TAX - DENTAL APR	721-200	850	9.40
					CHECK GENS 65508 TOTAL FOR FUND 101:			1,193.91
03/23/2017	GENS	3(E)*#	HEALTH INS - APRIL	WEST MICHIGAN HEALTH INSURANCE	HEALTH INSURANCE BENEFITS APR	719-000	850	12,264.00
					Total for department 850:			14,213.12
Department: 901 CAPITAL OUTLAY								

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03/03/2017	GENS	3846(A)	364873	FISHBECK THOMPSON CARR & HUBER	CAPITAL OUTLAY - LANDIMP SENTINEL POINTE	974-000	901	3,164.00
03/30/2017	GENS	3879(A)*#	20151231	IT RIGHT	EXCHANGE SERVER - P1200SPL	970-000	901	1,500.00
03/30/2017	GENS	3879(A)	20151231	IT RIGHT	APPLICATION SERVER - P4300CP4	970-000	901	900.00
03/30/2017	GENS	3879(A)	20150939	IT RIGHT	EXCHANGE SERVER - P1200SPL	970-000	901	10,820.20
03/30/2017	GENS	3879(A)	20150939	IT RIGHT	APPLICATION SERVER - P4300CP4	970-000	901	6,015.60
					CHECK GENS 3879(A) TOTAL FOR FUND 101:			19,235.80
					Total for department 901:			22,399.80
Department: 965 TRANSFERS OUT								
03/03/2017	GENS	65436	2016 BURIAL REV	CASCADE CHARTER TOWNSHIP	TRF TO CEMETERY TRUST FUND 2016 BURIAL	999-004	965	1,575.00
03/03/2017	GENS	65437	4TH QRT 2016 & 1ST Q	CASCADE CHARTER TOWNSHIP	TRANSFER TO DAM MAJOR REPAIR 4TH QRT2016	999-005	965	10,000.00
03/03/2017	GENS	65437	4TH QRT 2016 & 1ST Q	CASCADE CHARTER TOWNSHIP	TRANSFER TO DAM MAJOR REPAIR 1ST QRT2016	999-005	965	10,000.00
					CHECK GENS 65437 TOTAL FOR FUND 101:			20,000.00
03/03/2017	GENS	65438	FEB 2017 GF ALLOC	CASCADE CHARTER TOWNSHIP	TRANSFER TO FIRE FUND FEB 2017	999-006	965	33,333.33
03/16/2017	GENS	65503	MARCH 2017 GF ALLOC	CASCADE CHARTER TOWNSHIP	TRANSFER TO FIRE FUND MARCH	999-006	965	33,333.33
					Total for department 965:			88,241.66
					Total for fund 101 GENERAL FUND			235,115.34
FUND 206 - FIRE DEPT								
03/23/2017	GENS	3(E)*#	HEALTH INS - APRIL	WEST MICHIGAN HEALTH INSURANCE	COBRA BRITTNAY RASHID APR	231-205	000	484.86
					Total for department 000:			484.86
Department: 336 FIRE DEPARTMENT								
03/03/2017	GENS	65440*#	50542339	COMCAST	FIRE PHONES	924-000	336	56.59
03/03/2017	GENS	65440	50542339	COMCAST	FIRE PHONES/BUTTRICK	924-002	336	21.23
					CHECK GENS 65440 TOTAL FOR FUND 206:			77.82
03/03/2017	GENS	65441	8529112730015086 3/2	COMCAST	FIRE PHONES/BUTTRICK INTERNET MARCH	924-002	336	94.90
03/03/2017	GENS	65443	RENEWAL 2017	FIRE ENGINEERING	FIRE PUBLICATIONS RENWAL FIRE ENGINEERIN	901-000	336	39.00
03/03/2017	GENS	65444*#	432059	FIRST BANKCARD	FIRE EDUCATION POOLMAN LODGING CONF	724-000	336	203.30
03/03/2017	GENS	65446*#	6271021	THE HOME DEPOT CREDIT SERVICES	FIRE STATION MAINT/BUTTRICK TILED GLASS	936-002	336	136.04
03/03/2017	GENS	65448	993858291	MOORE MEDICAL, LLC	FIRE SUPPLEMENTAL EQUIP ELECTRODE CNCT	958-000	336	100.71
03/03/2017	GENS	65450	593953	NYE UNIFORM COMPANY	FIRE UNIFORMS DEERING	768-000	336	20.50
03/03/2017	GENS	65451*#	68850685	PAETEC	FIRE PHONES	924-000	336	66.01
03/03/2017	GENS	65451	68850685	PAETEC	FIRE PHONES/BUTTRICK	924-002	336	39.49
					CHECK GENS 65451 TOTAL FOR FUND 206:			105.50
03/03/2017	GENS	65454*#	0240006501952	REPUBLIC SERVICES	FIRE STATION MAINT/BUTTRICK RECYCLE MARC	936-002	336	152.92
03/03/2017	GENS	65455	REIMB 3/02/2017	JOHN SIGG	FIRE OFFICE SUPPLIES FOLDERS	727-000	336	19.07
03/03/2017	GENS	65465	119637	TIME EMERGENCY EQUIPMENT	FIRE EQUIPMENT MAINT AKRON BAIL HANDLES	938-000	336	86.13

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03/09/2017	GENS	3855(A)	164423-1	5 ALARM	FIRE PROTECTIVE CLOTHING LEATHERETTE FRN	959-000	336	49.04
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	103023462197 2867 THORNHILLS AVE SE	921-002	336	25.37
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012762959 2990 BUTTRICK AVE SE FE	921-002	336	595.18
				CHECK GENS 3856(A) TOTAL FOR FUND 206:				620.55
03/09/2017	GENS	3860(A)	17055901	FUEL MANAGEMENT SYSTEM	FIRE FUELS	745-000	336	132.66
03/09/2017	GENS	3860(A)	17055901	FUEL MANAGEMENT SYSTEM	FIRE FUELS DISCOUNT	745-000	336	(5.26)
				CHECK GENS 3860(A) TOTAL FOR FUND 206:				127.40
03/09/2017	GENS	65473	48169	CASCADE AUTOMOTIVE SERVICE	FIRE EQUIP MAINT OIL CHG 2015 CHEVY SUB	938-000	336	74.40
03/09/2017	GENS	65473	48164	CASCADE AUTOMOTIVE SERVICE	FIRE EQUIP MAINT TIRE REPAIR 2007 CHEVY	938-000	336	81.49
				CHECK GENS 65473 TOTAL FOR FUND 206:				155.89
03/09/2017	GENS	65479*#	457268600048 2/2017	DTE ENERGY	FIRE HEATING/BUTTRICK FEB	923-002	336	353.72
03/09/2017	GENS	65483	36100-12016319 6/17	GRAND RAPIDS PRESS	FIRE PUBLICATIONS GR PRESS 12 WKS TO 6/4	901-000	336	57.60
03/09/2017	GENS	65484*#	WS2059561 NV-FEB17	GRAND RAPIDS CITY TREASURER	FIRE WATER/BUTTRICK NOV-FEB	927-002	336	79.29
03/09/2017	GENS	65484	WS2059560 NV-MAR17	GRAND RAPIDS CITY TREASURER	FIRE WATER/BUTTRICK NOV-MAR FIRE PROTECT	927-002	336	33.44
				CHECK GENS 65484 TOTAL FOR FUND 206:				112.73
03/09/2017	GENS	65492	11779128-00	NICHOLS PAPER & SUPPLY CO	CLEANING SUPPLIES FOR STATION 2	936-002	336	433.71
03/09/2017	GENS	65496	119882	TIME EMERGENCY EQUIPMENT	FIRE EQUIPMENT MAINT BIG EASY KIT	938-000	336	130.55
03/09/2017	GENS	65497	28458760	VALLEY CITY LINEN INC	FIRE STATION MAINT-RUG & TOWEL CLEANING	936-000	336	39.95
03/09/2017	GENS	65497	28453691	VALLEY CITY LINEN INC	FIRE STATION MAINT-RUG & TOWEL CLEANING	936-000	336	39.95
03/09/2017	GENS	65497	28448559	VALLEY CITY LINEN INC	FIRE STATION MAINT-RUG & TOWEL CLEANING	936-000	336	39.95
03/09/2017	GENS	65497	28443451	VALLEY CITY LINEN INC	FIRE STATION MAINT-RUG & TOWEL CLEANING	936-000	336	39.95
				CHECK GENS 65497 TOTAL FOR FUND 206:				159.80
03/16/2017	GENS	3868(A)*#	197666	KINGSLAND'S ACE HARDWARE	FIRE STATION MAINT AUTO SUPPLIES	936-000	336	19.41
03/16/2017	GENS	3868(A)	197547	KINGSLAND'S ACE HARDWARE	FIRE STATION MAINT CERAMIC HEATER	936-000	336	60.28
03/16/2017	GENS	3868(A)	197510	KINGSLAND'S ACE HARDWARE	FIRE STATION MAINT CLEANING SUPPLIES	936-000	336	21.59
03/16/2017	GENS	3868(A)	197696	KINGSLAND'S ACE HARDWARE	FIRE EQUIPMENT MAINT BOLTS	938-000	336	0.31
				CHECK GENS 3868(A) TOTAL FOR FUND 206:				101.59
03/16/2017	GENS	3869(A)	5130267	SERVPRO SW GRAND RAPIDS #2705	CLEANING OF VENTS STATION 2	936-002	336	316.88
03/16/2017	GENS	3870(A)*#	48910755	WEX BANK	FIRE FUELS FEB	745-000	336	612.16
03/16/2017	GENS	65505*#	301-02736 FEB 2017	CINTAS CORP #301	2017 RUG CLEANING SERVICE S.C.	936-000	336	32.00
03/16/2017	GENS	65505	301-02736 FEB 2017	CINTAS CORP #301	2017 RUG CLEANING SERVICE FIRE	936-000	336	112.24
				CHECK GENS 65505 TOTAL FOR FUND 206:				144.24
03/16/2017	GENS	65513	AR164056	KRAFT BUSINESS SYSTEM	FIRE COPIER/LEASE/SERVICE SHARP NX-M363N	939-000	336	72.03
03/16/2017	GENS	65518*#	24690	SUPERIOR PEST CONTROL INC	PEST CONTROL - STATION 1 FEB	936-000	336	32.00
03/16/2017	GENS	65518	24689	SUPERIOR PEST CONTROL INC	PEST CONTROL - STATION 2	936-002	336	32.00
				CHECK GENS 65518 TOTAL FOR FUND 206:				64.00
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	FIRE PHONES FEB	924-000	336	111.08

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03/16/2017	GENS	65520	9781312630	VERIZON WIRELESS	CELL PHONES/DATA-MODEMS FEB	924-100	336	118.60
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	CELL PHONES/DATA-MODEMS TAABLET	924-100	336	16.03
					CHECK GENS 65520 TOTAL FOR FUND 206:			245.71
03/16/2017	GENS	65521*#	3755	VREDEVELD HAEFNER LLC	2016 AUDIT FINAL BILLING THROUGH FEB	807-000	336	450.00
03/23/2017	GENS	3872(A)	47904000	FUEL MANAGEMENT SYSTEM	FIRE FUELS	745-000	336	168.13
03/23/2017	GENS	3872(A)	47904000	FUEL MANAGEMENT SYSTEM	FIRE FUELS DISCOUNT	745-000	336	(6.24)
					CHECK GENS 3872(A) TOTAL FOR FUND 206:			161.89
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- FIRE	936-000	336	139.08
03/23/2017	GENS	3875(A)	201364	QUALITY AIR	MONTHLY MAINTENANCE- FIRE BUTTRICK	936-002	336	101.94
					CHECK GENS 3875(A) TOTAL FOR FUND 206:			241.02
03/23/2017	GENS	65525	48213	CASCADE AUTOMOTIVE SERVICE	LABOR	938-000	336	468.29
03/23/2017	GENS	65525	48213	CASCADE AUTOMOTIVE SERVICE	PARTS	938-000	336	204.76
03/23/2017	GENS	65525	48213	CASCADE AUTOMOTIVE SERVICE	HAZ-MAT	938-000	336	7.50
					CHECK GENS 65525 TOTAL FOR FUND 206:			680.55
03/23/2017	GENS	65528*#	51389354	COMCAST	FIRE PHONES/BUTTRICK MAR	924-002	336	21.23
03/23/2017	GENS	65528	51389354	COMCAST	CELL PHONES/DATA-MODEMS MAR	924-100	336	56.59
					CHECK GENS 65528 TOTAL FOR FUND 206:			77.82
03/23/2017	GENS	65538	106528	MARK'S BODY SHOP	FIRE EQUIPMENT MAINT H50SN12 BULB	938-000	336	18.00
03/23/2017	GENS	65545	12535	REITSMA ELECTRIC	REPLACE 5 LIGHTS OVER HEAD DOORS STA 2	936-002	336	3,797.45
03/23/2017	GENS	65550	9781885791	VERIZON WIRELESS	CELL PHONES/DATA-MODEMS FEB	924-100	336	334.28
03/30/2017	GENS	3879(A)*#	20149735	IT RIGHT	FIRE OFF EQUIP & COMPUTER REPA SSL CERT	932-000	336	500.00
03/30/2017	GENS	65553*#	8529112730047816 APR	COMCAST	CELL PHONES/DATA-MODEMS	924-100	336	119.75
03/30/2017	GENS	65553	8529112730015086APR	COMCAST	CELL PHONES/DATA-MODEMS APRIL INTERNET	924-100	336	94.90
03/30/2017	GENS	65553	85291127300478416FEB	COMCAST	CELL PHONES/DATA-MODEMS FEB	924-100	336	119.75
03/30/2017	GENS	65553	8527112730015086FEB	COMCAST	CELL PHONES/DATA-MODEMS INTERNET FEB	924-100	336	94.90
					CHECK GENS 65553 TOTAL FOR FUND 206:			429.30
03/30/2017	GENS	65554	8529112730083548APR	COMCAST	FIRE PHONES/BUTTRICK XFINITY APR	924-002	336	42.44
03/30/2017	GENS	65559*#	0240-006530735	REPUBLIC SERVICES	FIRE STATION MAINT/BUTTRICK RECYCLE APR	936-002	336	152.84
03/30/2017	GENS	65561*#	514304-0	SUPPLYGEEKS.BIZ	FIRE FUND OFFICE SUPPLIES	727-000	336	361.81
					Total for department 336:			12,040.89
Department: 850 BENEFITS/INSURANCE								
03/03/2017	GENS	65449*#	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DIS INSURANCE BENEFITS LIF MARCJ	720-000	850	204.50
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DISABILITY INSURANCE AD&D MARCH	720-000	850	31.09
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DISABILITY INSURANCE LTD MARCH	720-000	850	543.28
					CHECK GENS 65449 TOTAL FOR FUND 206:			778.87
03/09/2017	GENS	65481*	163107829	FIDELITY SECURITY LIFE INS	VISION INSURANCE BENEFITS FEB	718-000	850	212.06
03/16/2017	GENS	65508*	RIS0001419942	DELTA DENTAL	DENTAL INSURANCE BENEFITS APR	721-000	850	1,925.20
03/16/2017	GENS	65508	RIS0001419942	DELTA DENTAL	MI CLAIMS TAX - DENTAL APR	721-200	850	15.75
					CHECK GENS 65508 TOTAL FOR FUND 206:			1,940.95

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03/23/2017	GENS	3(E)*#	HEALTH INS - APRIL	WEST MICHIGAN HEALTH INSURANCE	HEALTH INSURANCE BENEFITS APR	719-000	850	12,315.46
					Total for department 850:			15,247.34
					Total for fund 206 FIRE FUND			27,773.09
FUND 207 - POLICE FUND								
03/09/2017	GENS	3861(A)	17030700277	KENT COUNTY TREASURER	SHERIFF PROTECTION JAN 2017	801-000	301	38,124.42
03/09/2017	GENS	3861(A)	17030700277	KENT COUNTY TREASURER	SHERIFF PROTECTION FEB 2017	801-000	301	48,677.78
					CHECK GENS 3861(A) TOTAL FOR FUND 207:			86,802.20
					Total for department 301:			86,802.20
					Total for fund 207 POLICE FUND			86,802.20
FUND 208 - HAZMAT FUND								
03/09/2017	GENS	65469	04123561	ARGUS-HAZCO	HAZMAT EQUIPMENT MULTIIRAE SENSORS	958-000	344	161.97
					Total for department 344:			161.97
					Total for fund 208 HAZMAT FUND			161.97
FUND 209 - CCT OPEN SPACE FUND								
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100061096465 6803 BURTON ST SE FEB	921-000	751	23.13
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100041772151 6803 BURTON ST SE FEB	921-000	751	266.81
					CHECK GENS 3856(A) TOTAL FOR FUND 209:			289.94
03/09/2017	GENS	65484*#	WS2049855 NOV-FEB17	GRAND RAPIDS CITY TREASURER	WATER-SEWER 6805 BRTON ST NOV-FEB	927-000	751	66.39
03/16/2017	GENS	3868(A)*#	197595	KINGSLAND'S ACE HARDWARE	PARK MAINTENANCE SUPPLIES	935-000	751	25.12
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- BURTON PARK	935-000	751	13.90
					Total for department 751:			395.35
Department: 990 DEBT SERVICE								
03/16/2017	GENS	65502	252-2009198	THE BANK OF NEW YORK MELLON TRU	INTEREST AND FEES BA 2009	996-001	990	750.00
					Total for department 990:			750.00
					Total for fund 209 CCT OPEN SPACE			1,145.35
FUND 216 - PATHWAYS FUND								
03/30/2017	GENS	65558*#	9014045	THE HOME DEPOT CREDIT SERVICES	MAINT & REPAIR CEDAR LUMBER	931-000	758	314.52
					Total for department 758:			314.52
					Total for fund 216 PATHWAYS FUND			314.52
FUND 246 - IRF FUND								
03/30/2017	GENS	65552*	P# 2962	CASCADE CHARTER TOWNSHIP	HOOKUP FEES S/W CONNEC 6208 BECHALLA DR	630-000	000	1,100.00
					Total for department 000:			1,100.00
Department: 295 ADMINISTRATIVE								
03/09/2017	GENS	3859(A)*	365565	FISHBECK THOMPSON CARR & HUBER	ADMIN ENGINEERING COSTS TRD UTILITY EXT	821-000	295	2,867.60
					Total for department 295:			2,867.60
					Total for fund 246 IRF			3,967.60
FUND 248 - DDA FUND								

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03/03/2017	GENS	65444*#	KORHORN 3/7CONF	FIRST BANKCARD	DDA - EDUCATION KORHORN,S REGISTRATION	724-000	170	35.00
03/03/2017	GENS	65444	1/24/17 PURCHASE	FIRST BANKCARD	OTHER EXPENSES LIBRARY GATHERING	787-000	170	28.93
					CHECK GENS 65444 TOTAL FOR FUND 248:			63.93
03/03/2017	GENS	65453*#	PETTYCASH 3/1/2017	CASH - GENERAL FUND	DDA - MILEAGE KORHORN PARKING COUNTY	860-000	170	1.25
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100012017115 6753 OLD 28TH ST FEB	921-000	170	229.87
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012017305 6610 28TH ST SE FEB	921-000	170	192.79
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100011901541 6800 CASCADE RD SE FEB	921-000	170	331.38
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100011901814 6811 CASCADE RD SE FEB	921-000	170	158.16
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100054379084 5196 28TH ST SE FEB	921-000	170	232.89
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100054393572 5434 28TH ST SE FEB	921-000	170	86.50
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100012213862 6658 28TH ST SE FEB	921-000	170	22.57
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100041058650 6116 28TH ST SE FEB	921-000	170	101.55
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100041059278 5905 28TH ST SE FEB	921-000	170	116.15
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100041081355 5613 28TH ST SE FEB	921-000	170	104.27
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100063460503 5770 FOREMOST DR SE FEB	921-000	170	184.51
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100066874924 2990 LUCERNE DR SE FEB	921-000	170	74.86
03/09/2017	GENS	3856(A)	FEB 2017	CONSUMERS ENERGY	100041059393 6282 28TH ST SE FEB	921-000	170	155.85
					CHECK GENS 3856(A) TOTAL FOR FUND 248:			1,991.35
03/16/2017	GENS	65514	SCULPTURE 3/17-2/18	MCKEAN,CYNTHIA	LEASE OF SCULPTURE FOR MUSEUM GARDENS	967-000	170	1,650.00
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	CELL PHONES FEB	924-100	170	49.95
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	CELL PHONES TABLET	924-100	170	16.03
					CHECK GENS 65520 TOTAL FOR FUND 248:			65.98
03/23/2017	GENS	65530	49535	FALCON PRINTING INC	DDA BUSINESS MEETING COMMENT CARDS	787-000	170	386.60
03/23/2017	GENS	65531*#	MEDA8733080	FIRST BANKCARD	DDA - EDUCATION KORHORN MEDA CONF	724-000	170	40.00
03/23/2017	GENS	65534*#	088817	INTERURBAN TRANSIT PARTNERSHIP	BUS SERVICE 28TH ST MARCH	861-100	170	7,834.26
03/30/2017	GENS	65558*#	3020892	THE HOME DEPOT CREDIT SERVICES	MAINT & REPAIR/IMPROV RED FLAG STAKES	931-000	170	47.88
					Total for department 170:			12,081.25
Department: 990 DEBT SERVICE								
03/23/2017	GENS	65526	009999796106-109	CHEMICAL BANK	MUN BOND 2010 / INT & FEES	996-003	990	6,614.50
					Total for department 990:			6,614.50
					Total for fund 248 DDA			18,695.75
FUND 249 - BUILDING FUND								
03/09/2017	GENS	65475	2959	CASCADE CHARTER TOWNSHIP	S/W CONNECT 5380 52ND	237-000	000	498.00
03/16/2017	GENS	65504	P# 2958	CASCADE CHARTER TOWNSHIP	S/W CONNECT 7647 PINE PARK	237-000	000	1,100.00
03/30/2017	GENS	65552*	P# 2963	CASCADE CHARTER TOWNSHIP	S/ CONNECT 6220 BECIA;;A	237-000	000	1,100.00
03/30/2017	GENS	65552	P# 2964	CASCADE CHARTER TOWNSHIP	S/W CONNECT 6214 BECHALLAQQ	237-000	000	1,100.00
					CHECK GENS 65552 TOTAL FOR FUND 249:			2,200.00
03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR ELECTRICAL PERMITS PE17700386	607-537	000	115.00
03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR ELECTRICAL PERMITS ADM CR	607-537	000	(25.00)
03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR MECHANICAL PERMITS ADM CR	607-538	000	(25.00)
03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR MECHANICAL PERMITS PM17700645	607-538	000	55.00

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03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR PLUMBING PERMITS PP17700312	607-539	000	63.00
03/30/2017	GENS	65557	REFUND VARIOUS PERMT	HEGLUND,JACOB	EAST GR PLUMBING PERMITS ADM CR	607-539	000	(25.00)
					CHECK GENS 65557 TOTAL FOR FUND 249:			158.00
					Total for department 000:			3,956.00
Department: 371 BUILDING DEPARTMENT								
03/03/2017	GENS	65440*#	50542339	COMCAST	PHONES	924-000	371	49.52
03/03/2017	GENS	65444*#	111088	FIRST BANKCARD	SUPPLIES PATCH CABLES	727-000	371	55.36
03/03/2017	GENS	65444	100363452	FIRST BANKCARD	CODE BOOKS	757-000	371	1,126.32
03/03/2017	GENS	65444	H373643561	FIRST BANKCARD	OTHER EXPENSES INK CARTRIDGE	787-000	371	76.31
					CHECK GENS 65444 TOTAL FOR FUND 249:			1,257.99
03/03/2017	GENS	65451*#	68850685	PAETEC	PHONES BLDG	924-000	371	27.19
03/09/2017	GENS	65470	MILG 2/20-3/03 & CLO	BENOIT, BILL	DEPARTMENT UNIFORMS BENOIT CLOTH ALLOW	768-000	371	300.00
03/09/2017	GENS	65470	MILG 2/20-3/03 & CLO	BENOIT, BILL	MILEAGE - BENOIT 619 MILES	860-000	371	331.17
					CHECK GENS 65470 TOTAL FOR FUND 249:			631.17
03/09/2017	GENS	65472	MILG 2/20-3/03	BIEGALLE, JEFFREY	MILEAGE- BIEGALLE,J 614 MILES	860-000	371	328.49
03/09/2017	GENS	65478	MILG 2/20-3/01	KEN DAVIS	MILEAGE DAVIS 433 MILES	860-000	371	231.66
03/09/2017	GENS	65486	MILG 2/20-3/03	DANIEL L HEYER	MILEAGE HEYER 580 MILES	860-000	371	310.30
03/09/2017	GENS	65487	MILG 2/20-3/03	HUYSER, DANIEL A.	MILEAGE- HUYSER 582 MILES	860-000	371	311.37
03/09/2017	GENS	65489	9003275697	KONICA MINOLTA ALBIN	C454 PRINTER/COPIER	939-000	371	74.00
03/09/2017	GENS	65491	MILG 2/20-3/03	VINCENT MILITO	MILEAGE MILITO- 481 MILES	860-000	371	257.34
03/09/2017	GENS	65494	MILG 2/20-3/03	RON SABIN	MILEAGE SABIN 461 MILES	860-000	371	246.64
03/09/2017	GENS	65500	MILG 2/20-3/3	BRIAN WILSON	MILEAGE WILSON 282 MILES	860-000	371	150.87
03/16/2017	GENS	65506	SABIN, RON 2017	CODE OFFICIALS CONFERENCE OF MI	MEMBERSHIPS AND DUES SABIN COCM	723-000	371	40.00
03/16/2017	GENS	65506	SABIN, RON 2017	CODE OFFICIALS CONFERENCE OF MI	EDUCATION SABIN REISGRATION COCM 5/8-11	724-000	371	165.00
					CHECK GENS 65506 TOTAL FOR FUND 249:			205.00
03/16/2017	GENS	65507	BENOIT,BILL 2017	CODE OFFICIALS CONFERENCE OF MI	MEMBERSHIPS AND DUES BENOIT COCM	723-000	371	40.00
03/16/2017	GENS	65507	BENOIT,BILL 2017	CODE OFFICIALS CONFERENCE OF MI	EDUCATION BENOIT REGISTR COCM 5/8-5/11	724-000	371	165.00
					CHECK GENS 65507 TOTAL FOR FUND 249:			205.00
03/16/2017	GENS	65509	SABIN, RON	DOUBLE TREE BY HILTON HOTEL	EDUCATION LODGING SABIN 5/08-5/11	724-000	371	343.35
03/16/2017	GENS	65509	BENOIT, BILL	DOUBLE TREE BY HILTON HOTEL	EDUCATION BENOIT LODGING 5/08-5/11/2017	724-000	371	343.35
					CHECK GENS 65509 TOTAL FOR FUND 249:			686.70
03/16/2017	GENS	65519*#	516666-0	SUPPLYGEEKS.BIZ	BUILDING FUND OFFICE SUPPLIES	727-000	371	20.18
03/16/2017	GENS	65520*#	9781103972	VERIZON WIRELESS	CELL PHONES FEB	924-100	371	402.78
03/16/2017	GENS	65520	9781300743	VERIZON WIRELESS	CELL PHONES TABLETS	924-100	371	128.26
					CHECK GENS 65520 TOTAL FOR FUND 249:			531.04

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03/16/2017	GENS	65521*#	3755	VREDEVELD HAEFNER LLC	2016 AUDIT FINAL BILLING THROUGH FEB	807-000	371	150.00
03/23/2017	GENS	3877(A)	64564	WOLVERINE PRINT SOLOUTIONS	FORMS NOTICE OF CORRECTIONS	727-000	371	204.60
03/23/2017	GENS	65523	MILG 3/6-3/17	BENOIT, BILL	MILEAGE - BENOIT 652 MILES	860-000	371	348.82
03/23/2017	GENS	65524	MILG 3/6-3/16	BIEGALLE, JEFFREY	MILEAGE- BIEGALLE,J 478 MILES	860-000	371	255.73
03/23/2017	GENS	65528*#	51389354	COMCAST	PHONES MAR	924-000	371	49.52
03/23/2017	GENS	65529	MILG 3/6-3/17	KEN DAVIS	MILEAGE DAVIS 482 MILES	860-000	371	257.87
03/23/2017	GENS	65531*#	100369083	FIRST BANKCARD	CODE BOOKS 2015 COMPLETE COMMENTARY COLL	757-000	371	800.80
03/23/2017	GENS	65532	MILG 3/6-3/17	DANIEL L HEYER	MILEAGE HEYER 545 MILES	860-000	371	291.58
03/23/2017	GENS	65533	MILG 3/6-3/17	HUYSER, DANIEL A.	MILEAGE- HUYSER 539 MILES	860-000	371	288.37
03/23/2017	GENS	65540	MILG 3/6-3/15	VINCENT MILITO	MILEAGE MILITO- 458 MILES	860-000	371	245.03
03/23/2017	GENS	65546	MILG 3/6--3/17	RON SABIN	MILEAGE SABIN 364 MILES	860-000	371	194.74
03/23/2017	GENS	65551	MILG 3/6-3/17	BRIAN WILSON	MILEAGE WILSON 159 MILES	860-000	371	85.07
Department: 850 BENEFITS/INSURANCE								8,696.59
03/03/2017	GENS	65449*#	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DISABILITY INSURANCE LTD MARCH	720-000	850	288.24
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DISABILITY INSURANCE AD&D MARCH	720-000	850	16.38
03/03/2017	GENS	65449	000616896964	MUTUAL OF OMAHA INSURANCE	LIFE & DISABILITY INSURANCE BENEFITS LIF	720-000	850	107.75
CHECK GENS 65449 TOTAL FOR FUND 249:								412.37
03/09/2017	GENS	65481*	163107829	FIDELITY SECURITY LIFE INS	VISION INSURANCE BENEFITS FEB	718-000	850	101.20
03/16/2017	GENS	65508*	RIS0001419942	DELTA DENTAL	DENTAL INSURANCE BENEFITS APR	721-000	850	685.95
03/16/2017	GENS	65508	RIS0001419942	DELTA DENTAL	MI CLAIMS TAX - DENTAL APR	721-200	850	5.59
CHECK GENS 65508 TOTAL FOR FUND 249:								691.54
03/23/2017	GENS	3(E)*#	HEALTH INS - APRIL	WEST MICHIGAN HEALTH INSURANCE	HEALTH INSURANCE BENEFITS APR	719-000	850	9,126.02
Department: 964 PAYMENTS TO OTHER TOWNSHIPS								10,331.13
03/09/2017	GENS	3858(A)	FEB 2017 PERMITS	EAST GRAND RAPIDS/CITY OF	PERMITS DUE TO EAST GR	964-500	964	2,759.00
03/09/2017	GENS	3862(A)	FEB 2017 PERMITS	LOWELL TOWNSHIP	PERMITS DUE TO LOWELL TWP FEB	964-100	964	1,031.00
03/09/2017	GENS	3863(A)	FEB 2017 PERMITS	PLAINFIELD CHARTER TOWNSHIP	PERMITS DUE PLAINFIELD FEB	964-600	964	3,006.00
03/09/2017	GENS	65468	FEB 2017 PERMITS	ADA TOWNSHIP	PERMITS DUE TO ADA TWP FEB	964-400	964	1,540.40
03/09/2017	GENS	65474	FEB 2017 PERMITS	CASCADE CHARTER TOWNSHIP	PERMITS DUE CASCADE TWP FEB	964-800	964	8,944.80

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03/09/2017	GENS	65485	FEB 2017 PERMITS	GRAND RAPIDS CHARTER TOWNSHIP	PERMITS DUE TO GR TWP FEB	964-300	964	4,041.20
03/09/2017	GENS	65490	FEB 2017 PERMITS	LOWELL MI, CITY OF	PERMITS DUE CITY OF LOWELL FEB	964-700	964	1,520.00
03/09/2017	GENS	65498	FEB 2017 PERMITS	VERGENNES TOWNSHIP	PERMITS DUE TO VERGENNES TWP FEB	964-200	964	176.20
					Total for department 964:			23,018.60
					Total for fund 249 BUILDING FUND			46,002.32
FUND 270 - LIBRARY FUND								
03/03/2017	GENS	65440*#	50542339	COMCAST	LIBRARY PHONES	924-000	790	21.23
03/03/2017	GENS	65446*#	3030295	THE HOME DEPOT CREDIT SERVICES	LIBRARY MAINTENANCE HOSE REEL	931-000	790	171.57
03/03/2017	GENS	65451*#	68850685	PAETEC	LIBRARY PHONES	924-000	790	39.49
03/03/2017	GENS	65454*#	0240006501952	REPUBLIC SERVICES	LIBRARY MAINTENANCE RECYCLE MARCH	931-000	790	480.80
03/09/2017	GENS	3856(A)*#	FEB 2017	CONSUMERS ENERGY	100000284784 2870 JACKSMITH AVE FEB	921-000	790	4,256.78
03/09/2017	GENS	3864(A)	200310	QUALITY AIR	LABOR TO CHECK PILOT SOLENOID VALVE	931-000	790	209.00
03/09/2017	GENS	3864(A)	200311	QUALITY AIR	INSTALLED PILOT GAS SOLENOID & LABOR	931-000	790	425.00
03/09/2017	GENS	3864(A)	200198	QUALITY AIR	NEW MOTOR & COUPLER & LABOR	931-000	790	1,275.45
03/09/2017	GENS	3864(A)	200197	QUALITY AIR	REPLACE IGNITION CONTROL ON THE BOILER	931-000	790	735.00
03/09/2017	GENS	3864(A)	200277	QUALITY AIR	REPLACED VALVE & ACTUATOR & LABOR	931-000	790	952.26
					CHECK GENS 3864(A) TOTAL FOR FUND 270:			3,596.71
03/09/2017	GENS	65479*#	457271900013 2/2017	DTE ENERGY	LIBRARY HEATING FEB	923-000	790	1,344.44
03/16/2017	GENS	3865(A)*#	84941	ENVIRO-CLEAN	CLEANING LIBRARY FEB	802-200	790	2,244.35
03/16/2017	GENS	3865(A)	84941	ENVIRO-CLEAN	CLEANING WISNER FEB	802-200	790	458.67
03/16/2017	GENS	3865(A)	84941	ENVIRO-CLEAN	CLEANING LIBRARY (WEEKEND)FEB	802-200	790	272.58
					CHECK GENS 3865(A) TOTAL FOR FUND 270:			2,975.60
03/16/2017	GENS	3868(A)*#	197549	KINGSLAND'S ACE HARDWARE	LIBRARY MAINT ELECTRIC BALLAST	931-000	790	59.38
03/16/2017	GENS	3868(A)	197695	KINGSLAND'S ACE HARDWARE	LIBRARY MAINT ELECTRIC BALLAST	931-000	790	59.38
03/16/2017	GENS	3868(A)	197739	KINGSLAND'S ACE HARDWARE	LIBRARY MAINTENANCE BATTERIES	931-000	790	52.96
03/16/2017	GENS	3868(A)	197630	KINGSLAND'S ACE HARDWARE	LIBRARY MAINTENANCE PLEXI GLASS	931-000	790	233.14
03/16/2017	GENS	3868(A)	197740	KINGSLAND'S ACE HARDWARE	LIBRARY MAINT CR ON INV 197739	931-000	790	(29.98)
03/16/2017	GENS	3868(A)	197631	KINGSLAND'S ACE HARDWARE	LIBRARY MAINT CR ON INV 197630	931-000	790	(211.95)
					CHECK GENS 3868(A) TOTAL FOR FUND 270:			162.93
03/16/2017	GENS	65505*#	301-02737 FEB 2017	CINTAS CORP #301	2017 RUG CLEANING SERVICE LIBRARY FEB	931-000	790	872.96
03/16/2017	GENS	65518*#	24687	SUPERIOR PEST CONTROL INC	PEST CONTROLL - LIBRARY	931-000	790	65.00
03/16/2017	GENS	65522	5886350-00	W.W. WILLIAMS CO LLC	REMOVE & REPLACE HEATER UNIT @WISNER	931-000	790	140.00
03/16/2017	GENS	65522	5886350-00	W.W. WILLIAMS CO LLC	LABOR	931-000	790	783.00
					CHECK GENS 65522 TOTAL FOR FUND 270:			923.00
03/23/2017	GENS	3875(A)*#	201364	QUALITY AIR	MONTHLY MAINTENANCE- LIBRARY	931-000	790	806.16
03/23/2017	GENS	65528*#	51389354	COMCAST	LIBRARY PHONES MAR	924-000	790	21.23

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03/23/2017	GENS	65539	SV001798	MIDSTATE SECURITY CO.	TRIP CHARGE	931-000	790	50.00
03/23/2017	GENS	65539	SV001798	MIDSTATE SECURITY CO.	LABOR	931-000	790	712.50
					CHECK GENS 65539 TOTAL FOR FUND 270:			762.50
03/30/2017	GENS	65556*#	1460-103007	FISH WINDOW CLEANING	LIBRARY MAINTENANCEWINDOW CLEANING 3/27	931-000	790	285.00
03/30/2017	GENS	65558*#	2011717	THE HOME DEPOT CREDIT SERVICES	LIBRARY MAINTENANCE BLACKTOP PATCH	931-000	790	69.30
03/30/2017	GENS	65559*#	0240-006530735	REPUBLIC SERVICES	LIBRARY MAINTENANCE APR	931-000	790	76.42
03/30/2017	GENS	65559	0240-006530735	REPUBLIC SERVICES	LIBRARY MAINTENANCE RECYCLE	931-000	790	480.55
					CHECK GENS 65559 TOTAL FOR FUND 270:			556.97
					Total for department 790:			17,411.67
					Total for fund 270 LIBRARY FUND			17,411.67
FUND 703 - CURRENT TAX COLLECTION FUND								
03/03/2017	GENS	3847(A)	CAL 1626	CALEDONIA COMMUNITY SCHOOLS	CALEDONIA - OPERATING	225-410	000	17,766.12
03/03/2017	GENS	3847(A)	CAL 1626	CALEDONIA COMMUNITY SCHOOLS	CALEDONIA - INTEREST OPER	225-411	000	243.04
					CHECK GENS 3847(A) TOTAL FOR FUND 703:			18,009.16
03/03/2017	GENS	3848(A)	CALD 1626	CALEDONIA COMMUNITY SCHOOLS	CALEDONIA - INTEREST	225-411	000	211.33
03/03/2017	GENS	3848(A)	CALD 1626	CALEDONIA COMMUNITY SCHOOLS	CALEDONIA - DEBT	225-420	000	16,356.96
03/03/2017	GENS	3848(A)	CALD 1626	CALEDONIA COMMUNITY SCHOOLS	CALEDONIA - IFT DEBT	225-520	000	1,997.73
					CHECK GENS 3848(A) TOTAL FOR FUND 703:			18,566.02
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - OPERATING	225-110	000	11,875.13
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - INTEREST DEBT	225-111	000	807.21
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - INTEREST OPER	225-111	000	344.47
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - INTEREST REC	225-111	000	106.19
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - DEBT	225-120	000	49,066.51
03/03/2017	GENS	3849(A)	FHPS 1626	FOREST HILLS PUBLIC SCHOOLS	FHPS - RECREATION	225-130	000	6,455.89
					CHECK GENS 3849(A) TOTAL FOR FUND 703:			68,655.40
03/03/2017	GENS	3850(A)	GRCC 1626	GRAND RAPIDS COMMUNITY COLLEGE	GRCC - TAXES	235-110	000	4,130.06
03/03/2017	GENS	3850(A)	GRCC 1626	GRAND RAPIDS COMMUNITY COLLEGE	GRCC - TAXES INTEREST	235-111	000	239.41
					CHECK GENS 3850(A) TOTAL FOR FUND 703:			4,369.47
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - OPERATING	222-110	000	9,895.35
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - INTEREST	222-111	000	858.39
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - JAIL	222-160	000	12,477.46
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - ZOO/MUSEUM	222-165	000	6,955.53
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - SENIOR	222-170	000	7,904.10
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - VETERAN'S MILLAGE	222-172	000	790.14
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY DRAIN	222-180	000	9.98
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - IFT JAIL	222-260	000	450.51
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - IFT ZOO/MUSEUM	222-265	000	251.14
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - IFT SENIOR	222-270	000	285.38
03/03/2017	GENS	3851(A)	KC 1626	KENT COUNTY TREASURER	KENT COUNTY - IFT VETERAN'S MILLAGE	222-272	000	28.53
					CHECK GENS 3851(A) TOTAL FOR FUND 703:			39,906.51
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	KENT COUNTY - INTEREST CALEDONIA	222-111	000	13.93
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	KENT COUNTY - INTEREST FHPS	222-111	000	632.04
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	KENT COUNTY - INTEREST LOWELL	222-111	000	114.93
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	CALEDONIA SET & OPERATING TAX (COUNTY)	228-001	000	230.68
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	FHPS SET & OPERATING TAX (COUNTY)	228-001	000	11,006.05
03/03/2017	GENS	3852(A)	SET 1626	KENT COUNTY TREASURER-SET	LOWELL SET & OPERATING TAX (COUNTY)	228-001	000	1,915.57
					CHECK GENS 3852(A) TOTAL FOR FUND 703:			13,913.20

04/04/2017 CHECK DISBURSEMENT REPORT FOR CASCADE CHARTER TOWNSHIP
CHECK DATE FROM 03/01/2017 - 03/31/2017
MARCH 2017 PAYABLES, PAYROLL, AND TRANSFERS

Check Date	Bank	Check #	Invoice	Payee	Description	Account	Dept	Amount
03/03/2017	GENS	3853(A)	KISD 1626	KENT INTERMEDIATE SCHOOLS	KENT ISD - TAXES	234-110	000	11,074.40
03/03/2017	GENS	3853(A)	KISD 1626	KENT INTERMEDIATE SCHOOLS	KENT ISD - TAXES INTEREST	234-111	000	641.94
CHECK GENS 3853(A) TOTAL FOR FUND 703:								11,716.34
03/03/2017	GENS	3854(A)	LOW 1626	LOWELL AREA SCHOOLS	LOWELL - OPERATING	226-110	000	1,358.00
03/03/2017	GENS	3854(A)	LOW 1626	LOWELL AREA SCHOOLS	LOWELL - INTEREST	226-111	000	160.18
03/03/2017	GENS	3854(A)	LOW 1626	LOWELL AREA SCHOOLS	LOWELL - DEBT	226-120	000	1,872.10
03/03/2017	GENS	3854(A)	LOW 1626	LOWELL AREA SCHOOLS	LOWELL BLDG/SITE	226-130	000	266.60
CHECK GENS 3854(A) TOTAL FOR FUND 703:								3,656.88
03/03/2017	GENS	65459	FIRE 1626	CASCADE CHARTER TOWNSHIP	CCT-INTEREST & PENALTY	214-111	000	210.48
03/03/2017	GENS	65459	FIRE 1626	CASCADE CHARTER TOWNSHIP	CCT - FIRE PP	214-115	000	4,296.42
03/03/2017	GENS	65459	FIRE 1626	CASCADE CHARTER TOWNSHIP	CCT - FIRE	214-115	000	16,494.81
03/03/2017	GENS	65459	FIRE 1626	CASCADE CHARTER TOWNSHIP	CCT - IFT FIRE	214-215	000	750.68
CHECK GENS 65459 TOTAL FOR FUND 703:								21,752.39
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - OPERATING TAXES	214-110	000	12,185.46
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - OPERATING TAXES PP	214-110	000	3,173.95
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT-INTEREST & PENALTY	214-111	000	160.69
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT-INTEREST & PENALTY	214-111	000	7,530.48
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - OVER/SHORT	214-112	000	(2.46)
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - STREET LIGHTS	214-140	000	522.00
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - ADMIN	214-155	000	2,583.70
03/03/2017	GENS	65460	GF 1626	CASCADE CHARTER TWP	CCT - IFT OPERATING TAXES	214-210	000	554.56
CHECK GENS 65460 TOTAL FOR FUND 703:								26,708.38
03/03/2017	GENS	65461	LIB 1626	CASCADE LIBRARY FUND	CCT-INTEREST & PENALTY	214-111	000	24.01
03/03/2017	GENS	65461	LIB 1626	CASCADE LIBRARY FUND	CCT - LIBRARY PP	214-120	000	490.00
03/03/2017	GENS	65461	LIB 1626	CASCADE LIBRARY FUND	CCT - LIBRARY	214-120	000	1,881.00
03/03/2017	GENS	65461	LIB 1626	CASCADE LIBRARY FUND	CCT-IFT LIBRARY	214-220	000	85.60
CHECK GENS 65461 TOTAL FOR FUND 703:								2,480.61
03/03/2017	GENS	65462	OS 1626	CASCADE CHARTER TOWNSHIP	CCT-INTEREST & PENALTY	214-111	000	36.70
03/03/2017	GENS	65462	OS 1626	CASCADE CHARTER TOWNSHIP	CCT OPEN SPACE	214-116	000	2,884.37
03/03/2017	GENS	65462	OS 1626	CASCADE CHARTER TOWNSHIP	CCT OPEN SPACE PP	214-116	000	751.32
03/03/2017	GENS	65462	OS 1626	CASCADE CHARTER TOWNSHIP	CCT OPEN SPACE IFT	214-216	000	131.27
CHECK GENS 65462 TOTAL FOR FUND 703:								3,803.66
03/03/2017	GENS	65463	PATH 1626	PATHWAYS FUND	CCT-PATHWAYS	214-100	000	4,997.66
03/03/2017	GENS	65463	PATH 1626	PATHWAYS FUND	CCT-PATHWAYS PP	214-100	000	1,301.71
03/03/2017	GENS	65463	PATH 1626	PATHWAYS FUND	CCT-INTEREST & PENALTY	214-111	000	63.81
03/03/2017	GENS	65463	PATH 1626	PATHWAYS FUND	CCT - IFT PATHWAYS	214-200	000	227.45
CHECK GENS 65463 TOTAL FOR FUND 703:								6,590.63
03/03/2017	GENS	65464	POL 1626	POLICE FUND	CCT-POLICE	214-105	000	5,757.66
03/03/2017	GENS	65464	POL 1626	POLICE FUND	CCT-POLICE PP	214-105	000	1,499.68
03/03/2017	GENS	65464	POL 1626	POLICE FUND	CCT-INTEREST & PENALTY	214-111	000	73.46
03/03/2017	GENS	65464	POL 1626	POLICE FUND	CCT - IFT POLICE	214-205	000	262.04
CHECK GENS 65464 TOTAL FOR FUND 703:								7,592.84
03/03/2017	GENS	65466	KDL 1626	KENT DISTRICT LIBRARY	KDL - TAXES	223-110	000	20,234.85
03/03/2017	GENS	65466	KDL 1626	KENT DISTRICT LIBRARY	KDL - TAX INTEREST	223-111	000	204.85
03/03/2017	GENS	65466	KDL 1626	KENT DISTRICT LIBRARY	KDL - IFT TAXES	223-210	000	730.60
CHECK GENS 65466 TOTAL FOR FUND 703:								21,170.30
03/03/2017	GENS	65467	MI 1626	STATE OF MICHIGAN	IFT SET & OPER TAX CALED OPER	228-201	000	4,792.79
Total for department 000:								273,684.58
Total for fund 703 CURRENT TAX COLLECTION FUND								273,684.58
TOTAL - ALL FUNDS								711,074.39

**1-INDICATES CHECK DISTRIBUTED TO MORE THAN ONE FUND
#1-INDICATES CHECK DISTRIBUTED TO MORE THAN ONE DEPARTMENT

Transactions Log for Payroll Deductions
MONTH ENDING: MARCH 2017

Direct Deposit

Date Submitted	<u>3.07.17</u>	Transaction#	<u>1325222</u>	Amount	<u>61,921.00</u>
Date Submitted	<u>3.21.17</u>	Transaction#	<u>1335701</u>	Amount	<u>52,385.99</u>
Date Submitted	_____	Transaction#	_____	Amount	_____

Deferred Comp

Date Submitted	<u>3.6.17</u>	Transaction#	<u>GBTV1</u>	Amount	<u>953.03</u>
Date Submitted	<u>3.20.17</u>	Transaction#	_____	Amount	<u>953.03</u>
Date Submitted	_____	Transaction#	_____	Amount	_____

Payroll Taxes

Date Submitted	<u>3.7.17</u>	Transaction#	<u>20295668</u>	Amount	<u>29,464.08</u>
Date Submitted	<u>3.21.17</u>	Transaction#	<u>80473428</u>	Amount	<u>24,863.64</u>
Date Submitted	_____	Transaction#	_____	Amount	_____

HSA

Date Submitted	<u>3.7.17</u>	Transaction#	<u>1325235</u>	Amount	<u>3121.96</u>
Date Submitted	<u>3.21.17</u>	Transaction#	<u>1335711</u>	Amount	<u>2818.00</u>
Date Submitted	_____	Transaction#	_____	Amount	_____

ICMA RC

Date Submitted	<u>3.7.17</u>	Transaction#	<u>1325232</u>	Amount	<u>541.00</u>
Date Submitted	<u>3.20.17</u>	Transaction#	<u>1335705</u>	Amount	<u>541.00</u>
Date Submitted	_____	Transaction#	_____	Amount	_____

MERS

Date Submitted	<u>3.20.17</u>	Transaction#	<u>00067800-2</u>	Amount	<u>30,807.70</u>
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Monthly Check Register - Gross

Date Submitted	<u>3.20.17</u>	Amount	<u>318,216.56</u>
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Clerk's Office

Date 3.20.17

76 18

TOWNSHIP BOARD MEMORANDUM

To: Cascade Charter Township Board
From: Sandra Korhorn, DDA/Economic Development Director *SKK*
Subject: Consider Pay Draw #1 for the Thornapple River Dr. Utility
Extension Project
Meeting Date: April 12, 2017

Attached is the contractor's application for payment #1 for the Thornapple River Dr. utility extension project. The pay application, pay estimate report and account balance are attached.

The amount due is \$26,923.50. The pay draw is for mobilization and tree removals in the work zone. The work completed and recommended for payment in this pay request has been reviewed and approved by FTCH.

Staff recommends approval of Pay Draw #1 in the amount of \$26,923.50 for the Thornapple River Dr. utility extension project.

Attachments: FTCH letter
Pay Draw #1



TRANSMITTAL

Ms. Sandra Korhorn
Cascade Charter Township
2865 Thornhills Avenue, SE
Grand Rapids, MI 49546-7192

April 4, 2017

Re: Cascade Charter Township
Thornapple River Drive Utility Extension

Project No. G150788CD

- FOR REVIEW
- FOR YOUR USE
- AS REQUESTED

Sent By: Michael L. Berrevoets, PE/jc2

COPIES	DATE	DESCRIPTION
1	4/4/2017	Application and Recommendation Payment No. 1

COMMENTS

We have reviewed the contractor's Application and Recommendation for Payment No. 1 for the period ending March 31, 2017, and find it in compliance with the work completed to date.

An executed copy of Application and Recommendation for Payment No. 1 is attached.

Please forward a copy, with payment, to the contractor, and keep a copy for your files.

By email

cc: Mr. Jeff Talsma - Kamminga & Roodvoets, Inc.

APPLICATION AND RECOMMENDATION FOR PAYMENT
 PAGE 1 OF 3

TO: Cascade Charter Township
 In Care of: Fishbeck, Thompson, Carr & Huber, Inc. (FTCH)
 1515 Arboretum Drive, SE
 Grand Rapids, MI 49546

FROM (Contractor): Kamminga & Roodvoets, Inc.
 3435 Broadmoor, SE
 Grand Rapids, MI 49512

Application No: 1
 Period From: March 1, 2017
 To: March 31, 2017

Project: Thornapple River Drive Utility Extension
 FTCH Project Number: G150788CD

APPLICATION FOR PAYMENT:

Application for Payment is made, as indicated below, in connection with the Contract. Schedule of Values sheet is attached as page 3 of 3.

1.	Original Contract Price	\$623,476.50
2.	Net change by Change Orders	\$0.00
3.	Current Contract Price (1 plus 2)	\$623,476.50
4.	Gross Amount Due (From Unit Price Schedule)	\$29,915.00
5.	Retainage (Per Agreement) 10%of Work Completed: \$2,991.50	
	Total Retainage	\$2,991.50
6.	Amount Eligible to Date (4 minus 5)	\$26,923.50
7.	Less Previous Payments	\$0.00
8.	Amount Due This Application (6 minus 7)	<u>\$26,923.50</u>

CHANGE ORDER SUMMARY:

Change Orders Approved by Owner	ADDITIONS	DEDUCTIONS
Change Order No. 1 Change Order No. 2 Change Order No. 3 Change Order No. 4 Change Order No. 5		
Net Change by Change Orders	\$0.00	\$0.00

APPLICATION AND RECOMMENDATION FOR PAYMENT
PAGE 2 OF 3

CONTRACTOR'S CERTIFICATION:

The undersigned Contractor certifies that to the best of its knowledge (1) all previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment; (2) title of all Work, materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest or encumbrances); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Dated APRIL 4, 2017
Contractor KAWMURA + BERREVOETS INC
By [Signature]
(Signature)
DANIEL BERREVOETS, PROJECT MGR
Name and Title of Signatory

ENGINEER'S RECOMMENDATION:

To: Cascade Charter Township

In accordance with the Contract, the undersigned recommends payment to Contractor.

AMOUNT RECOMMENDED: \$26,923.50
(Attach explanation if amount recommended differs from the amount applied for.)

ENGINEER: Fishbeck, Thompson, Carr & Huber, Inc.

Dated APR 4, 2017 By [Signature]
(Signature)
Mike Berrevoets, PE, Project Manager
Name and Title of Signatory

This Recommendation is not negotiable. The AMOUNT RECOMMENDED is payable only to Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of Owner or Contractor under this Contract.

This recommendation for payment is based on a review of the Work performed as compared to the amount of the application. This recommendation does not imply that Engineer is reviewing construction lien documents nor does it imply that Engineer is acting as a guarantor of the property. Any review of construction lien documents by Engineer is for information purposes only.

APPLICATION AND RECOMMENDATION FOR PAYMENT
PAGE 3 OF 3

TO: Cascade Charter Township
In Care of: Fishbeck, Thompson, Carr & Huber, Inc. (FTCH)
1515 Arboretum Drive, SE
Grand Rapids, MI 49546

FROM (Contractor): Kamminga & Roodvoets, Inc.
3435 Broadmoor, SE
Grand Rapids, MI 49512

Application No: 1
Period From: March 1, 2017
To: March 31, 2017

Project: Thornapple River Drive Utility Extension
FTCH Project Number: G150788CD

Unit Price Schedule

See attached Construction Pay Estimate Report and Construction Pay Estimate Amount Balance Report.

Gross Amount Due	\$29,915.00
Less 10% Retainage	\$2,991.50
Amount Due to Date	\$26,923.50
Less Previous Payments Recommended	\$0.00
Amount Due This Application	\$26,923.50



Construction Pay Estimate Report

Fishbeck, Thompson, Carr & Huber, Inc.

4/4/2017 8:40 AM

FieldManager 5.2a

Contract: _G150788CD, Thornapple River Dr Utility Extension

Estimate Date	Estimate No.	Entered By	Estimate Type	Electronic File Created	All Contract Work Completed	Construction Started Date
04/04/2017	1	Michael L Berrevoets	Semi-Monthly	No		
Prime Contractor Kammaing & Roodvoets, Inc.				Managing Office Fishbeck, Thompson, Carr & Huber, Inc.		
Comments						
Pay Application #1						

Item Usage Summary

Item Description	Item Code	Prop. Line	Project	Category	Project Line No.	Item Type	Mod. No.	Quantity	Dollar Amount
Maintaining Traffic	_3622003	0003	G150788CD	0001	0015	00	000	0.200	\$2,580.00
Mobilization (5% Maximum of Total Bid)	_3622001	0001	G150788CD	0001	0005	00	000	0.200	\$6,220.00
Remove Tree, 19-inch to 36-inch Diameter	_3622008	0008	G150788CD	0001	0040	00	000	12.000	\$6,600.00
Remove Tree, 6-inch to 18-inch Diameter	_3622007	0007	G150788CD	0001	0035	00	000	47.000	\$13,865.00
Soil Erosion and Sedimentation Control	_3622004	0004	G150788CD	0001	0020	00	000	0.200	\$650.00

Total Estimated Item Payment: \$29,915.00

Time Charges

Site	Site Description	Site Method	Days Charged	Liq. Damages
00	Overall Contract Site	Completion Date		\$0
Total Liquidated Damages:				\$0

Pre-Voucher Summary

Project	Voucher No.	Item Payment	Stockpile Adjustment	Dollar Amount
G150788CD, Thornapple River Dr Utility Extension	0001	\$29,915.00	\$0.00	\$29,915.00
Voucher Total:				\$29,915.00



Construction Pay Estimate Report

Fishbeck, Thompson, Carr & Huber, Inc.

4/4/2017 8:40 AM

FieldManager 5.2a

Summary

Current Voucher Total:	\$29,915.00	Earnings to date:	\$29,915.00
-Current Retainage:	\$2,991.50	- Retainage to date:	\$2,991.50
-Current Liquidated Damages:	\$0.00	- Liquidated Damages to date:	\$0.00
-Current Adjustments:	\$0.00	- Adjustments to date:	\$0.00
Total Estimated Payment:	\$26,923.50	Net Earnings to date:	\$26,923.50
		- Payments to date:	\$0.00
		Net Earnings this period:	\$26,923.50

Estimate Certification

Kevin Kietzman, PE (Project Engineer)

(Date)

(Construction Engineer)

(Date)



Construction Pay Estimate Amount Balance Report

Estimate: 1

4/4/2017 8:40 AM

Fishbeck, Thompson, Carr & Huber, Inc.

FieldManager 5.2a

Contract: _G150788CD, Thornapple River Dr Utility Extension

Item Description	Item Code	Prop. Line	Project	Category	Authorized Quantity	Quantity This Estimate	Qty. Paid To Date	Total Qty. Placed	% Cpt	Unit Price	Dollar Amt. Paid To Date
1" water service	_362202	E 0029	G150788CD	0001	475.000		0.000			33.00000	
10" Sanitary Sewer D-2680	_362203	E 0033	G150788CD	0001	1,050.000		0.000			80.00000	
12" 11.25 Degree Bend	_362202	A 0024	G150788CD	0001	3.000		0.000			825.00000	
12" Plug	_362202	E 0028	G150788CD	0001	1.000		0.000			600.00000	
12" Sleeve	_362202	E 0026	G150788CD	0001	1.000		0.000			2,000.00000	
12" Valve and Box	_362201	E 0015	G150788CD	0001	2.000		0.000			2,400.00000	
12" Water Main (DI CL53)	_362201	E 0012	G150788CD	0001	1,025.000		0.000			89.00000	
12"x12"x6" Tee	_362202	C 0020	G150788CD	0001	3.000		0.000			1,100.00000	
4' Dia. Sanitary manhole, per Detail S-1	_362203	A 0034	G150788CD	0001	7.000		0.000			3,100.00000	
5" Hydrant	_362201	E 0016	G150788CD	0001	4.000		0.000			2,500.00000	
6" 90 Degree Bend	_362202	1 0021	G150788CD	0001	1.000		0.000			450.00000	
6" Sanitary Sewer Lateral (PVC SDR 23.5)	_362203	E 0035	G150788CD	0001	480.000		0.000			38.00000	
6" tee/wye on 10" Sanitary Sewer	_362203	E 0036	G150788CD	0001	13.000		0.000			400.00000	
6" Valve and Box	_362201	E 0013	G150788CD	0001	4.000		0.000			1,250.00000	
6" Water Main (DI CL53)	_362201	C 0010	G150788CD	0001	45.000		0.000			65.00000	
8" 22.5 Degree Bend	_362202	A 0022	G150788CD	0001	2.000		0.000			575.00000	
8" 45 Degree Bend	_362202	E 0023	G150788CD	0001	2.000		0.000			600.00000	
8" Plug	_362202	7 0027	G150788CD	0001	2.000		0.000			425.00000	
8" Sleeve	_362202	E 0025	G150788CD	0001	2.000		0.000			1,250.00000	
8" Valve and Box	_362201	A 0014	G150788CD	0001	4.000		0.000			1,500.00000	
8" Water Main (DI CL53)	_362201	1 0011	G150788CD	0001	435.000		0.000			80.00000	
8"x8"x6" Tee	_362201	E 0018	G150788CD	0001	1.000		0.000			750.00000	
8"x8"x8" Tee	_362201	E 0019	G150788CD	0001	2.000		0.000			800.00000	
Aggregate Base, 6-inch	_362204	E 0046	G150788CD	0001	4,325.000		0.000			8.00000	
Asphalt Driveway Approach, 3-inch	_362205	1 0051	G150788CD	0001	150.000		0.000			85.00000	

Contract: _G150788CD

Estimate: 1

Page 1 of 3



Construction Pay Estimate Amount Balance Report

Estimate: 1

4/4/2017 8:40 AM

FieldManager 5.2a

Fishbeck, Thompson, Carr & Huber, Inc.

Item Description	Item Code	Prop. Line	Project	Category	Authorized Quantity	Quantity This Estimate	Qty. Paid To Date	Total Qty. Placed	% Cpt	Unit Price	Dollar Amt. Paid To Date
Bituminous Pavement, 3C (2.0")	_3622047	0047	G150788CD	0001	440.000		0.000			65.00000	
Bituminous Pavement, 5E1 (1.5")	_3622048	0048	G150788CD	0001	330.000		0.000			68.00000	
Cash Allowances - Testing	_3622002	0002	G150788CD	0001	15,000.000		0.000			1.00000	
Catch Basin, 2-foot Diameter	_3622040	0040	G150788CD	0001	1.000		0.000			1,750.00000	
Concrete Driveway Approach, 6-inch	_3622050	0050	G150788CD	0001	1,350.000		0.000			3.75000	
Core and Boot 10" Sewer into Manhole or Sewer	_3622037	0037	G150788CD	0001	1.000		0.000			1,100.00000	
Curb Stop and box on 1" water service	_3622031	0031	G150788CD	0001	14.000		0.000			450.00000	
Flared End Section, 12-inch	_3622041	0041	G150788CD	0001	11.000		0.000			600.00000	
Hydrant Extension	_3622017	0017	G150788CD	0001	3.000		0.000			550.00000	
Maintaining Traffic	_3622003	0003	G150788CD	0001	1.000	0.200	0.200	0.200	20%	12,900.00000	\$2,580.00
Miscellaneous Work Allowance	_3622055	0055	G150788CD	0001	15,000.000		0.000			1.00000	
Mobilization (5% Maximum of Total Bid)	_3622001	0001	G150788CD	0001	1.000	0.200	0.200	0.200	20%	31,100.00000	\$6,220.00
Pavement Markings	_3622052	0052	G150788CD	0001	3,600.000		0.000			0.39000	
Remove Concrete Drive Approach	_3622006	0006	G150788CD	0001	140.000		0.000			7.00000	
Remove Pavement	_3622005	0005	G150788CD	0001	3,800.000		0.000			2.00000	
Remove Tree, 19-inch to 36-inch Diameter	_3622008	0008	G150788CD	0001	14.000	12.000	12.000	12.000	86%	550.00000	\$6,600.00
Remove Tree, 6-inch to 18-inch Diameter	_3622007	0007	G150788CD	0001	40.000	47.000	47.000	47.000	118%	295.00000	\$13,865.00
Remove, Salvage and Place Street Sign	_3622009	0009	G150788CD	0001	3.000		0.000			65.00000	
Roadway Grading	_3622044	0044	G150788CD	0001	11.000		0.000			2,075.00000	
Soil Erosion and Sedimentation Control	_3622004	0004	G150788CD	0001	1.000	0.200	0.200	0.200	20%	3,250.00000	\$650.00
Storm Sewer, 12-inch	_3622039	0039	G150788CD	0001	175.000		0.000			40.00000	
Storm Sewer, 8-inch	_3622038	0038	G150788CD	0001	80.000		0.000			50.00000	

Contract: _G150788CD

Estimate: 1

Page 2 of 3



Construction Pay Estimate Amount Balance Report

Estimate: 1

4/4/2017 8:40 AM

Fishbeck, Thompson, Carr & Huber, Inc.

FieldManager 5.2a

Item Description	Item Code	Prop. Line	Project	Category	Authorized Quantity	Quantity This Estimate	Qty. Paid To Date	Total Qty. Placed	% Cpt	Unit Price	Dollar Amt. Paid To Date
Structure Casting, Adjust	_3622042	0042	G150788CD	0001	2.000		0.000			500.00000	
Subbase	_3622045	0045	G150788CD	0001	1,380.000		0.000			8.00000	
Subbase Underdrain, 6-inch	_3622043	0043	G150788CD	0001	2,160.000		0.000			4.00000	
Subgrade Undercutting	_3622049	0049	G150788CD	0001	500.000		0.000			9.00000	
Tap for 1" water service, including corporation stop	_3622030	0030	G150788CD	0001	14.000		0.000			300.00000	
Temporary Gravel	_3622056	0056	G150788CD	0001	1.000		0.000			750.00000	
Turf Establishment	_3622053	0053	G150788CD	0001	5,600.000		0.000			1.50000	
Turf Reinforcement Mat	_3622054	0054	G150788CD	0001	2,200.000		0.000			3.00000	
Valve Box	_3622032	0032	G150788CD	0001	1.000		0.000			300.00000	
Percentage of Contract Completed(curr): 5%							Total Amount Paid This Estimate:			\$29,915.00	
(total paid to date / total of all authorized work)							Total Amount Paid To Date:			\$29,915.00	

Cascade Charter Township
Thomapple Hills Drain
Project Number G130842

APPLICATION AND RECOMMENDATION FOR PAYMENT
PAGE 2 OF 3

CONTRACTOR'S CERTIFICATION:

Undersigned Contractor certifies that (1) all previous progress payments received from Owner on account of Work done under the Contract referred to above have been applied to discharge Contractor's legitimate obligations incurred in connection with Work covered by prior Applications for Payment numbered 1 through 1 inclusive; and (2) title to all materials and equipment incorporated in said Work or otherwise listed in or covered by this Application for Payment will pass to Owner at time of payment free and clear of all Liens, security interests and encumbrances (except such as covered by a Bond acceptable to Owner indemnifying Owner against any such Lien, security interest or encumbrance); and (3) all Work covered by this Application for Payment is in accordance with the Contract Documents and not defective.

Dated 3-13-17, 20

Jackson Dirt Works

By [Signature]
(Signature)

Ross Jackson Pres.
Name and Title of Signatory

ENGINEER'S RECOMMENDATION:

To: Cascade Charter Township

In accordance with the Contract, the undersigned recommends payment to Contractor.

AMOUNT RECOMMENDED:\$102,546.00
(Attach explanation if amount recommended differs from the amount applied for.)

ENGINEER: Fishbeck, Thompson, Carr & Huber, Inc.

Dated 3/14/2017, 20

By [Signature]
(Signature)

Cheryl L. Pitchford, Project Manager

This Recommendation is not negotiable. The AMOUNT RECOMMENDED is payable only to Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of Owner or Contractor under this Contract.

-01



CASCADE CHARTER TOWNSHIP

2865 Thornhills SE Grand Rapids, Michigan 49546-7140

Date: April 12th, 2017
To: Supervisor Beahan and Township Board Members
From: Ben Swayze, Township Manager
Subject: Request for Additional Use of Burton Park Entranceway Easement

FACTS:

In the fall of 2016 Cascade Township received a request from the Merestone Group, on behalf of property owner Dave Kooistra, to split the property located at 6081 Burton Street (commonly known as the Tassel Estate). This parcel is currently served by a shared easement for ingress and egress, which is further subject to a consent agreement that the two property owners are a party to. Because a property split would result in two or more buildable parcels, the Township zoning ordinance requires that the drive servicing the parcels meet the requirements of the Township private street ordinance. Because the current private drive is in a shared easement with the Township, and because the subject property sits in an island of Township property (Burton Park), the property owner will need the Township's permission to upgrade the drive to private street standards and utilize the drive to access the additional parcels.

The Township originally received a request from the Merestone Group to upgrade the private drive to a private street to serve a total of six property splits. At that time the Infrastructure Committee requested that the applicant hold a meeting with the surrounding property owners to gather feedback on the proposed development before the Infrastructure Committee made a recommendation whether or not to grant the request. The meeting was not held, and in late December the Township received a revised request from the Merestone Group asking for two splits rather than the original six.

For the current request, the Township is considering the request as a property owner and not as a regulatory agency. Should the Merestone Group be granted the request to upgrade the private drive to meet private street standards, they will still need to apply to the Township as a regulatory agency for the requested splits.

Attached for your review are:

- Letter of Request from The Merestone Group on behalf of Dave Kooistra
- Letter from property owner Dave Kooistra
- Project Drawings

ANALYSIS & CONCLUSIONS:

The Infrastructure Committee received the revised request from the Merestone Group in late December and reviewed the request at their January meeting. At that time they did not make a recommendation, but requested further information from the developer including:

- Detail design of the proposed private street improvements.

- Detail design of required Stormwater improvements to accommodate upgraded private street.
- Clarification on the use of the splits parcels and, if applicable, a site plan indicating where on the new parcels any houses may be located.
- A commitment from the applicant to amend the consent agreement on the shared easement to remove the signage requirements
- A commitment from the applicant to assist in relocating the park signage to an area closer to the Burton Street entrance.

The applicant delivered the requested materials to the Township in late February and the Infrastructure Committee reviewed the submitted materials at their March meeting. After reviewing the requested materials, the Infrastructure Committee has recommended that the Township Board approve the request to upgrade the private drive to a private street based on the following conditions:

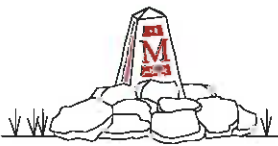
- Usage of the private drive for a private street is for only the two splits as requested. Any further splits must ask for further permission.
- All required upgrades must take place solely on applicant's property and not on Township property.
- Applicant agrees to amend the consent agreement to eliminate the signage requirements
- Applicant agrees to assist in relocating the park signage to an area closer to the Burton Street entrance.

FINANCIAL CONSIDERATIONS:

There are no financial ramifications in approving the request. The costs of the required upgrades are solely those of the applicant.

RECOMMENDED ACTION:

Approve the request from the Merestone Group to allow for the upgrade of the Burton Park private Drive to private street standards, subject to the conditions recommended by the Infrastructure Committee and an agreement memorializing said conditions to be approved by the Township Attorney.



"The Point of Beginning for all
your development dreams"

The Merestone Group

LAND PLANNING • PROJECT MANAGEMENT

January 30, 2017

Ben Swayze
Cascade Township Manager
2865 Thornhills Ave. S.E.
Grand Rapids, Mi 49546-7192

Re; 6801 Burton Street Parcel Splits

Dear Ben

Enclosed find three copies of the revised drawing for the land divisions for 6801 Burton parcel per your e-mail on January 10, 2017 and our meeting with you on January 17, 2017.

Private Street

The private street section detail is shown on the plan and will provide two nine foot lanes, and two feet shoulders on each side. The right of way will be sixty six feet. The current surface is approximately sixteen feet. The private street will be centered on the easement and will be approximately 350 linear feet long. The turnaround will be located on the end on the owner's property and have a 60 feet radius on the easement and 40 feet on the asphalt. The private street will have roadside ditches on both sides of the street within the easement and will be detained in an easement basin on the south west corner of the property.


Proposed Home sites

The proposed locations of the home sites are located on the plans. On January 20, 2017 we were on the site with the KCHD doing soil evaluations and were able to find suitable soils for the additional sites. Copies of KCHD reports are enclosed.

Signage

Owner would be willing to modify the consent judgments to remove the signage requirement

Please contact us if you have any questions or need any additional information.

Sincerely

Ron Van Singel
The Merestone Group

cc: Dave Kooistra
Steve Peterson



01/31/2017

Dear Cascade Township,

Thank you for considering these splits.

As the property owner of 6801 Burton St. SE, Grand Rapids MI 49546 I am willing to remove and/or modify the consent judgement that is currently in place. There are several large "NO TRESPASSING" signs that could be removed or reduced in size. I am very open to working through the details to re-write this as you see fit.

My thought is to sell the existing home with roughly 5 acres and to build on the middle 8 acre lot. I have a friend interested in building on the two acre lot. Both homes will be extremely high quality. The house plans I am working on right now are about 3,500-4,000 above grade plus another 1,500-2,000 finished in lower level with 4 stalls of upper garage and at least 1-2 lower stalls. Right now the land is pretty scrappy looking with over-grown vines that are choking out any decent trees on the property. I look forward to grooming this property and making improvements to the area.

The locations that perked are approximately marked on the survey. These locations offer the most privacy for new homes as well as existing homes. I spent many hours in the woods considering the potential and thought the proposed to be highest and best use with the least intrusion to surrounding homes. There is still a very decent buffer and in the middle of winter the other homes are barely visible. From the existing drive there is a nice pine buffer for the 2 acre lot and the 8 acre home site drops slightly behind a ridge.

I am easy to work with and open to any additional suggestions on improving the area.

Talk to you soon.

Sincerely,

A handwritten signature in blue ink that reads "Dave Kooistra".

Dave Kooistra
Apex Realty Group



Onsite Residential Site Evaluation

Kent County Health Department
700 Fuller Avenue NE - Grand Rapids, Michigan 49503
616-632-6900 (ph) 616-632-6892 (fax) kchdmail@kentcountymi.gov

This is not a permit for installation and may not be used for the issuance of a building permit.

Location/Address: 6801 Burton St SE Permanent Parcel No.: 41-19-09-201-007
 City, Village, or Twp: Cascade Subdivision & Lot No.: n/a
 Owner: Dave Koolstra Phone No: (616) 485-3435 E-mail: davek@soldbyapex.com
 Address: 6801 Burton St SE City: Grand Rapids State: MI Zip Code: 49546

It shall be unlawful for any sewage dispersal facility to be constructed, repaired, enlarged, or relocated without the issuance of a permit for such by the Kent County Health Department. This site evaluation is valid for two years from the date of issuance of the site evaluation. Application for an onsite waste water dispersal permit is required.

Proposed Building Information: No. Of Bedrooms: ?

Proposed Site Details

Soil Texture: Various

Isolation Requirements:
50 Ft. to surface water(s)
10 Ft. from lot lines
25 Ft. Other Drained from footing drains

Permit Type & Fee:*

Conventional System - \$250
 Low pressure dose mound - \$400
 Alternative System - \$600

*Fees will be assessed to the current fee schedule and may be subject to change.

Comments and Site Specification:

Water Supply:
 Water quality may vary dramatically in short distances. A water quality device may be necessary. Wells in the area are generally between 70 and 150 feet deep.

Septic System:
 Soil boring location 1 had sandy loam to 2.5 feet over sandy clay loam and silty clay loam to 11 feet. Mottling, an indicator of seasonal water level, was not present. Soil boring location 2 had sandy loam to 4 feet over sandy clay loam to 10 feet. Mottling was present 4 feet below the surface. Soil boring location 5 had sandy loam to 6 feet over sandy clay loam to 11 feet. Mottling was present at 4 feet below the surface. Soil boring location 6 had sandy loam to 3 feet over sandy clay loam to 7 feet. Mottling was present 5 feet below the surface.

Soil boring location 3 had sandy loam topsoil over sandy clay loam to 10 feet. Mottling was present 6 feet below the surface. Soil boring location 4 had sandy loam to 4 feet over sandy clay loam and silty loam to 9 feet. Below the silty loam from 9 to 10 feet was well-drained sand. Mottling was not present.

Soil borings in locations 1, 2, 3, 4, 5, and 6 found permeable soils to depths of 2 to 4 feet. These areas are suitable for a pressurized mound septic system with site modification including, but not limited to, sand fill beneath the drainedbed. Soil boring location 4 found sand from 9 to 10 feet. Further exploration is necessary to evaluate the deeper soils for the possibility of a partial cut down (T-trench) septic system.

The exact location and design of the system will be determined at the time a permit application is received. An approved application will contain a detailed site plan and survey, including all easements, as well as plans for the proposed dwelling.

Site evaluation determinations are contingent upon proposed site plan and site conditions at the time of the evaluation. This determination is subject to change in the event that the site conditions no longer exist or proposed site plan is no longer supportable due to substantial change from the time of the initial evaluation.

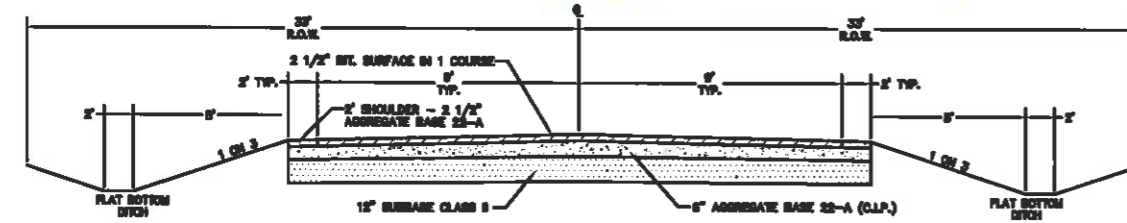
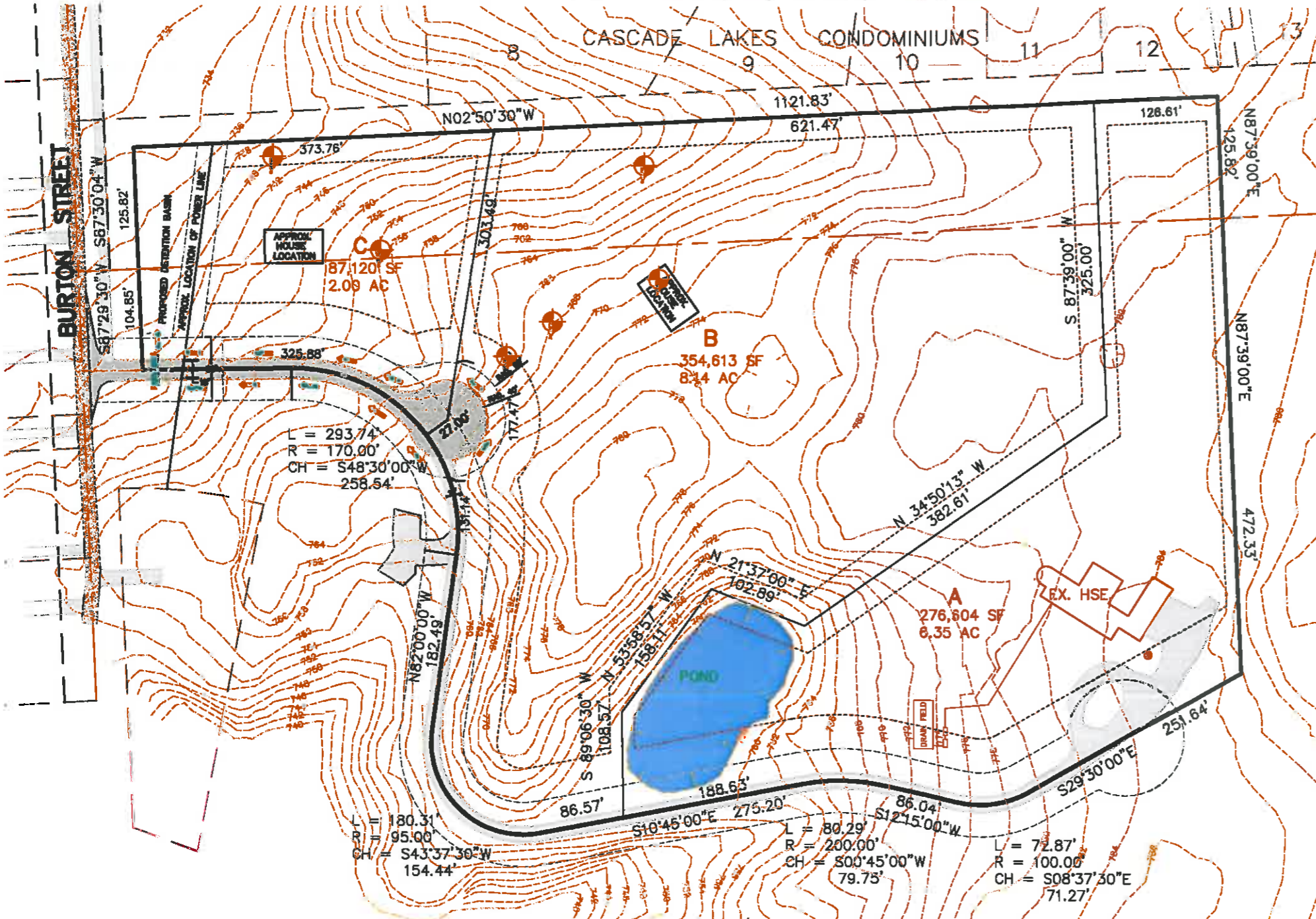
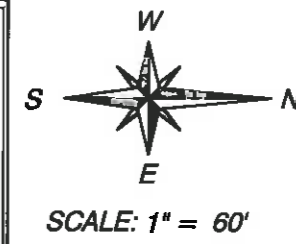
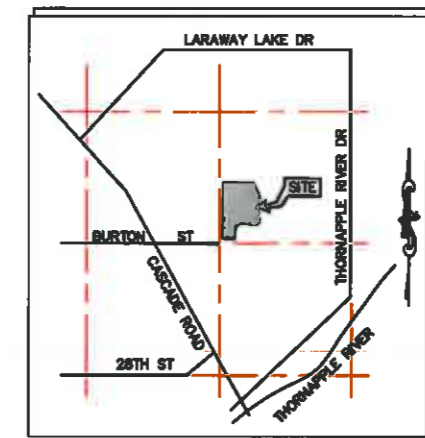
See Attached Sketch For Location Details and Additional Information.

Signature of Sanitarian: Rusty Flewelling III Date Issued: 1/31/2017

6801 BURTON STREET LAND DIVISIONS

CASCADE TOWNSHIP, KENT CO., MICHIGAN

SECTION 9, T6N, R10W



PRIVATE STREET SECTION
NOT TO SCALE

LOCATION MAP
NO SCALE

GENERAL NOTES

- 6801 BURTON STREET - PP# 41-19-09-201-007
- ZONING REQUIREMENTS
CURRENT ZONE: R-1 SINGLE FAMILY RESIDENTIAL
 - MINIMUM UNIT SIZE: 40,000 SQ. FT.
MINIMUM UNIT FRONTAGE: 110 FT.
SETBACK REQUIREMENTS
FRONT YARD = 35 FT.
SIDE YARD = 10 FT./ 25 FT.
REAR YARD = 25 FT.
 - GENERAL REQUIREMENTS
 - THIS PROPERTY WILL BE DEVELOPED AS SINGLE FAMILY PARCELS WITH A PRIVATE STREET BUILT TO THE STANDARDS OF CASCADE TOWNSHIP AND/OR THE KENT COUNTY ROAD COMMISSION.
 - THE SITE WILL BE SERVED BY PRIVATE WELLS AND SEPTIC SYSTEMS.
 - THE SITE WILL ALSO BE SERVED BY UNDERGROUND ELECTRIC, TELEPHONE, GAS AND CABLE TV.

LEGAL DESCRIPTION

6801 BURTON STREET - PP# 41-19-09-201-007

THAT PART OF THE NW 1/4 AND THAT PART OF THE NE 1/4, SECTION 9, T6N, R10W, CASCADE TOWNSHIP, KENT COUNTY, MICHIGAN, DESCRIBED AS: BEGINNING AT A POINT ON THE WEST LINE OF SAID NE 1/4 WHICH IS S02°50'30"E 1456.85 FEET FROM THE N 1/4 CORNER OF SECTION 9; THENCE N87°39'00"E 472.33 FEET; THENCE S29°30'00"E 251.64 FEET; THENCE SOUTHERLY 72.87 FEET ON A 100.00 FOOT RADIUS CURVE TO THE RIGHT, THE CHORD OF WHICH BEARS S08°37'30"E 71.27 FEET; THENCE S12°15'00"W 86.04 FEET; THENCE SOUTHERLY 80.29 FEET ON A 200.00 FOOT RADIUS CURVE TO THE LEFT, THE CHORD OF WHICH BEARS S00°45'00"W 79.75 FEET; THENCE S10°45'00"E 275.20 FEET; THENCE SOUTHERLY AND WESTERLY 180.31 FEET ON A 95.00 FOOT RADIUS CURVE TO THE RIGHT, THE CHORD OF WHICH BEARS S43°37'30"W 154.44 FEET; THENCE N82°00'00"W 182.48 FEET; THENCE WESTERLY AND SOUTHERLY 293.74 FEET ON A 170.00 FOOT RADIUS CURVE TO THE LEFT, THE CHORD OF WHICH BEARS S48°30'00"W 258.54 FEET; THENCE S01°00'00"E 163.64 FEET; THENCE S87°29'30"W 104.85 FEET PARALLEL WITH THE SOUTH LINE OF SAID NE 1/4 TO THE WEST LINE OF SAID NE 1/4; THENCE S87°30'04"W 125.82 FEET PARALLEL WITH THE SOUTH LINE OF SAID NW 1/4; THENCE N02°50'30"W 1121.83 FEET; THENCE N87°39'00"E 125.82 FEET TO THE PLACE OF BEGINNING, SUBJECT TO AND TOGETHER WITH AN EASEMENT FOR INGRESS, EGRESS AND UTILITIES DESCRIBED AS: COMMENCING AT THE N 1/4 CORNER OF SECTION 9; THENCE S02°50'30"E 2644.35 FEET ALONG THE WEST LINE OF THE NE 1/4, SECTION 9 TO THE CENTER OF SECTION 9; THENCE N87°29'30"E 102.82 FEET ALONG THE SOUTH LINE OF SAID NE 1/4 TO THE PLACE OF BEGINNING OF THE CENTERLINE OF A 68.00 FOOT WIDE STRIP OF LAND; THENCE N01°00'00"W 216.56 FEET; THENCE NORTHERLY AND EASTERLY 293.74 FEET ALONG A 170.00 FOOT RADIUS CURVE TO THE RIGHT, THE CHORD OF WHICH BEARS N48°30'00"E 258.54 FEET; THENCE S82°00'00"E 182.48 FEET; THENCE EASTERLY AND NORTHERLY 180.31 FEET ON A 95.00 FOOT RADIUS CURVE TO THE LEFT, THE CHORD OF WHICH BEARS N43°37'30"E 154.44 FEET; THENCE N10°45'00"W 275.20 FEET; THENCE NORTHERLY 80.29 FEET ON A 200.00 FOOT RADIUS CURVE TO THE RIGHT, THE CHORD OF WHICH BEARS N00°45'00"E 79.75 FEET; THENCE N12°15'00"E 86.04 FEET; THENCE NORTHERLY 72.87 FEET ON A 100.00 FOOT RADIUS CURVE TO THE LEFT, THE CHORD OF WHICH BEARS N08°37'30"W 71.27 FEET; THENCE N29°30'00"W 115.00 FEET TO THE PLACE OF ENDING OF THE CENTERLINE OF SAID 68.00 FOOT WIDE STRIP OF LAND. ALSO, AN EASEMENT FOR INGRESS, EGRESS AND UTILITIES OVER A 60.00 FOOT RADIUS CIRCLE, THE CENTER OF WHICH IS THE PLACE OF ENDING OF THE ABOVE DESCRIBED 68.00 FOOT WIDE STRIP OF LAND.

PREPARED FOR:
DAVE KOOISTRA
8375 RIDGESTONE DR.
BYRON CENTER, MI 49315
PH: (616) 485-3435

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Rule Engineering
1000 Lakeshore Dr. N
Farmington Hills, MI 48334
Tel: (248) 850-1100
Fax: (248) 850-1101

BURTON'S
Surveying
1000 Lakeshore Dr. N
Farmington Hills, MI 48334
Tel: (248) 850-1100
Fax: (248) 850-1101

The Merestone Group
8375 Ridgestone Drive NW, Byron Center, MI 49315
Tel: (616) 370-9000, Fax: (616) 370-9001

LAND PLANNING - PROJECT MANAGEMENT

6801 BURTON STREET LAND DIVISIONS
PART OF THE NE 1/4, SECTION 9, T6N, R10W
CASCADE TOWNSHIP, KENT COUNTY, MI

PRELIMINARY PLAN

ISSUE DATE
3/29/16
7/13/16
8/10/16
01/21/17

DRAWN BY: LEEK

PROJECT NO: 1607401

FILE NAME: L1

SHEET NO: 1 OF 1



CASCADE CHARTER TOWNSHIP

2865 Thornhills SE Grand Rapids, Michigan 49546-7140

Date: April 12th, 2017
To: Supervisor Beahan and Township Board Members
From: Ben Swayze, Township Manager
Subject: Contract with Hamilton Helicopter Inc. for Gypsy Moth Suppression Services

FACTS:

In the fall of 2016 Cascade Township contracted with Aquatic Consulting Services LLC to conduct gypsy moth egg mass surveys to determine areas that require aerial spraying for 2017. As a result of that survey, it has been recommended that approximately 433 acres of the Township be sprayed for gypsy moth suppression. The proposed spray blocks have been further broken down into Priority "A" blocks totaling 305 acres and Priority "B" blocks totaling 128 acres. Priority "A" blocks are recommended for spray in Spring 2017 as potential for nuisance and tree damage is quite high. Priority "B" blocks are also recommended for spraying as financing permits. If left untreated, it is highly recommended that monitoring continue as the potential for nuisance and tree damage is still a concern.

The Township had utilized Mid-Michigan Helicopter Inc. for Gypsy Moth Suppression services since the onset of our program until 2015. In 2015 Mid-Michigan Helicopter was bought by Hamilton Helicopter, and they have overseen our spraying program for the last two years. Our spray program last year was successful with no known issues reported from the contractor or residents in the affected areas. The Township last sprayed for gypsy moths in spring of 2016, when we sprayed 384 acres. The follow up report from Aquatic Consulting Services in summer of 2016 indicated the spray program was successful in suppressing the gypsy moth population in a majority of the indicated spray areas. A portion of one area sprayed last year will need to be sprayed again this year, possibly a result of residents who chose to opt their properties out of the program.

The proposed contract would provide for gypsy moth suppression services for the Township at a cost of \$63.85 per acre, which is a \$0.85 per acre increase (1.35%) from 2016. The cost to spray the entire recommended area would be \$27,647.05. If the Township chooses only to spray the "Priority "A" areas, the cost to spray would be \$19,474.25. The program will take place in the time period between May 1st and June 15th, with a more specific date to be available when the weather breaks. The Township is required to notify all residences in the spray block areas of the program. Any objectors to the spray program are eligible to be removed from the spray block at the discretion of the Township.

Attached for your review are:

- Proposed agreement with Hamilton Helicopter Inc. for Gypsy Moth Suppression Services.
- Map of the proposed spray blocks for 2017
- Gypsy Moth information brochure published by the MSU Extension
- Information regarding Bacillus Thuringiensis pesticide.

ANALYSIS & CONCLUSIONS:

The Township has participated in the gypsy moth spray program in conjunction with Mid-Michigan Helicopter Inc/Hamilton Helicopter and Aquatic Consulting Services going on 19 years. The Township has participated in the program because of the acknowledgement of the devastating effect the gypsy moth population could have on the tree canopy cover of the Township.

The partnership with both Aquatic Consulting Resources and Hamilton Helicopters Inc. has allowed us to efficiently allocate our financial resources to this program. The survey ensures that the aerial spray program effectively targets areas of infestation above the set thresholds, and on several occasions has saved us from unnecessarily spraying, as was the case in 2013 and 2010-11

FINANCIAL CONSIDERATIONS:

The proposed agreement with Hamilton Helicopter Inc. is for a rate of \$63.85 per acre, which is \$0.85 per acre more than the 2016 contract. If the Township chooses to spray the entire recommended area, the cost of the program would come to \$27,647.05. If the Township chooses only to spray the "Priority "A" areas, the cost to spray would be \$19,474.25. The Township has budgeted \$25,000 for this program in 2017, so a budget amendment in the amount of \$2,648 will be needed if the Township chooses to spray the entire recommended area.

RECOMMENDED ACTION:

Approve the agreement with Hamilton Helicopter Inc. for Gypsy Moth Suppression Services to spray 433 acres at a cost of \$27,647.05

or

Approve the agreement with Hamilton Helicopter Inc. for Gypsy Moth Suppression Services to spray 305 acres at a cost of \$19,474.25

GYPSY MOTH SUPPRESSION SERVICES AGREEMENT

This agreement is made as of _____. 2017, between Cascade Charter Township, a Michigan municipal corporation at 2865 Thornhills Ave. SE, Grand Rapids Michigan. 49546. (Hereafter referred to as the Township), and Hamilton Helicopter Inc. (hereafter referred to as Hamilton Helicopters).

Whereas the Township desires to control the gypsy moth population within its boundaries, and Hamilton Helicopters is interested in and capable of participating in a Gypsy moth suppression program with the Township.

NOW, therefore, the parties agree as follows.

- A With regard to the gypsy moth suppression program, the Township shall provide or arrange for the following to be performed.
- (1) Determination of spray blocks.
 - (2) Provide homeowner notification of the spraying program, and make all public notices required, and make sure there are no objectors in the spray blocks.
 - (3) Provide location of all objectors in and outside the spray blocks, and exclude and defend Hamilton Helicopters from any action, legal or otherwise, that should arise from the "no exclusion policy".
 - (4) Provide digitized maps of the spray blocks.
 - (5) Provide traffic and crowd control at the time of spraying, in the spray blocks and at the load site if deemed necessary by the parties.
 - (6) Provide a central loading site.
- B With regard to the gypsy moth suppression program, Hamilton Helicopters shall.
- (1) Have and maintain insurance coverage during the term of this agreement in the amount of \$2,000,000.00 single limit bodily injury and property damage. The Township and its employees shall be named as "additional insured". All liability for Hamilton Helicopters and its employees will be limited to the insurance policy provided.
 - (2) Will apply to the F.A.A. for a (workable) congested area spray plan for the time period from May 1, 2017 to June 15, 2017.
 - (3) Provide Bacillus Thuringiensis 'BT' at the rate of 19 B.I.U. per acre to cover 433 acres for the Township.
 - (4) Coordinate the spray timing with Aquatic Consulting Services.
- C In addition to providing the services in paragraph A above, the City shall pay Hamilton Helicopters a fee of \$63.85 per acre for providing the services listed in paragraph B. This shall be paid within 30 days of billing.
- D In the event Hamilton Helicopters is prevented from spraying as a result of legal action, court injunction, terrorist related problems or any problems beyond the control of Hamilton Helicopters, the Township will pay \$15.00 per acre to cover some of the costs incurred.

E For the purposes of this contract, the contractor and its employees shall be considered Independent contractors.

F Either party upon Thirty (30) days' notice may terminate this agreement, in addition, this agreement may be amended by mutual consent of the parties.

IN WITNESS THERE OF, the parties here have executed this agreement by and through their authorized representatives as of the date written above.

Cascade Charter Township

Hamilton Helicopters Inc.

_____ DATE _____

Kent Hanks
Its Prec DATE 3/14/17



Aquatic Consulting Services

P.O. Box 530, Sanford, MI 48657
www.aquaticremedies.com

989-689-0223

November 22, 2016

Mr. Ben Swayze,
Township Manager
Cascade Charter Township
2865 Thornhills, S.E.
Grand Rapids, MI 49546

Dear Mr. Swayze:

I have completed the gypsy moth surveys for the 2017 season in Cascade Charter Township. I have attached JPG and PDF versions of the map designating the areas of concern along with a short report on the conditions in each recommended spray block. One 18 x 24 inch display map is being sent by US mail.

I am pleased to report that we have achieved good control of gypsy moth populations in Cascade Township. This puts us in a good position considering what we have been seeing elsewhere across West Michigan. It appears that gypsy moth populations are on the rise again, even in areas that haven't seen any meaningful numbers in several years. This type of life history is common with invasive species such as gypsy moths, and it appears we are in another growth phase. Considering the situation, there have been some new populations that popped up during my survey as well as a few remnant populations that have been particularly stubborn. Accordingly, there has been slight increase in recommended acreage, but nothing of concern and well within normal metrics. We have their limits well defined, and the spray should be effective at keeping the overall population in check. The proactive approach toward monitoring that Cascade has employed over the years has been shown to be the best means of control. We achieved good results in areas sprayed last year and I anticipate nothing different this year.

I will hold off for a few of months on digitizing the spray blocks for the pilot's use until you have had a chance to review the map. If it meets with your approval, I will put a final package together for Kurt Homkes of Hamilton Helicopters, Inc. I am told that the cost per acre should stay the same as last year with any increases solely due to the cost of the B.t. product. Kurt will contact you to discuss this season's spray contract.

Thank you again for the opportunity to work for Cascade Township. Please let me know if you need anything further. (989) 689-0223 or gypsymoth@aquaticremedies.com.

Sincerely,

Neal Swanson
Owner/Biologist

**Cascade Charter Township
Recommended Gypsy Moth Spray Areas 2017**

By
Aquatic Consulting Services LLC
November 2016

Priority A		
Block #	Acres	Reason for Spray
Cas01	7	A rising population in good habitat, spray to prevent nuisance and suppress growth.
Cas02	7	See Above.
Cas03	45	A remnant population in prime habitat. Spray to further suppress population and limit nuisance.
Cas04	49	See Above.
Cas05	20	An established population in good habitat. Spray to limit nuisance and contain possible spread.
Cas06	99	An established population in very good habitat, spray to contain spread and suppress growth.
Cas07	28	An isolated population in very good habitat. Spray to limit nuisance and suppress growth.
Cas08	50	A rising population in good habitat. Spray to suppress growth.

Total Acreage (Priority A) = 305 acres

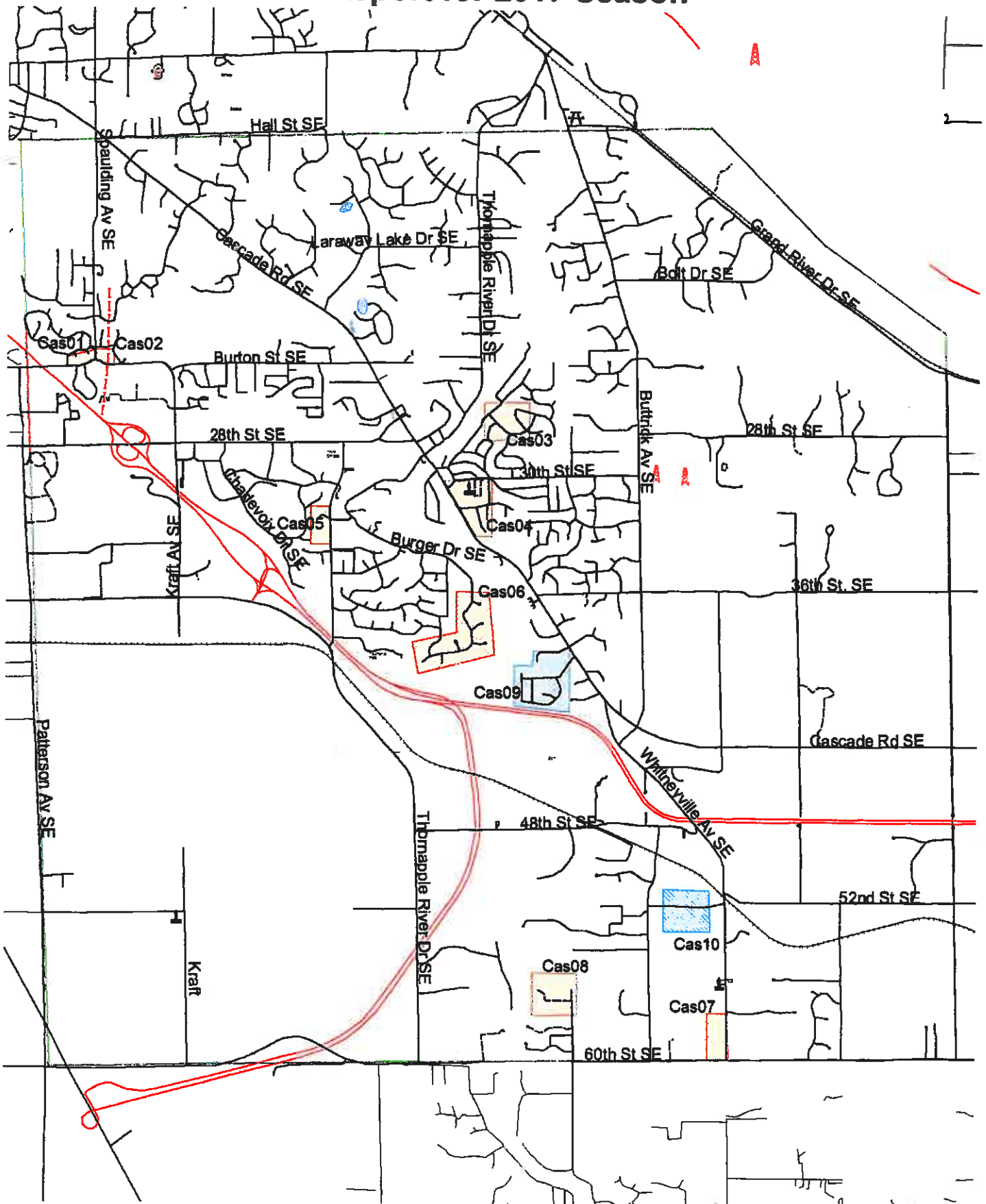
Priority B		
Block #	Acres	Reason for Spray
Cas09	79	A remnant population in good habitat. Spray to limit nuisance and further suppress growth.
Cas10	49	An established population in good habitat. Spray to limit nuisance.

Total Acreage (Priority B) = 128 acres

Acreage Grand Total (Priority A & B) = 433 acres

Priority A blocks are recommended for spray in Spring 2017 as potential for nuisance and tree damage is quite high. Priority B blocks a recommended for spray in Spring 2017 as well, should financing permit. Priority B blocks can be left untreated in 2017, although monitoring is highly recommended as potential for nuisance and tree damage is still a concern.

Cascade Township Gypsy Moth Survey Report for 2017 Season



(Priority A) (Priority B)

Please See Accompanying
Report for Description of Areas



— Township Border
2016 Aquatic Consulting Services



GYPSEY MOTH IN MICHIGAN HOMEOWNER'S GUIDE

Major Revision April 1993 (First printing 1991) ♦ EXTENSION BULLETIN E-2302

Gypsy Moth Management Starts At Home

You are the first line of defense for protecting your trees and shrubs from damage by gypsy moth, other insects, nematodes and diseases. Being knowledgeable about the life cycle of the gypsy moth will pay off in money saved, labor expended and peace of mind.

Depending upon where you live in Michigan, gypsy moth outbreaks may last from two to several years or may never occur. Why gypsy moth populations explode from time to time is not entirely clear. Outbreaks will eventually collapse, usually from natural causes.

Until a local gypsy moth population crashes, however, there are several techniques that homeowners can employ to keep damage and nuisance to an affordable minimum.

Monitoring

Hopefully, the mind set of dragging the sprayer out of the garage and spraying insecticide on trees and shrubs just because something might be out there lurking is no longer a part of the Michiganian mentality. Years ago this was called "insurance spraying" when everybody was spraying chlorinated hydrocarbon insecticides (e.g., DDT) on everything that moved. We all know where that got us!

Take time to inspect your trees and shrubs periodically for the various life forms of gypsy moth. Especially look for the caterpillars when they begin to hatch, usually in early May.

Contrary to popular belief, population explosions in a locality do not happen suddenly! An area will undergo a gradual population buildup for a time before the population goes into a phase of rapid release. This gives vigilant homeowners, neighborhoods and communities time to assess local conditions and take appropriate action.

The gypsy moth is in the egg mass form for nearly nine months, plenty of time to find and destroy them before they hatch in the spring. While it may not be possible to find and destroy all of the egg masses in and around your backyard, this activity will complement management activity taken in the spring.

Management

Non-Pesticide Techniques

Water and Fertilize

We often take trees and shrubs for granted, figuring that they are indestructible and meant to last forever. Trees and shrubs have specific nutrient and water requirements. Take the time to determine what they need, and water and fertilize properly. There are bulletins available at all county extension offices and garden centers. Most insects and diseases select trees and shrubs that are being stressed. Keeping your trees and shrubs healthy will reduce the pests and diseases attracted to your foliage and lessen the damage done if they are attacked.

Sanitation

Keep your yard as clean as possible. Remove discarded items, dead branches (from the ground and out of the trees), stumps, etc., where the adult female moth is likely to lay egg masses. It is very important that homeowners be watchful when obtaining firewood from areas infested by the gypsy moth. A good rule of thumb is to never get more firewood in the summer or fall than you can burn by spring.

Each fall, check recreation vehicles (boats, trailers, campers, etc.) for gypsy moth egg masses. Vehicular movement is how gypsy moth came to Michigan.

Destroy Egg Masses

As mentioned, gypsy moth egg masses are around for nearly nine months before they hatch. Homeowners can help reduce gypsy moth populations on their property and in their neighborhood by seeking out and destroying egg masses each year.

When a gypsy moth caterpillar is about to pupate, it will look for a protected area such as a loose flap of bark, something flat nailed to a tree, woodpile or the underside of branches, etc. Once a suitable location is found, it weaves a loose net of silk around itself and transforms into a pupa. This is the resting state where the caterpillar undergoes the miracle transformation from caterpillar to moth. This takes about two weeks.

Upon emergence, the female gypsy moth is creamy white and has a wingspan of about two inches. The male moth is smaller in size and camouflage brown with black mottling. Both have a distinguishing mark on their forewings: an inverted black V often referred to as a chevron marking.

The female generally deposits egg masses from early July to mid-August depending upon local weather conditions. The female cannot fly, so she will lay egg masses near where she was in the pupal (cocoon) stage.

The adult female lives about a week. Her only purpose in life is to breed as quickly as possible and lay her eggs. She cannot fly, so she emits a chemical odor to attract the nearest male for mating. This chemical is called a pheromone. After mating, the male flies off to mate several more times before dying. After mating, the female spends about a day depositing her egg mass, falls to the ground and dies. Neither the male or female moth feed.

Each egg mass can contain from 50 - 1,500 eggs. The eggs are intertwined in a matting of hair from the body of the female. The hair is a tan-buff color. It is also very water repellent and a good insulator.

The egg masses begin hatching the following May. Hatching coincides with the bud break of aspen and the flowering of serviceberry.

Homeowners are encouraged to search out and destroy egg masses. This is accomplished by scrap-

Continued on page 2

Gypsy Moth Life Cycle



1. Small Larvae—May



2. Large Larva—June



3. Pupa—July



4. Adults—August



5. Egg masses—August

1) Small Larvae. This stage lasts for 7-10 days after eggs hatch in early May (or sooner in warmer weather). Larvae are less than 1.2 inch long and usually black. They linger around the egg cluster for several days if the weather is cool or rainy, then climb trees or other objects, trailing silken threads as they move. When the larvae reach the top of the tree, they do not feed but drop on silken threads and are dispersed by the wind.

2) Large Larvae. Feeding at night for 4 to 6 weeks, large larvae generally rest during the day unless populations are very large, then they wander constantly. They grow until they are about 2 inches long.

3) Pupae. During this stationary stage the larvae are changing into moths. This generally occurs from the end of July until early August. After about 10 days in the dark colored pupal cases, the adult moths emerge, leaving the pupal cases behind.

4) Adults. The female moth is creamy white and does not fly but emits a chemical called a pheromone to attract a male moth. The male is brownish and flies in a zigzag pattern looking for the female. A single male can mate with many females. Both sexes have chevron markings (V or notch-shaped marking) on each forewing.

5) Egg masses. The buff-colored egg masses contain between 50 and 1,500 eggs. The female deposits the eggs on any convenient surface. The masses are usually covered with hairs from the female's abdomen. The egg masses are quite cold resistant and can survive temperatures as low as -20 degrees F. Egg masses hatch during May.

Management...

Continued from page 1

ing them from the surface to which they are attached into a coffee can or similar receptacle. They can be buried or burned. Remember that each egg mass destroyed probably eliminates 400-500 caterpillars. Destroying egg masses is not a cure all. Many times egg masses are overlooked or inaccessible. However, it is a very good and certainly very cheap way to significantly impact the gypsy moth population in your yard and neighborhood.

Barrier Bands

Sticky, or slippery bands can be placed around tree trunks to help curtail, though not necessarily prevent, the caterpillars movement into and out of the tree canopy.

Sticky bands can be purchased or made using a nonporous material that can be wrapped around a tree trunk, then coated with a commercially made, vegetable-based sticky material. **Never put sticky material directly on the tree trunk.** This will permanently stain the bark and may harm the tree.

Sticky bands should not be put on the tree until the caterpillars are about an inch long. Smaller caterpillars usually stay in the tree canopy. Because sticky bands eventually lose their effectiveness due to rain and other weather factors, the sticky material has to be reapplied periodically. Bands covered completely with caterpillars need to be cleaned or replaced.

Slippery bands are also intended to interrupt the daily migration of the caterpillar. They prevent the caterpillar from climbing up into the canopy.

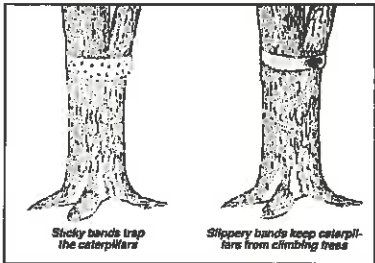
Hiding Bands

Cloth, or hiding bands, can be homemade from medium weight dark cloth about 12 to 18 inches wide and long enough to completely wrap around the tree. Fasten each band at about chest height around the tree with twine, cord or wire about midway from the bottom of the cloth. Then fold the top part of the cloth down over the bottom half.

Some of the caterpillars descending the tree in the morning hours in search of a secluded daytime resting spot will hide under the flap of the band. Remove and destroy the caterpillars each day by scraping them into a bucket of soapy water.



Gypsy moth caterpillars use cloth bands to hide during daylight hours. Scrape the caterpillars into a bucket of soapy water.



Sticky bands trap the caterpillars

Slippery bands keep caterpillars from climbing trees

Pesticide Techniques

Biological Pesticide

There are many pesticides registered for use against gypsy moth in Michigan. The **only** pesticides used in the Michigan Voluntary Cooperative Suppression Program are products that contain B.t.k. *Bacillus thuringiensis* var. *kurstaki* as the active ingredient. B.t. is a common soil bacteria. It is commercially formulated and sold under various labels (e.g., Dipel, Foray, Thuricide and Bactur to name a few). B.t. can be

applied from the ground or by aerial spraying. B.t. formulations are quite safe to humans. There is no apparent human toxicity, although there have been rare cases of allergic reaction by humans to certain formulations of B.t. In fact, B.t. is only known to be toxic to the caterpillars of moths and butterflies. While there are many species of caterpillars affected by B.t., this pesti-

cide is the most "selective" product available.

To be most effective in minimizing defoliation, B.t. must be applied when the caterpillars are less than one inch long. As caterpillars get larger, the efficacy of B.t. diminishes. B.t. has a reported residual activity (i.e. how long it remains potent) of about a week. It is broken down by sunlight. In instances where there are extremely high gypsy

Continued on page 4



Be careful with pesticides!



Use proper recycling procedures for disposing of pesticide containers

This publication contains pesticide recommendations based on research and pesticide regulations. However, changes in pesticide regulations occur constantly. Some pesticides mentioned may no longer be available, and some may no longer be legal. If you have questions about the legality and/or registration status for using pesticides, contact your MSU Extension county office.

To protect yourself and others, and the environment, always read the label before applying any pesticide.

For information about pesticide labels see Extension Bulletin E-2182 *Reading a Pesticide Product Label*

For more information about pesticide safety, see Extension Bulletin E-2215, *Using Pesticides Safely: A Guide for the Applicator*. Extension Bulletin E-1546 *Take Cover! Protect Yourself from Exposure (Pesticides)*

For more information about safe disposal of pesticide containers see Extension Bulletin AM-95 *Rinsing and Recycling Pesticide Containers*

Dozens of other Extension bulletins on safe application of pesticides are also available.

WOODLOT MANAGEMENT and THE GYPSY MOTH

According to experts at MSU, the appearance of gypsy moth has caused foresters to rethink their approach to timber management. In stands that are composed of a large percentage of trees that are preferred hosts for gypsy moth, the potential effects from defoliation and tree mortality must be considered in the planning of any timber management operation.

"Gypsy moth is a relatively new disturbance to the forests of Michigan," states Russell Kidd, District Forestry Agent for MSU Extension in Roscommon. "Consequently, scientists have only been able to study its impact for just a few years. Therefore, it is difficult to predict all the long-term changes that gypsy moth will cause in Michigan's forests," says Kidd.

Michigan has large areas of oak and aspen forests that are extremely susceptible to defoliation by gypsy moth. Additionally, many parcels have been weakened by old age or are too dense for optimum growth. These parcels are at some risk to tree mortality because of all the stress they are under.

Generally speaking, good traditional timber management recommendations that keep stands healthy and vigorous are the best approach to minimizing impacts from defoliation. Depending upon the stand, recommendations for thinning younger stands to optimum densities, and harvesting overage stands to regenerate them, would be appropriate management.

Timing is Critical

The timing of thinning and harvest operations must be planned carefully in relation to gypsy moth population outbreaks. If an outbreak of gypsy moth caterpillars (i.e. heavy defoliation) is taking place or is expected in the next year or two, then landowners should wait before cutting down any trees. Instead, such stands should be watched

to see what mortality, if any, occurs. Any tree that dies can be harvested promptly with little loss of value.

If heavy defoliation is not expected in the near future, landowners should proceed with thinning or harvesting. However, landowners should monitor gypsy moth activity in their woodlots for 2-3 years after the completed thinning or harvesting operation has taken place.

According to Kidd, thinning and selective harvesting causes some short-lived stresses to a forest as it adjusts to both the demand for increased growth and to the small openings created during these operations. Timing these operations for these years when populations of gypsy moth are at low levels avoids adding another stress to the stand.

In carrying out the thinning or harvest operation, the forester or landowner managing the stand should concentrate on the following guidelines in selecting trees for removal:

1. Reduce the number of poor-quality, high-risk species.
2. Remove trees of any species with poorly developed crowns.
3. Give strong consideration to removing trees that provide good egg laying habitat for gypsy moth (e.g. rough bark, small cavities, and large, overhanging branches). However, if such trees are also being actively used by wildlife, which may include gypsy moth predators, those trees should not be removed.

A question that is often raised by landowners is whether spraying their woodlot with pesticide to manage gypsy moth is justified. "In most cases," says Kidd, "aerial spraying of woodlots is not justifiable. When you compare the cost of aerial spraying against the value of timber that may be lost, it's probably not worthwhile. This is especially true in stands that have not been well-tended by the landowner or are growing on poor-quality, droughty sites."

Continued on page 5



Trees and shrubs defoliated by gypsy moth

Although gypsy moth caterpillars feed primarily on deciduous tree species such as oak or aspen, this insect is known for its wide-ranging appetite. When populations of gypsy moth are very high, the caterpillars quickly devour the leaves of their preferred host tree species. Once their favored food source disappears, the hungry caterpillars do not hesitate to seek out new sources of food. When this occurs, almost any deciduous or conifer tree, shrub or other landscape plant may be at risk of suffering some amount of defoliation.

Consequently, it is difficult to state exactly how susceptible a tree or shrub species is to defoliation by gypsy moth caterpillars. Therefore, the following list is offered only as a guide to homeowners. This list does not guarantee that any species listed as minimally at risk will never be defoliated by the gypsy moth.

More importantly, homeowners need to recognize that gypsy moth caterpillars do have preferences for certain types of trees and thrive best on those species. Typically these favored food sources are usually the first ones attacked in a homeowner's yard, especially tall, large crowned trees. These are the trees most likely at risk to defoliation.

Generally speaking, when gypsy moth caterpillars move into less preferable food sources, the caterpillars do not thrive as well and often only cause minor damage.

However, regardless of this insect's food preferences, close inspection of yard trees and outdoor fixtures and prompt action by the homeowner to destroy egg masses and small caterpillars is crucial (see related articles). This is the real key to minimizing the discomfort and, to some degree, the defoliation caused by large numbers of gypsy moth caterpillars.

If a homeowner is able to minimize the amount of defoliation from the gypsy moth, it will lessen the overall impact on tree health. When a hardwood tree is heavily defoliated, the needed energy to regrow a new set of leaves causes stress. This

stress often weakens a tree which may lead to additional tree health problems. Moreover, conifer species, such as spruce or pine, are at greater risk than hardwoods because conifers are not able to regrow needles lost to defoliation. Thus complete defoliation of conifers by gypsy moth is usually fatal.

Trees and Shrubs Most at Risk to Defoliation

- All oak (*Quercus*)
- All aspen and poplar (*Populus*)
- Gray, paper (white), and river birch (*Betula*)
- All willow (*Salix*)
- All apple and crabapple (*Malus*)
- All thornapple and hawthorne (*Craetagus*)
- White pine (*Pinus*)
- Blue spruce (*Picea*)
- American beech (*Fagus*)
- Basswood (*Tilia*)
- Sweetgum (*Liquidambar*)
- Junaberry or serviceberry (*Amelanchier*)
- Witch hazel (*Hamamelis*)
- Hazelnut (*Corylus*)
- Mountain ash (*Sorbus*)

Trees and Shrubs Somewhat at Risk to Defoliation

- Black walnut and butternut (*Juglans*)
- All cherry and plum (*Prunus*)
- Norway, red and sugar maple (*Acer*)
- Hophornbeam or ironwood (*Ostrya*)
- Hornbeam or blue beech (*Carpinus*)
- Alder (*Alnus*)
- Elm (*Ulmus*)
- Hickory (*Carya*)
- Eastern redbud (*Cercis*)
- Sassafras (*Sassafras*)
- Paw paw (*Asimina*)
- White and Norway spruce (*Picea*)
- Eisam fir (*Abies*)
- Eastern hemlock (*Tsuga*)
- Red jack, scotch and Austrian Pine (*Pinus*)

Trees and Shrubs at Minimal Risk to Defoliation

- Ash (*Fraxinus*)
- Tulip tree or yellow poplar (*Liriodendron*)
- Sycamore and London plane tree (*Platanus*)



Gypsy moth caterpillars prefer to eat leaves of certain tree species, including poplar.

- Northern catalpa (*Catalpa*)
- Honey locust (*Gleditsia*)
- Black locust (*Robinia*)
- Horsechestnut (*Aesculus*)
- Dogwood (*Cornus*)
- Eastern redcedar (*Juniperus*)
- Juniper (*Juniperus*)
- Yew (*Taxus*)
- Lilac (*Syringa*)
- Azalea (*Azalea*)
- Rhododendron (*Rhododendron*)
- Arbovitae (*Thuja*)
- Viburnum (*Viburnum*)

Homeowners considering planting trees or shrubs in areas prone to high gypsy moth population build-ups should choose species that are at minimal risk to defoliation. Contact your local MSU Extension office for bulletins and information on tree selection, planting and care.

Be careful about quick fixes for your gypsy moth problem

Struggling with the effects of the gypsy moth can be frustrating enough without unscrupulous people trying to take advantage of the homeowner by offering quick fixes.

There are no quick fixes, declares Russell Kidd, MSU Extension district forestry agent in Roscommon County.

He advises homeowners to be wary of products or services that promise or imply they can end gypsy moth problems in the backyard or woodlot.

Be careful of salespeople who want to spray your trees with chemicals that are "guaranteed" to control the gypsy moth. In some cases, these may be worthless or even dangerous.

Homeowners should ask what chemical is to be used, its hazard, what its effect will be and what precautions will be taken to minimize spray drift to nearby objects.

Homeowners should also ask to see proof that the company and the individual are certified and licensed to apply such a material. Michigan law requires that commercial pesticide spraying companies be certified and licensed by the Michigan Department of Agriculture.

Remember that chemical sprays are effective only during the caterpillar stage of the gypsy moth. Spraying trees before the eggs hatch or after the caterpillars have pupated or emerged as adult

moths is worthless. (See the gypsy moth life cycle chart on Page 1.)

Be wary of unrealistic claims about products or techniques to rid your property of the gypsy moth by themselves.

Some products, such as sticky bands, are indeed useful, but they will not control the gypsy moth completely, especially when used alone. Only a combination of control treatments, used diligently by the homeowner, will achieve satisfactory control of the gypsy moth.

Other products may not do what their names imply. Take, for instance, the gypsy moth trap. The purpose of the trap is to attract and capture the adult gypsy moth. Traps are used to monitor gypsy moth populations. They will not control or eliminate next year's gypsy moth problem in your yard because one adult male moth can mate with many female moths and one or two traps will not capture enough males to interfere with mating or cause the population to decline significantly next year.

Be very careful about timber buyers who offer to buy standing trees that have been defoliated. Unscrupulous timber buyers may use gypsy moth infestations in an area as a scare tactic to persuade people to sell valuable timber at low prices before the trees die.

Timber owners should always consult with professional foresters before they decide to sell any standing timber.

Your county MSU Extension office can provide the names of professional foresters in your area.

Woodlot Management...

"Spraying is only justifiable under certain conditions such as in high value, large diameter oak stands that are very close to harvest or in stands that are under severe stress from other factors," advises Kidd. "Landowners should not fool themselves into thinking that spraying is a panacea to the gypsy moth problem or that it is a substitute for good forest management. In fact under certain conditions, spraying could actually prolong defoliation if it eliminates the buildup of predators," says Kidd.

More research is needed before foresters and others working with gypsy moth can answer most of the questions and concerns about the ultimate impact of gypsy moth in Michigan. To date, the bulk of the research done on gypsy moth has been

conducted in the eastern states and Europe. Michigan is different in terms of soil, climate and forest types. Therefore, it is not always easy to apply what happened elsewhere to our state.

Over the past several years, MSU extension specialists have held workshops for professional foresters and other natural resource managers to help them learn more about gypsy moth and how to manage timber stands to minimize the negative effects.

"Private landowners should seek out professional help if they are unsure as to how to manage their timber; given gypsy moth as a new development," advises Kidd. "The best place to start for further information would be your local MSU Extension office."



GYPSY MOTH QUESTIONS AND ANSWERS

Management on state lands

The battle to rid Michigan of the gypsy moth was long ago. The gypsy moth is an established resident of our state's forests. Spraying in most areas of the state will only temporarily reduce the numbers of caterpillars. For most areas, this effect will last for only one year.

Gypsy moth numbers are controlled by many predators, parasites and diseases. Like most leaf-eating insects, the number of gypsy moth caterpillars cycle with time. Periods of bad years will be followed by periods of time when gypsy moth will hardly be noticed.

The key to this cycle is the rapid drop in gypsy moth numbers often referred to as a "population crash." A virus that kills only the gypsy moth is the main reason for these crashes. This remarkable phenomenon, when gypsy moth numbers return to low levels, is the basis for the Michigan Department of Natural Resources (DNR) management strategy for gypsy moth.

The DNR does not use insecticides against gypsy moth on vast areas of the forest. Small areas are treated if it is appropriate to do so. Gypsy moth on state land do not cause outbreaks on private lands, just as those insects on private lands do not cause outbreaks on state forest lands. In fact, spraying large areas of state land may actually help prolong outbreaks by altering natural mortality. While we understand that gypsy moth periodically rises to levels that create a problem, this in itself is not reason enough to spray. The benefits from using any pesticide must be carefully weighed against the risks and costs of that use.

A Few Commonly Asked Questions and Answers:

Q. What is the DNR doing about gypsy moths?

A. The DNR is responsible for protecting state land from gypsy moths and other tree pests. Through forest management practices, the department is striving to make our forests less vulnerable to gypsy moth. The gypsy moth is monitored to determine if the insect will kill valuable timber or become a serious nuisance in recreation areas. This information is used to ensure that we spray only where it is most appropriate.

Q. When and where is it appropriate to spray gypsy moths on state lands?

A. Put simply, it's appropriate where and when the benefits outweigh the costs, which is not always easy to determine. Generally, it makes sense to spray recreational areas, such as campgrounds and parks, with an appropriate insecticide. A well-used campground relatively free of caterpillars creates benefits that outweigh the small environmental and economic costs of treatment. On the other hand, it seldom makes economic sense to spray state-owned timber lands. The cost of treating those lands usually is greater than the timber value we would lose if we choose not to spray.

Q. How does the state know what areas to treat?

A. Areas of high recreational value or timber value are routinely surveyed for gypsy moth egg masses. A count of these egg masses tells us whether or not to expect a problem.

Q. What would happen if the state did not treat recreational areas such as campgrounds or parks?

A. If there are sufficient egg masses in the area, it is likely that most visitors would find the experience intolerable

because of the large number of caterpillars. Some trees may die, although this may not happen until several years after the outbreak. Visitors to an infested area may unknowingly transport gypsy moths back to areas that were previously not infested.

Q. If state lands are not sprayed what will be the long term effects on the forest?

A. A forest's first encounter with gypsy moth defoliation will cause some change, which can be thought of as the forest's way of fighting back. In some areas some trees will die, weakened by repeated gypsy moth attacks. Certain susceptible species will be replaced by some extent by more resistant ones. In those areas the forest makeup will change slightly creating a forest type that is more resistant to future mortality. This means that after the first outbreak, future defoliation will have much less impact. This change may be quite noticeable in a few areas, while in others, the change will be hard to see. Although a few trees will die, the forest will survive.

Q. Isn't it worth spraying to avoid changing the forest?

A. Forests are always in a state of change; this is normal. Spraying for gypsy moth on a large scale may have the effect of prolonging the outbreak and delaying population collapse. This is because large-scale spraying may alter naturally occurring organisms that regulate gypsy moth populations. Spraying on a large scale to prevent a problem may actually cause a bigger one in the long run.

Q. What happens environmentally in an area that is treated for gypsy moth?

A. When an area is treated for gypsy moth, the safest material possible is used. The name of the material used will be posted on a sign on the site. Generally it is Bacillus thuringiensis (Bt), a bacterial insecticide that has little effect on other organisms or the environment. The smallest area possible, usually 50 acres or less, is treated so we do not interfere with the pending gypsy moth population crash.

Q. What method of spraying is used?

A. The DNR uses the most up to date aerial application techniques, either by airplane or helicopter.

Management on private lands

Q. With county-administered suppression spray programs eradicate this pest?

A. No. Community suppression spray programs are designed to help homeowners cope with the gypsy moth and natural controls (predators, diseases, etc.) cause the population to fall to levels that people can tolerate without spraying.

Q. Once the county begins to spray, will my property have to be treated every year?

A. Not likely. Only small blocks of land are sprayed as part of any suppression program. Highly infested, unsprayed blocks bordering these areas are allowed to follow the course of nature. After three or four years of large outbreaks, natural controls such as disease-causing viruses and predators cause populations to crash or fall dramatically in the unsprayed areas. When this occurs, properties sprayed in previous years do not require spraying because the population crash usually extends into these areas.

Q. Will the trees in my yard or woodland die once the leaves are completely chewed off by the gypsy moth?

A. Most trees survive, but survival depends on tree vigor before defoliation and the species of tree being attacked. Healthy, vigorous trees are generally able to withstand two or three years of heavy feeding by the gypsy moth. However, yard trees that are weakened by old age, drought, competition from other trees, or insects and diseases may die after one defoliation.

In addition, coniferous trees, such as pine or spruce, cannot produce new needles after defoliation. Thus complete defoliation by the gypsy moth can kill these trees.

Q. What may happen if my neighbors and I do not have our properties sprayed as part of a gypsy moth suppression spray program?

A. Left on their own, gypsy moth populations generally continue to increase until trees are completely stripped of foliage and then natural causes, such as predators and virus diseases, reduce the population.

However, during multiyear outbreaks, droppings (frass) fall from trees in large quantities; masses of migrating larvae in search of new food or places to pupate climb on houses and other objects and become a nuisance that most people (or communities) whose properties qualify for a suppression spray program choose to participate to avoid the many uncomfortable aspects of large gypsy moth outbreaks.

Q. There are tents and webs in the cherry and crabapple trees in my yard. Is this gypsy moth?

A. No. The gypsy moth does not spin webs or tents as it feeds. Silken tents in the crotches of trees are made by the eastern tent caterpillar. This insect feeds primarily on fruit trees such as cherry and apple and the ornamental varieties of these species. Because this insect's hosts are more limited, the eastern tent caterpillar is not considered as threatening as the gypsy moth. Eastern tent caterpillar outbreaks occur periodically, and after a few years they crash or decline once predators and other natural diseases build up in the population.

Q. Is there anything I can do around my home to control gypsy moth without using pesticides?

A. Homeowners can use several nonpesticide methods that are effective, to some degree, in coping with the gypsy moth. For example, physical barriers can be placed around tree trunks. These include sticky bands that trap gypsy moth larvae or folded fabric bands that attract larvae which then can be easily destroyed. Scraping egg masses off of trees and manmade objects before they hatch also helps. Some measure of control can also be accomplished by spraying newly hatched larvae with a weak solution of hand soap mixed with water (1-2 fl. oz. per gal. of water).

In addition, insecticidal soaps (similar to dishwashing or hand soap) or *Bacillus thuringiensis*, a bacterial disease of caterpillars (tradenames: B.T., Dipel, BioTrol, and others) effectively control gypsy moth when larvae are about one inch long. B.T. is not toxic to animals or people. It is only lethal to the larvae of insects in the moth and butterfly family. This material has a low impact on the environment.

Q. How much does a caterpillar eat?

A. During the caterpillar stage, each gypsy moth eats about one square meter or foliage.

Management starts at home

Continued from page 2

moth populations, two applications five days apart might be needed.

Most chemical pesticides are 95% - 99% effective. B.t.k. is probably 80% - 85% efficient in field applications. This is actually a desirable attribute of B.t.k. That may sound like a contradiction, but it isn't. Pesticides that are highly efficient will eventually work against the pest manager. Insects, through natural selection, will develop resistance to the pesticide. By leaving 15% of the population intact, selection for resistance is slowed. B.t.k. has been used against gypsy moth for over fifteen years and no resistance has been discovered.

There is, quite naturally, a trade off. When B.t.k. is applied there are still some caterpillars crawling around. However, nuisance is reduced to a minimum, defoliation lowered below damaging levels, and B.t.k. remains effective.

Soap and Water

In addition to destroying egg masses, homeowners can use a number of other non-pesticide methods to reduce defoliation of their yard trees.

Watch for the appearance of the small caterpillars in the spring. A garden hose has sufficient water pressure to knock them off the foliage. Spraying them with water under pressure kills many of them.

Garden centers carry various brands of "insecticidal soap." An insecticidal soap is not a soap containing a synthetic insecticide but instead refers to the ability of the soap to kill certain insects. Spraying gypsy moth caterpillars with a hose with an attachment to dispense soap can be very effective. Be sure to follow label directions on the insecticidal soap container. Small and large caterpillars can easily be drowned when submerged into a bucket of soapy water.

Chemical Insecticides

A number of chemical pesticides are registered against gypsy moth in Michigan. Many are available at your local garden center or nursery. Some of the most common are formulation: of acephate, carbaryl, and malathion.

If you choose to use chemical insecticides to control gypsy moth, apply them judiciously and wisely. Besides gypsy moth they can have a potential impact on a variety of beneficial insects, including valuable predators, parasites and honeybees.

Regardless of what insecticide you choose, read the label instructions and follow them exactly. If you have any potential personal health concerns regarding pesticides, discuss them with your family physician or contact your local health department.



By 1990, gypsy moth had a firm grip on the Lower Peninsula. By this time it was accepted that this would cause episodes of serious defoliation by the end of the decade wherever suitable host plants existed in sufficient numbers (most of both peninsulas).

The state legislature, keenly aware of the potential for misuse of insecticides that could occur, provided funds to Michigan State University Extension to put into place the Michigan Gypsy Moth Education Program (MGMEP).

MGMEP provides a variety of educational material and programs to all counties that are now or will soon be affected by gypsy moth defoliation. The goal of the program is to provide the information necessary for the citizens of the state to make correct management decisions when confronted with gypsy moth.

"Once people have a solid understanding of what gypsy moth can and cannot do, they will

MICHIGAN GYPSY MOTH EDUCATION PROGRAM

make good management decisions," states Tom Ellis, Gypsy Moth Education Coordinator for Southern Michigan. "Our unstated goal," Ellis goes on to say, "is to learn to live with the gypsy moth, to avoid the knee-jerk reaction of spraying everything and anything with pesticides, and to teach everyone a little ecology along the way."

Initially, the program concentrated efforts in those counties in central northern Michigan that

were the first to be affected severely by gypsy moth," says Cora Gorsuch, education coordinator for Northern Michigan. As the program gained momentum, the scope of the activity has expanded to include programs for lake associations, the recreational industry, elementary and secondary education, the landscape and forestry industries, municipal grounds and forestry personnel, and community service organizations.

The MGMEP provides the vital link between regulatory activities and the people of Michigan. It also is the mechanism by which university researchers can discuss their role in searching out and implementing environmentally compatible, economically viable and socially acceptable management strategies to control this insect pest.

For more information regarding the role the Michigan Gypsy Moth Education Program plays in your locality, contact your county MSU Extension office.

❖ Gypsy Moth Educational Materials ❖

Workbooks:

The Gypsy Moth in the Classroom; by Eric Mullenbauer, published in cooperation with USDA Forest Service and others; available from Dr. Norman Dill, Delaware State College, 1200 N. Dupont highway, Dover, Delaware 19901; 92-page notebook with gypsy moth related activities aimed at elementary through junior high school. Includes lesson plans, ten minute introductory video and some graphics and teaching tips. Fee of \$5 to cover shipping and handling (S&H).

Gypsy Moth Workbook; published by American Forestry Association in cooperation with the USDA Forest Service; available from American Forestry, P.O. Box 2000, Washington, D.C. 20013 for \$6.95, including S&H; 1-800-368-5748; 80-page booklet of classroom projects divided by age level (4-8, 9-12, and 13 and over), suitable for photocopying.

The Gypsy Moth...A Workbook About Michigan's Newest Insect; 1987, updated; by Clare County Gypsy Moth Task Force Education Committee; available through Michigan legislators; 24-page paperback, plus teaching guide, addresses basic insect study and gypsy moth activities.

The Gypsy Moth Activity Book; 1991, by Midland County Gypsy Moth Suppression Program; available from Gypsy Moth Suppression Program, Midland County Services Bldg. 220 West Ellsworth St. Midland, MI 48640-5194; (517) 832-6785. 20-page activity book aimed at early elementary grades, mostly identify and color pages. Cost \$1.15 (including S&H).

Videos:

Living With the Gypsy Moth in Michigan MSU Extension Video VT-33, 1991; 23 minutes, Available through Michigan State University Extension offices. Complete study of the gypsy moth life cycle and demonstration of population suppression techniques.

A Balanced Perspective 1992; USDA/Forest Service; 18 minutes; available from Irene M. Borak, USFS Forest Health Protection, 1992 Folwell Ave., St. Paul, MN 55108; Focuses on living with gypsy moth infestations and nature's methods of reducing gypsy moth populations.

Gypsy Moth...the Way It Was 1991; USDA/Forest Service; 18 minutes; available from USDA Forest Service, Northern Region Public Affairs Office, P.O. Box 7669, Missoula, MT 59807; Good historical review of introduction in eastern United States; and travel westward.

MSU Extension Bulletins:

Available through your county MSU Extension office.

E-2299 "Comparison of the Gypsy Moth, Eastern Tent and Forest Tent Caterpillars." One page, color drawings. Free.

E-2300 "Cloth Banding Trees to Suppress the Gypsy Moth." One page with how-to graphics and explanation of gypsy moth caterpillar feeding and wandering behaviors. Free.

E-2301 "Barrier Bands to Suppress the Gypsy Moth." Illustrates the use of bands to trap or repel gypsy moth caterpillars. Free.

E-2281 "Gypsy Moth Homeowners Guide." Two pages, on what to look for and how to deal with the problem if your locality is affected. Free.

E-1983 "The Gypsy Moth in Michigan: A Guide for Homeowners and Small Woodlot Owners." Eight page color bulletin on recognizing and managing the gypsy moth. Excellent photos of life stages and life cycle and extensive management recommendations. 50 cents.

GYPSY MOTH GLOSSARY OF TERMS

Btk. *Bacillus thuringiensis* var. *kurstaki*. A common soil bacterium that produces a toxin deadly to gypsy moth caterpillars. Commercial formulations of Btk are used exclusively in the Michigan Cooperative Suppression Program. While not 100% specific to gypsy moth, Btk is the most selective and human safe pesticide registered for use against gypsy moth.

Caterpillar. The larva (immature form) of moths and butterflies.

Defoliate. Remove leaves from plants. One gypsy moth caterpillar can remove over a square yard of leaves in its lifetime.

Egg mass. A cluster of eggs. A gypsy moth egg mass consists of eggs and body hair from the female moth. The buff-colored egg masses range in size from 1/2" x 1/4" to 2" x 1/2" and contains from 50 to 1,500 eggs.

Eradication. Elimination of an organism from a geographical area. To date, gypsy moth has proven to be impossible to eradicate from Michigan and eastern states.

Exoskeleton. Insects do not have an internal skeleton. Instead, they have evolved an outer shell (exoskeleton) that provides structural strength and protection.

Frass. Insect droppings (excrement).

Instar. Growth stages of immature insect forms. As immature insects grow (in this case caterpillars) they outgrow their exoskeleton and must shed it. The life stages between molts are called instars. The gypsy moth may complete 5 - 7 instars before forming a pupa.

IPM. Integrated Pest Management is the use of a variety of management strategies and techniques to limit insect pest populations to tolerable levels. It involves taking tree-directed actions, insect directed actions and no action depending

upon the circumstances. The management strategy selected is based on sound ecological, economic and sociological principals.

Michigan Voluntary Cooperative Gypsy Moth Suppression Program. A management partnership available to all counties. Up to 50% of the cost of aerial application of Bt may qualify for cost-sharing funds from the U.S. Forest Service. The program is managed at the state level by the Michigan Department of Agriculture. For more information contact your county extension office or MDA.

Molt. As the gypsy moth caterpillar grows, it must periodically shed its skin to allow for additional growth. It will molt four to six times.

NPV. Nucleopolyhedrovirus. NPV is a virus disease that is present in our gypsy moth population. It is most virulent when populations are high and food becomes scarce, weakening the caterpillars. At this time over 99% of the population will become sick, stop feeding and die (population crash). It is commonly referred to as wilt disease. Only caterpillars are affected.

Outbreak. Local gypsy moth populations will be innocuous for several years. When conditions are right, a population explosion (outbreak) will occur causing widespread, severe defoliation. Population densities of one half million to six million feeding caterpillars per acre are not uncommon during these outbreak episodes.

Parasite. An organism that lives on or in the body of another organism. There are several organisms (mostly other insects) that parasitize gypsy moth egg, caterpillar and pupa. A parasitism is an important population regulator.

Predator. Organisms that eat other organisms. Many different kinds of mammals, insects and birds prey on all gypsy moth life forms. A predator is an important population regulator.

Pheromone. A scent the flightless female emits to attract and induce male gypsy moth for mating.

Pheromone trap. A trap that resembles a rectangular 1/2 gallon milk container with a roof. The trap is "baited" with a synthetic form of the gypsy moth pheromone. The Michigan Department of Agriculture has been monitoring male moth activity throughout Michigan since 1985 from a permanent array of traps. Two traps are set and collected each summer from each township in Michigan. Pheromone traps are not recommended for backyard control.

Population crash. The collapse of a large population of gypsy moth caterpillars. It is brought on by starvation which triggers naturally occurring diseases to disseminate a local population.

Population monitoring. Keeping track of the presence, population density and rate of spread of the gypsy moth. Traps baited with synthetic pheromone are used to monitor male moths. Egg mass and defoliation surveys are also important components of gypsy moth monitoring programs.

Pupa. The development stage that occurs between the caterpillar and adult stages. This is the resting state where the caterpillar transforms into an adult moth.

Refoliation. When deciduous trees lose more than 60% of their leaves they will "flush" a new set of leaves. This is called refoliation. The new leaves are usually smaller and not quite as green as the first set. Trees that refoliate are weakened somewhat due to stored energy used to produce the new leaves.

Stress. The negative effect on plants caused by poor growing conditions or damage caused by poor soil, too much or too little water, insects and diseases. Gypsy moth is only one of many causes of stress to trees in Michigan.



Researchers in Michigan have taken aim at the gypsy moth. Their goal is to provide new tools to the integrated pest management toolbox.

Integrated pest management (IPM) is nothing more than a common sense approach to managing pests within the context of the ecological, economic and social structures they affect. Nothing new. Put together a toolbox of technologies and use them properly. Manage the target beast in a way that doesn't throw the overall biological framework out of whack; do it in such a way that it doesn't cause an economic burden to the taxpayer or the crop producer; do not introduce pesticides that persist in the water, air or animal body fat or cause cancers; and, finally, implement a management program that makes everybody happy.

While this seems like an impossible task, that is very difficult and painstaking, it is not impossible.

In Michigan, scientists at Michigan State University, the University of Michigan, other universities, colleges, and the U.S. Forest Service have accepted the challenge presented by the gypsy moth. They are looking at it from many angles depending upon their specific expertise.

Is sick better than dead?

Dr. Leah Bauer is a part of a group of U.S. Forest Service research entomologists who are headquartered and share lab space at Michigan State University.

"Since the introduction of the gypsy moth, entomologists have been trying to reinstate the balance of nature in our eastern forests," Bauer said, "Many natural enemies of gypsy moth are now established and have gradually begun to moderate the dramatic population swings that occur in newly infested areas such as Michigan."

Dr. Bauer has been working with a group of protozoan pathogens called microsporidia. "We hope to introduce a full complement of pathogens to keep these insects as unhealthy as possible." These one-celled animals, together with NPV, play an important role in stabilizing gypsy moth populations in its native Europe range.

A caterpillar infected with NPV, Nucleopolyhedrovirus, dies fairly quickly, usually within a week or two. One infected with microsporidia may take three or four weeks to succumb. Some just get sick and stay sick. The sick caterpillars pupate and turn into a female moth that lays a greatly reduced number of eggs. Many of these hatching caterpillars are sick also.

What is manifested, over time, is the spread of a long, lingering illness throughout a large portion of a local or regional population. Sick beetles sick. These individuals eat less, reproduce less and are more susceptible to other pathogens and parasites.

"As a result of natural enemy introductions, we can expect that gypsy moth populations will become more stable over time—similar to some of our native pests like spruce budworm or forest tent caterpillar that flare up only occasionally."

Dr. Suzanne Thiem of the Department of Entomology and the Pesticide Research Center is exploring the gypsy moth virus at the genetic level. Dr. Thiem has just received a grant to try and identify the genes of the gypsy moth virus that make the disease so host specific. Additionally, she will be looking at the genetics of other similar virus diseases that affect other insects, but not gypsy moth.

The forgotten fungus

For the last couple of years Dr. Leah Bauer has been collaborating with Dr. Dave Smitley of the Department of Entomology at MSU to determine the feasibility of introducing the fungal pathogen

Entomophaga mainwigi into Michigan's gypsy moth population.

The pathogen was successfully introduced into Crawford and Lake counties in 1991 and was still viable at these locations in 1992. Smitley will be monitoring the establishment of this organism over the next several years.

Ants in the plants!

In certain situations ants may be a valuable ally against gypsy moth. While many research projects look for an organism or pesticide to provide that big knockout punch, Dr. Cathy Bristow has been studying the potential of mound ants in the biological control of gypsy moth in Michigan.

Mound ants are fairly common in jack pine forests and plantations in northern Michigan. In her study plots in Crawford County she noted that no gypsy moth egg masses were deposited in areas with high mound ant activity while adjacent areas with low or no mound ant activity contained ovipositing female moths.

MICHIGAN RESEARCHERS TAKE AIM AT THE GYPSY MOTH

Bristow's group at MSU is currently assessing how ants affect gypsy moth behavior and survival and how ant density correlates with gypsy moth density and damage.

The exception to the rule dilemma

Dr. Dan Herms from Dow Gardens also holds the position of adjunct assistant professor in the Department of Entomology at MSU.

Dan is collaborating with Dr. James Nitao, a research associate in the Department of Entomology and Dr. Muralaeehan Nair, a natural products chemist in the Department of Horticulture. They are trying to unravel one of the many "exceptions to the rule."

Paper birch is a highly favored host of gypsy moth. However, some paper birch trees seem to be highly resistant to defoliation. Herms, Nitao and Nair hypothesize that leaves of resistant birch may contain compounds that cause this resistance. They are trying to identify and isolate the compounds responsible for this resistance.

Comparison of the gypsy moth, eastern tent, and forest tent caterpillars

The identity of three common caterpillars that may be present early each year could be confusing. These illustrations will help identify which caterpillar is leading on your trees.



Gypsy Moth Caterpillar



Eastern Tent Caterpillar



Forest Tent Caterpillar

Illustrations by: Peter Carrington

Ripples in the pond

The introduction of an insect like gypsy moth into a previously gypsy moth free forest causes massive changes. This phenomena may make far-reaching changes in the behavior of other leaf feeding insects in the way they select hosts to feed and lay eggs upon, how they select habitats and even behavioral changes in mating. These changes, in turn, may affect the way their predators and parasites relate to them. And so on.

Dr. Mark Scriber, chairman of the Department of Entomology, has been researching these questions for quite some time.

Scriber's group discovered recently that there has been an apparent shift of feeding and egg laying preference of the tiger swallowtail butterfly from quaking aspen to white ash in areas with gypsy moth activity. This "ash shift" will be examined at various distances ahead of gypsy moth "fronts" to try and determine what is responsible for this major ecological host shift.

Dr. Deborah McCullough is the newest faculty member in the Department of Entomology at MSU. McCullough's area of specialization is forest entomology. Like Scriber's efforts, McCullough will be looking at the impact that gypsy moth and suppression activities have on other foliage-feeding insects in the forest, and on impacts of defoliation in relation to nitrogen cycling in our forest ecosystems.

McCullough also plans to look at the importance of gypsy moth defoliation relative to two-lined chestnut borer and shoestring root rot in northern pin oak forests. Many of these stands have high mortality rates, but the causal agent is not known.

Plans are also underway to develop a hazard rating system to predict what kinds of aspen stands are most vulnerable to gypsy moth defoliation; habitat typing and ecological attributes of aspen stands will be related to gypsy moth-caused mortality.

Where are they and how many are there?

Dr. Stuart Gage of the Department of Entomology at MSU uses sophisticated computer technology to track the incidence and spread of gypsy moth throughout Michigan. Gage, in cooperation with Ron Priest of the Michigan Department of Agriculture, has developed a permanent network of pheromone traps throughout the state. Using a geographic information system (GIS), trap catch data are analyzed each year to monitor gypsy moth distribution and estimate population size. Spatial analysis and maps produced on the GIS can be used by other agencies and programs to target areas likely to experience defoliation. This information allows resource managers to initiate education and suppression efforts in a proactive, timely manner.

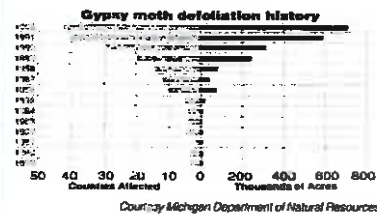
Dr. Charley Chilcote, a research associate in the Department of Entomology at MSU, is working to develop an egg mass sampling technique that is more accurate and may be as easy to execute as the five minute walk technique that is currently used in Michigan.

So what's happening to the trees?

Dr. John Wfiter and his current graduate assistant, Jennifer Stoyenoff, (Charley Chilcote before her) from the School of Natural Resources at UM have been examining the impact of gypsy moth on the forested landscapes of Michigan. Working closely with the Michigan Department of Natural Resources they have been attempting to document and evaluate the impact of gypsy moth on stand mortality, change in stand density, stand composition, and understory and groundcover vegetation.



Defoliation Survey, an Evolution of Technologies



Since 1985, the Forest Management Division of the Michigan Department of Natural Resources (DNR) has made many improvements in its annual gypsy moth defoliation survey techniques and is now turning to technology from the space program for even better data.

Michigan's Gypsy Moth Struggle Dates to 1954

Immediately following the discovery of the gypsy moth in 1954, the Michigan Department of Agriculture (MDA) and other agencies became involved in a continuing effort to first eradicate and later to control the spread of the insect.

During the late 1950s and the 1960s, it appeared that the gypsy moth had been eliminated with surveillance and targeted spray programs. No spray programs were conducted in 1958, 1961, 1963-66 or 1968-72 because no infestations could be found.

In 1971, it was discovered that the synthetic pheromone (chemical sex attractant) that had been used in traps in various locations in the state was not very attractive to the male gypsy moths. Traps baited with a more alluring scent revealed that the gypsy moth was alive and well in Michigan.

Since that time populations have grown steadily in the Lower Peninsula wherever suitable vegetation is abundant. In 1992 serious defoliation occurred across nearly 750,000 acres in the state.

Problem Spreading to the U.P.

Gypsy moth populations are starting to build in the U.P. also. Male moths are now routinely caught in surveillance traps as far west as Delta County. A program has been proposed to "slow the spread" of the gypsy moth in the U.P. If supported, the program will be a cooperative effort by the U.S. Forest Service, MDA, DNR and Michigan State University to use non-pesticide technology to slow the spread of the gypsy moth across the U.P. to northern Wisconsin, Minnesota and western Ontario. State-of-the-art GIS (Geographical Information System) computer technology will be employed to interpret population trends and aid in management decisions.

Michigan Voluntary Cooperative Suppression Program

Even though gypsy moth cannot be eradicated in Michigan, selective spraying of insecticides can be used to bring relief to homeowners that are severely affected by high populations of the pest. The MDA is the central coordinator of the Michigan Voluntary Cooperative Gypsy Moth Suppression Program.

A key aspect of the suppression program is cooperation between state government and local communities. Aerially applied sprays used today are biological and applied through the program when gypsy moth populations become intolerably high.

The voluntary suppression program does not attempt to eliminate the gypsy moth, but rather to reduce population levels in forested residential and recreational areas. The program requires public involvement through county government (the local coordinator in the program), in local decision making, and it provides financial assistance to communities experiencing intolerably high gypsy moth populations.

Facing decreasing fiscal resources and an ever-increasing area of defoliation, the DNR is investigating new technologies to help meet a commitment of providing a complete defoliation history of the gypsy moth in Michigan.

There have been many changes since 1985 when the first survey was completed in two hours by one sketch mapper flying over Midland county. Since that original mission, the survey has grown to more than 40 counties, taking up to five weeks, three aircraft and sketch mappers from both the DNR and the Michigan Department of Agriculture (MDA).

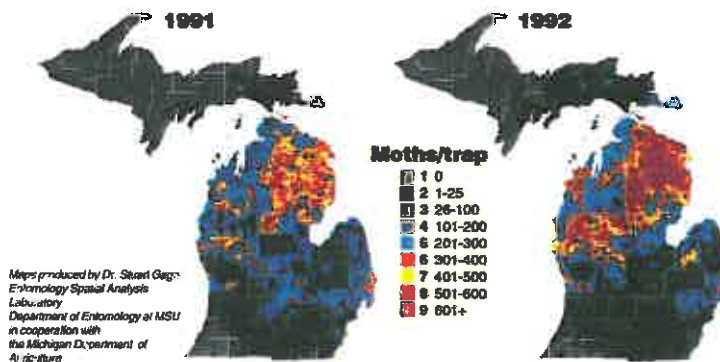
The early technology using one or two observers to sketch defoliation damage on topographic maps was quickly outgrown as the gypsy moth began to affect larger expanses of susceptible forest type. In 1986, a cooperative effort between the DNR and Dr. David Lusch at the Center for Remote Sensing, Michigan State University, in 1986 led to the use of an infra red video camera to record defoliation. In 1987, the

DNR purchased its first Blivision camera which was installed in an aircraft. In 1989, the MDA added a second camera and deck which the DNR installed in another aircraft.

Frank Sapio, Manager of the DNR's Forest Health Program explained, "We've contracted with the Center for Remote Sensing to develop a survey approach using low cost satellite imagery. We hope this project will yield a readily available method that will decrease our reliance on airplanes."

If successful, the DNR plans to use the satellite imagery over large expanses of forest to free up valuable resources during each field season. The monies for the project have been provided through a grant from the Northeastern Area State and Private Forestry branch of the U.S. Forest Service.

With a future 50-county scope of statewide gypsy moth impact likely, the DNR continues to look for the most practical, accurate, and cost effective methods of continuing the survey of gypsy moth defoliation in Michigan.



Maps produced by Dr. Stuart Gage, Entomology Spatial Analysis Laboratory, Department of Entomology at MSU in cooperation with the Michigan Department of Agriculture.

Ronald Priest, of MDA's Pesticide and Plant Management Division, is the program coordinator at the state level. In 1992, two-dozen counties were enrolled and nearly 300,000 acres were protected under the program.

Areas within a community that are eligible for treatment include: forested residential areas (communities and individual dwellings, both permanent and seasonal); forested recreational areas and public campgrounds (public parks, public picnic areas); and commercial campgrounds, resorts and golf courses.

MDA defines the term "forested" as tree covered, with a tree canopy covering half or more of the ground when seen from the air. There must also be 300 healthy gypsy moth egg masses per acre in the affected area.

Priest explains that the role of the MDA is to function as the administrator of the suppression program in Michigan. The costs of the local aerial suppression program are shared by local county government and the U.S. Forest Service.

Priest says the Michigan suppression program is designed to focus on the major trouble spots in the state. He believes that an orderly procedure based on research and objectivity is the best way to approach what will eventually be a pervasive problem in Michigan.

The MDA is not, however, limited to just an administrative role. Priest says that the MDA, in cooperation with the Michigan Department of Natural Resources and other state and federal agencies and universities, is trying to augment the natural forces in the woodlands that could contribute to more effective gypsy moth control. For example, the MDA since 1979 has introduced five natural enemies, including a gypsy moth egg parasite *Ooencyrtus kayanae*, a tiny wasp, into Michigan. The program has been very successful. Most areas that have gypsy moth also have established populations of the egg parasite. MDA personnel routinely introduce the wasp into new locations each year.

The Future: Tolerance, Involvement and Education

Like cancer or AIDS, finding a "cure" for gypsy moth in Michigan may be around the corner or it may be beyond our scope of understanding. "We will continue to implement new technology to find a way to rid Michigan of the gypsy moth," Priest says. "But for the foreseeable future, we will have to learn to live with it. Our challenge right now is to hold the gypsy moth population to a tolerable level. Our program is like an umbrella that we want to raise over homes and communities to make living conditions tolerable for the couple of years that the infestation is severe," Priest points out.

For success, the gypsy moth suppression program in Michigan needs citizen involvement, he believes.

Priest encourages local residents to become acquainted with and active in local county gypsy moth management programs and to attend educational meetings whenever they are offered by MSU Extension, the DNR, or local county and civic groups.

Gypsy Moth in Michigan

HOMEOWNER'S GUIDE

Produced by Michigan State University Extension in cooperation with the Department of Entomology. Funded by the Michigan Department of Agriculture.

For more information about the gypsy moth or other pest species, contact the MSU Extension nearby office nearest you.

MSU is an affirmative action, equal opportunity institution. MSU Extension programs and services are available to all without regard to race, color, national origin, sex, handicap, age or religion.

Issued in furtherance of a cooperative order on work in entomology and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Grant from director, Michigan State University Extension, E. Lansing, MI 48864.

Major revision 4-93-TGM-PP-Price 00 File 27.26 (Pests)



Built-in controls of gypsy moth—the 3 Ps

Living with the gypsy moth in Michigan is easier thanks to a little help from the 3 Ps—the Predators, Parasitoids and Pathogens of gypsy moth. These natural enemies take their toll on all stages of the gypsy moth life cycle.

P Number One—Predators

Birds, insects, mice and shrews—all are important predators of gypsy moth.

Although many birds don't like feeding on gypsy moth caterpillars, a few species such as the yellow-billed cuckoo, seem to relish the big, hairy caterpillars. Small rodents like white-footed mice, shrews and voles feed on large caterpillars and pupae. Mice seem to prefer the larger female pupae to smaller male pupae. This selective munching may have an even greater impact on gypsy moth populations than random dining. *Calosoma* beetles also actively seek out and devour young gypsy moth caterpillars. *Calosoma* beetles are large, attractive ground beetles. Some species were imported into North America specifically for gypsy moth control. Both the larval and adult stages of this beetle are predaceous.



Small gypsy moth larvae are parasitized by the Braconid wasp *Colletes melanoscolus*.

P Number Two—Parasitoids

Parasitoids are small wasp-like insects and specialized flies that live by feeding in the body of another insect. Gypsy moth eggs, caterpillars and pupae are attacked by many different kinds of parasitoids. Some parasitoids are native, while others have been imported from overseas in hopes of finding the "silver bullet" to control gypsy moth.

One parasitoid that is very important in Michigan is *Ooencyrtus kuvanae*. This insect is a tiny wasp and was imported into Michigan by the Department of Agriculture. The young wasps feed on the developing caterpillars inside gypsy moth eggs. When the adult wasps emerge, they are attracted to the scent of gypsy moth females or new egg masses. Once they find an egg mass, they lay their eggs inside the gypsy moth eggs. Estimates made by Cora Gornuch showed that an average of 35 percent of the eggs in an egg mass are parasitized. Other parasitoids may also feed in gypsy moth eggs, or in caterpillars or pupae. Although parasitoids won't control a gypsy moth outbreak by themselves, they certainly help.

P Number Three—Pathogens

Pathogens, or insect diseases, are the most important of the 3 Ps. One especially interesting pathogen is an organism that causes a virus disease in caterpillars. The virus disease Neucleopolyhedrovirus (usually referred to as NPV) is the major factor that causes gypsy moth outbreaks to collapse. When caterpillars are killed by this virus, they hang in an upside-down V, turn a dark color and appear to melt as they decompose over leaves and branches.

NPV, always present in gypsy moth populations, is seldom noticed except during gypsy moth outbreaks. During a gypsy moth outbreak, there are usually two waves of disease in the gypsy moth population. Adult females can pass the virus to some of their offspring when they lay eggs. Young caterpillars may then pick up the virus as they chew their way out of the eggs. When these young larvae die (the first wave), they can spread the virus around foliage, tree trunks, and other areas,

Older larvae may eventually pick up the virus and die before pupating (the second "wave"). NPV is known to affect only gypsy moth caterpillars and does not affect other insects or other animals.

Gypsy Moth Populations — Boom and Bust

Although the gypsy moth has many natural enemies, predators, parasitoids and most diseases can't keep up with a gypsy moth population explosion. In healthy gypsy moth populations, one female moth will lay 400-1500 eggs in one egg



White-footed mice, as well as shrews and voles, are rodents that feed on gypsy moth caterpillars and pupae.

mass. Even if 90 percent of the eggs are killed by natural enemies, the ones that are left can build up populations in a single year. Because the virus disease is the major factor causing gypsy moth populations to collapse, gypsy moth managers must be careful not to interfere too much with the natural build-up of virus in the population. Gypsy moth populations usually have to build to high levels before the virus kicks in and drives populations down. At high population levels, caterpillars must compete with each other for food and space. Caterpillars get stressed, which makes them more susceptible to the virus disease. As more caterpillars get sick and die, the disease spreads through the whole population.

When insecticides are used, many gypsy moths are killed. However, there are always some gypsy moths that survive and populations can rise back to outbreak levels within a year. If insecticides are applied repeatedly, larvae won't get stressed and the virus may not kick in. This could cause high gypsy moth populations to occur year after year.

Gypsy moth managers in Michigan use *Bacillus thuringiensis* var. *kurstaki* (Btk) rather than broad spectrum chemical insecticides. Even Btk is only applied in residential areas and high-use recreation areas. The goal of gypsy moth management is to reduce the discomfort of people living in infested areas, without disrupting the virus disease and other natural controls.

Gypsy Moth — Changing the Face of Michigan Forests

What will be the long-term impact of gypsy moth on Michigan forests? Will our woodlands cease to exist? "Not at all," says Deborah McCullough, MSU Forest Entomologist. "Impacts of gypsy moth are likely to be subtle and occur over a period of several years. To understand how gypsy moth will change Michigan forests, we need to understand how defoliation affects forest trees."

Certain trees are more affected by gypsy moth than other trees. Oak trees and other species that gypsy moth caterpillars prefer to feed on are more likely to be affected than trees like red maple and ash, which gypsy moth caterpillars avoid.

Most hardwood trees, including oaks, can recover from even complete defoliation. Severely defoliated trees will "refoliate" and use reserve energy to produce a second set of leaves later in the summer. Healthy trees can refoliate and tolerate defoliation for two or three, perhaps even four years. Eventually, however, the reserve energy the tree has stored is depleted. Diseases or other insects such as wood-borers may then attack trees with low energy reserves, eventually killing them.

Mortality occurs more rapidly when trees are diseased, suffering from drought or other stresses,

or when trees are very old and growing slowly. Trees on dry or shallow soils, or trees with injured root systems are often very vulnerable to gypsy moth defoliation and may also be killed quickly.

Unlike hardwood trees, conifer (evergreen) trees cannot refoliate and cannot tolerate complete defoliation. Conifers store most of their energy reserves in the needles, rather than in their roots like hardwood trees. When needles are consumed by gypsy moth caterpillars, no energy reserves are available to produce more foliage, and the tree will die.

Like hardwoods, conifer species differ in their vulnerability to gypsy moth defoliation and mortality. For example, hemlock trees are often killed during gypsy moth outbreaks. Gypsy moth caterpillars feed on new foliage of hemlock, which severely stresses the trees. White pine trees, on the other hand, often survive heavy defoliation. This is because gypsy moth caterpillars prefer to feed on older white pine foliage, which is less damaging to the trees. As is the case with hardwood trees,



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conifers that are stressed, wounded, diseased or on poor sites are more likely to die than healthy trees.

Based on what we know about gypsy moth and what we've seen in northeastern states where gypsy moth has long been established, we can



Calosoma beetles actively seek out and devour young gypsy moth caterpillars.

make some predictions about how gypsy moth will change Michigan forests.

Gypsy moth has been established in northeastern forests for over 100 years. Over this time, there has been a shift in the species of trees in the forest. Northeastern forests tend to have less oak and more species like red maple that gypsy moth generally does poorly on. A similar type of shift occurred across much of the eastern U.S. when chestnut blight disease began killing chestnut trees in the early 1900s. Chestnut trees were once a major part of eastern forests, but today, can hardly be found. Northeastern forests are still there, though, and the forests still provide the wildlife, beauty and recreation that we all value.

The situation is likely to be the same in Michigan over the next 100-150 years. Oaks may become less common, while red maples may become more common. This shift in species composition should make our forests more resistant to gypsy moth. Although outbreaks will continue, gypsy moth caterpillars may be less abundant during outbreaks.

The gypsy moth may change the face of Michigan forests, but it will not destroy them. With continued good management, we will all enjoy Michigan forests for a long time to come.



Built-in controls of gypsy moth—the 3 Ps

Living with the gypsy moth in Michigan is easier thanks to a little help from the 3 Ps—the Predators, Parasitoids and Pathogens of gypsy moth. These natural enemies take their toll on all stages of the gypsy moth life cycle.

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Gypsy Moth in Michigan

Michigan State University Extension & Michigan State University Department of Entomology
& the Michigan Department of Agriculture

The following information was taken from the
Gypsy Moth in Michigan Homeowner's Guide

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Gypsy Moth Management Starts At Home

You are the first line of defense for protecting your trees and shrubs from damage by gypsy moth, other insects, nematodes and diseases. Being knowledgeable about the life cycle of the gypsy moth will pay off in money saved, labor expended and peace of mind.

Depending upon where you live in Michigan, gypsy moth outbreaks may last from two to several years or may never occur. Why gypsy moth populations explode from time to time is not entirely clear. Outbreaks will eventually collapse, usually from natural causes.

Until a local gypsy moth population crashes, however, there are several techniques that homeowners can employ to keep damage and nuisance to an affordable minimum.

Monitoring

Hopefully, the mind set of dragging the sprayer out of the garage and spraying insecticide on trees and shrubs just because something might be out there lurking is no longer a part of the Michigander mentality. Years ago this was called "insurance spraying" when everybody was spraying chlorinated hydrocarbon insecticides (e.g., DDT) on everything that moved. We all know where that got us!

Take time to inspect your trees and shrubs periodically for the various life forms of gypsy moth. Especially look for the caterpillars when they begin to hatch, usually in early May.

Contrary to popular belief, population explosions in a locality do not happen suddenly! An area will undergo a gradual population buildup for a time before the population goes into a phase of rapid release. This gives vigilant homeowners, neighborhoods and communities time to assess local conditions and take appropriate action.

The gypsy moth is in the egg mass form for nearly nine months, plenty of time to find and destroy them before they hatch in the spring. While it may not be possible to find and destroy all of the egg masses in and around your backyard, this activity will complement management activity taken in the spring.

Management Non-Pesticide Techniques:

Water and Fertilize

We often take trees and shrubs for granted, figuring that they are indestructible and meant to last forever. Trees and shrubs have specific nutrient and water requirements. Take the time to determine what they need, and water and fertilize properly. There are bulletins available at all county extension offices and garden centers. Most insects and diseases select trees and shrubs that are being stressed. Keeping your trees and shrubs healthy will reduce the pests and diseases attracted to your foliage and lessen the damage done if they are attacked.

Sanitation

Keep your yard as clean as possible. Remove discarded items, dead branches (from the ground and out of the trees), stumps, etc., where the adult female moth is likely to lay egg masses. It is very important that homeowners be watchful when obtaining firewood from areas infested by the gypsy moth. A good rule of thumb is to never get more firewood in the summer or fall than you can burn by spring.

Each fall, check recreation vehicles (boats, trailers, campers, etc.) for gypsy moth egg masses. Vehicular movement is how gypsy moth came to Michigan.

Destroy Egg Masses

As mentioned, gypsy moth egg masses are around for nearly nine months before they hatch. Homeowners can help reduce gypsy moth population on their property and in their neighborhood by seeking out and destroying egg masses each year.

When a gypsy moth caterpillar is about to pupate, it will look for a protected area such as a loose flap of bark, something flat nailed to a tree, woodpile of the underside of branches, etc. Once a suitable location is found, it weaves a loose net of silk around itself and

transforms into a pupa. This is the resting state where the caterpillar undergoes the miracle transformation from caterpillar to moth. This takes about two weeks.

Upon emergence, the female gypsy moth is creamy white and has a wingspan of about two inches. The male moth is smaller in size and camouflage brown with black mottling. Both have a distinguishing mark on their forewings: an inverted black V often referred to as a chevron marking.

The female generally deposits egg masses from early July to mid-August depending upon local weather conditions. The female cannot fly, so she will lay egg masses near where she was in the pupal (cocoon) stage.

The adult female lives about a week. Her only purpose in life is to breed as quickly as possible and lay her eggs. She cannot fly, so she emits a chemical odor to attract the nearest male for mating, the male flies off to mate several more times before dying. After mating, the female spends about a day depositing her egg mass, falls to the ground and dies. Neither the male or female moth feed.

Each egg mass can contain from 50-1,000 eggs. The eggs are intertwined in a matting of hair from the body of the female. The hair is a tan-buff color and helps insulate eggs.

The egg masses begin hatching the following May. Hatching coincides with the bud break of aspen and the flowering of serviceberry.

Homeowners are encouraged to search out and destroy egg masses. This is accomplished by scraping them from the surface to which they are attached into a coffee can or similar receptacle. They can be buried or burned. Remember that each egg mass destroyed probably eliminated 400-500 caterpillars. Destroying egg masses is not a cure all. Many times egg masses are overlooked or inaccessible. However, it is a very good and certainly very cheap way to significantly impact the gypsy moth population in your yard and neighborhood.

Continued on page 3

Barrier Bands

Sticky, or slippery bands can be placed around tree trunks to help curtail, though not necessarily prevent, the caterpillars movement into and out of the tree canopy.

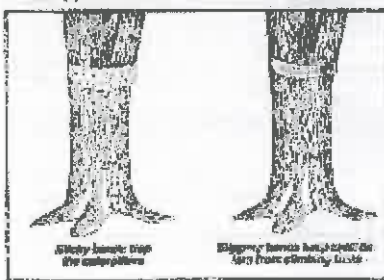
Sticky bands can be purchased or made using a nonporous material that can be wrapped around a tree trunk, then coated with a commercially made, vegetable-based sticky material. **Never put sticky material directly on the tree trunk.** This will permanently stain the bark and may harm the tree.

Sticky bands should not be put on the tree until the caterpillars are about an inch long. Smaller caterpillars usually stay in the tree canopy. Sticky bands eventually lose their effectiveness due to rain and other weather factors, the sticky material has to be reapplied periodically. Bands covered completely with caterpillars need to be cleaned or replaced.

Slippery bands are also intended to interrupt the daily migration of the caterpillar. They prevent the caterpillar from climbing up into the canopy.



Gypsy moth caterpillars use sticky bands to hide during daylight hours. Scrape the caterpillars into a bucket of soapy water.



Hiding Bands

Cloth, or hiding bands, can be homemade from medium weight dark cloth about 12 to 18 inches wide and long enough to completely wrap

around the tree. Fasten each band at chest height around the tree with twine, cord or wire about midway from the bottom of the cloth. Then fold the top part of the cloth down over the bottom half.

Caterpillars descending the tree in the morning in search of a secluded daytime resting spot will hide under the flap of the band. Remove and destroy caterpillars each day by scraping them into a bucket of soapy water.

Pesticide Techniques

Biological Pesticide

Many pesticides are registered for use against gypsy moth in Michigan. A biological pesticide commonly used on gypsy moth is *Bacillus thuringiensis* var. *kurstaki*. B.t. is a common soil bacteria. It is commercially formulated and sold under various labels (e.g., Dipel, Foray, Thuricide and Bactur to name a few). B.t. can be applied from the ground or by aerial spraying.

B.t. formulations are quite safe to humans. There is no apparent human toxicity, although there have been rare cases of allergic reaction by humans to certain formulations of B.t. In fact, B.t. is only known to be toxic to the caterpillars of moths and butterflies. While there are many species of caterpillars affected by B.t., this pesticide is the most "selective" product available.

To be effective in minimizing defoliation, B.t. must be applied when caterpillars are less than one inch long. As caterpillars get larger, the efficacy of B.t. diminishes. B.t. has a reported residual activity (i.e. how long it remains potent) of about a week. It is broken down by sunlight. In instances where there are very high gypsy moth populations, two applications five days apart might be needed.

Most chemical pesticides are 95% - 99% effective. B.t.k. is probably is 80% - 85% efficient in field applications. This is a desirable attribute of B.t.k.. That may sound like a contradiction, but it isn't. pesticides that are highly efficient will eventually work against the pest manager. Insects, through natural selection, will develop resistance to the pesticide. By

leaving 15% of the population intact, selection for resistance is slowed. B.t.k. has been used against gypsy moth for over twenty-five years and no resistance has been discovered. There is, quite naturally, a trade off. When B.t.k. is applied there are still some caterpillars crawling around. However, nuisance is reduced to a minimum, defoliation lowered below damaging levels.

Soap and Water

In addition to destroying egg masses, homeowners can use other non-pesticide methods to reduce defoliation of their yard trees.

Watch for the appearance of the small caterpillars in the spring. A garden hose has sufficient water pressure to knock them off the foliage. Spraying them with water under pressure kills many of them.

Garden centers carry various brands of "insecticidal soap." An insecticidal soap is not a soap with a synthetic insecticide but instead refers to the ability of the soap to kill certain insects. Spraying gypsy moth caterpillars with a hose with an attachment to dispense soap can be effective. Always follow label directions on the insecticidal soap container. Small and large caterpillars can be drowned when submerged into a bucket of soapy water.

Chemical Insecticides

A number of chemical pesticides are registered against gypsy moth in Michigan. Many are available at your local garden center or nursery. Some of the most common are formulations of acephate, carbaryl, and malathion.

If you choose to use chemical insecticides, apply them judiciously and wisely. Besides gypsy moth they can have a potential impact on a variety of beneficial insects, including valuable predators, parasites and honeybees.

Regardless of what insecticide you choose, read the label instructions and follow them exactly. If you have any potential personal health concerns regarding pesticides, discuss them with a physician or contact your local health department.

Trees and shrubs defoliated by gypsy moth

Although gypsy moth caterpillars feed primarily on deciduous tree species such as oak or aspen, this insect is known for its wide-ranging appetite. When populations of gypsy moth are very high, the caterpillars quickly devour the leaves of their preferred host tree species. Once their favored food source disappears, the hungry caterpillars do not hesitate to seek out new sources of food. When this occurs, almost any deciduous or conifer tree, shrub or other landscape plant may be at risk of suffering some amount of defoliation.

Consequently, it is difficult to state exactly how susceptible a tree or shrub species is to defoliation by gypsy moth caterpillars. Therefore, the following list is offered only as a guide to homeowners. This list does not guarantee that any species listed as minimally at risk will never be defoliated by the gypsy moth.

More importantly, homeowners need to recognize that gypsy moth caterpillars do have preferences for certain types of trees and thrive best on those species. Typically these favored food sources are usually the first ones attacked in a homeowner's yard, especially tall, large crowned trees. These are the trees most likely at risk to defoliation.

Generally speaking, when gypsy moth caterpillars move into less preferable food sources, the caterpillars do not thrive as well and often only cause minor damage.

However, regardless of this insect's food preferences, close inspection of yard trees and outdoor fixtures and prompt action by the homeowner to destroy egg masses and small caterpillars is crucial. This is the real key to minimizing the discomfort and, to some degree, the defoliation caused by large numbers of gypsy moth caterpillars.

If a homeowner is able to minimize the amount of defoliation from the gypsy moth, it will lessen the overall impact on tree health. When a hardwood tree is heavily defoliated, the needed energy to regrow a new set of leaves causes stress. This stress often weakens a tree which may lead

to additional tree health problems. Moreover, conifer species, such as spruce or pine, are at greater risk than hardwoods because conifers are not able to regrow needles lost to defoliation. Thus complete defoliation of conifers by gypsy moth is usually fatal.

Trees and Shrubs Most at Risk to Defoliation

All Oak (*Quercus*).
 All aspen and poplar (*Populus*).
 Gray, paper (white), and river birch (*Betula*).
 All willow (*Salix*).
 All apple and crabapple (*Malus*).
 All thornapple and hawthorne (*Craetagus*).
 White pine (*Pinus*).
 Blue spruce (*Picea*).
 American beech (*Fagus*).
 Basswood (*Tilia*).
 Sweetgum (*Liquidambar*).
 Juneberry or serviceberry (*Amelanchier*).
 Witch hazel (*Hamamelis*).
 Hazelnut (*Corylus*).
 Mountain ash (*Sorbus*).

Trees and Shrubs Somewhat at Risk to Defoliation

Black walnut and butternut (*Juglans*).
 All cherry and plum (*Prunus*).
 Norway, red and sugar maple (*Acer*).
 Hophornbeam or ironwood (*Ostrya*).
 Alder (*Alnus*).
 Elm (*Ulmus*).
 Hickory (*Carya*).
 Eastern redbud (*Cercis*).
 Sassafras (*Sassafras*).
 Paw paw (*Asimina*).
 White and Norway spruce (*Picea*).
 Balsam fir (*Abies*).
 Eastern hemlock (*Tsuga*).
 Red, jack, scotch and Austrian Pine (*Pinus*).

Trees and Shrubs at Minimal Risk to Defoliation

Ash (*Fraxinus*).
 Tulip tree or yellow poplar (*Liriodendron*).
 Sycamore and London plane tree (*Plantanus*).
 Northern catalpa (*Catalpa*).
 Honey locust (*Gleditsia*).
 Black locust (*Robinia*).
 Horsechestnut (*Aesculus*).
 Dogwood (*Cornus*).



Gypsy moth caterpillars prefer to eat leaves of certain tree species, including poplar.

Eastern redcedar (*Juniperus*).
 Juniper (*Juniperus*).
 Yew (*Taxus*).
 Lilac (*Syringa*).
 Azalea (*Azalea*).
 Rhododendron (*Rhododendron*).
 Arborvitae (*Thuja*).
 Viburnum (*Viburnum*).

Homeowners considering planting trees or shrubs in areas prone to high gypsy moth population build-ups should choose species that are at minimal risk to defoliation. Contact your local MSU Extension office for bulletins and information on tree selection, planting and care.



Be careful about quick fixes for your gypsy moth problem

Struggling with the effects of the gypsy moth can be frustrating enough without unscrupulous people trying to take advantage of the homeowner by offering quick fixes.

There are no quick fixes, declares Russell Kidd, MSU Extension district forestry agent in Roscommon County.

He advises homeowners to be wary of products or services that promise or imply they can end gypsy moth problems in the backyard or woodlot.

Be careful of salespeople who want to spray your trees with chemicals that are "guaranteed" to control the gypsy moth. In some cases, these may be worthless or even dangerous.

Homeowners should ask what chemical is to be used, its hazard, what its effect will be and what precautions will be taken to minimize spray drift to nearby objects.

Homeowners should also ask to see proof that the company and the individual are certified and licensed to

apply such a material. Michigan law requires that commercial pesticide spraying companies be certified and licensed by the Michigan Department of Agriculture.

Remember that chemical sprays are effective only during the caterpillar stage of the gypsy moth. Spraying trees before the eggs hatch or after the caterpillars have pupated or emerged as adults moths is worthless. (See the gypsy moth life cycle chart).

Be wary of unrealistic claims about products or techniques to rid your property of the gypsy moth by themselves.

Some products, such as sticky bands, are indeed useful, but they will not control the gypsy moth completely, especially when used alone. Only a combination of control treatments, used diligently by the homeowner, will achieve satisfactory control of the gypsy moth.

Other products may not do what their names imply. Take, for instance, the gypsy moth trap. The

purpose of the trap is to attract and capture the adult gypsy moth.

Traps are used to monitor gypsy moth populations. They will not control or eliminate next year's gypsy moth problem in your yard because one adult male moth can mate with many female moths and one or two traps will not capture enough males to interfere with mating or cause the population to decline significantly next year.

Be very careful about timber buyers who offer to buy standing trees that have been defoliated. Unscrupulous timber buyers may use gypsy moth infestations in an area as a scare tactic to persuade people to sell valuable timber at low prices before the tree die.

Timber owners should always consult with professional foresters before they decide to sell any standing timber.

Your county MSU Extension office can provide the names of professional foresters in your area.



Be careful with pesticides!



the proper recycling procedures for disposing of pesticide containers.

This publication contains pesticide recommendations based on research and pesticide regulations. However, changes in pesticide regulations occur constantly. Some pesticides mentioned may no longer be available, and some may no longer be legal. If you have questions about the legality and/or registration status for using pesticides, contact your MSU Extension county office.

To protect yourself and others and the environment, always read the label before applying any pesticide. For information about pesticide labels see Extension Bulletin E-2182 *Reading a Pesticide Product Label*.

For more information about pesticide safety, see Extension Bulletin E-2215, *Using Pesticides Safely: A Guide for the Applicator*; Extension Bulletin E-1546 *Take Cover! Protect Yourself from Exposure (Pesticides)*.

For more information about safe disposal of pesticide containers see Extension Bulletin AM-95 *Rinsing and Recycling Pesticide Containers*.

Dozens of other Extension bulletins on safe application of pesticides are also available.

Gypsy Moth Life Cycle

1) Small Larvae. This stage lasts for 7-10 days after eggs hatch in early May (or sooner in warmer weather). Larvae are less than 1/2 inch long and usually black. They linger around the egg cluster for several days if the weather is cool or rainy, then climb trees or other objects, trailing silken threads as they move. When the larvae reach the top of the tree, they do not feed but drop on silken threads and are dispersed by the wind.

2) Large Larvae. Feeding at night for 4 to 6 weeks, large larvae generally rest during the day unless populations are very large, then they wander constantly. They grow until they are about 2 inches long.



1. Small Larvae—May



2. Large Larva—June



3. Pupae—July



4. Adults—August



5. Egg masses—August

3) Pupae. During this stationary stage the larvae are changing into moths. This generally occurs from the end of July until early August. After about 10 days in the dark colored pupal cases, the adult moths emerge, leaving the pupal cases behind.

4) Adults. The female moth is creamy white and does not fly but emits a chemical called a pheromone to attract a male moth. The male is brownish and flies in a zigzag pattern looking for the female. A single male can mate with many females. Both sexes have chevron markings (V or notch-shaped marking) on each forewing.

5) Egg masses. The buff-colored egg masses contain between 50 and 1,500 eggs. The female deposits the eggs on any convenient surface. The masses are usually covered with hairs from the female's abdomen. The egg masses are quite cold resistant and can survive temperatures as low as -20 degrees F. Egg masses hatch during May.



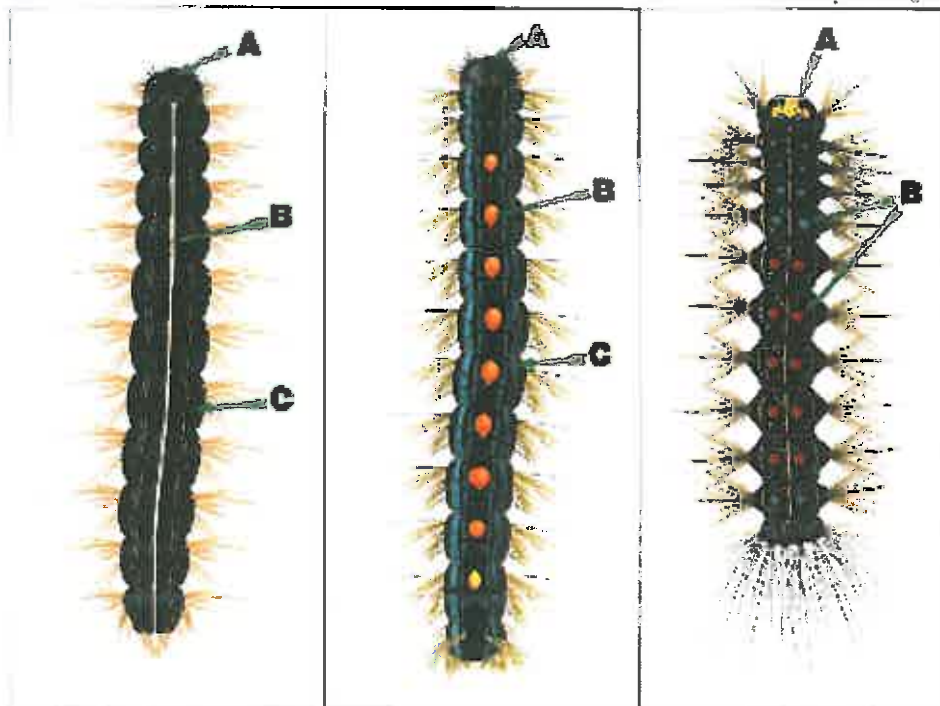
Comparison of the Eastern Tent Caterpillar, Forest Tent Caterpillar and Gypsy Moth

Michigan State University Extension

These three insects are often found feeding on the leaves of hardwood trees early in the summer. They can be easily confused with one another. The illustrations and information here will help you to identify which caterpillar is feed-

ing on your trees. Contact your local MSU Extension office or regional Dept. of Natural Resources office for more information on the biology and management of these insects.

Illustrations by Bob Langley









	Eastern Tent Caterpillar <i>Malacosoma americanum</i>	Forest Tent Caterpillar <i>Malacosoma disstria</i>	Gypsy Moth Caterpillar <i>Lycophotia dispar</i>
Markings	A) Dark head; B) prominent white or yellow stripe down the center of the body; C) small blue spots to the side.	A) Blue head; B) prominent central row of white or yellow markings in keyhole or footprint shape; C) bluish on sides of body.	A) Yellow head with black markings; B) prominent blue and red spots.
Tents	Prominent silk tent in branch junction.	They do not spin silk tents; resting sites on leaves may have small silk layer.	No silk tents.

E-2299



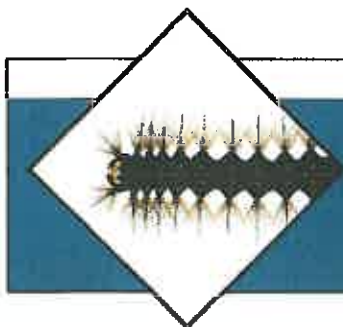
Comparison of the Eastern Tent Caterpillar, Forest Tent Caterpillar and Gypsy Moth

	 Eastern Tent Caterpillar <i>(Malacosoma americanum)</i>	 Forest Tent Caterpillar <i>(Malacosoma disstria)</i>	 Gypsy Moth Caterpillar <i>(Lymantria dispar)</i>
Egg Mass	Dark, spindle-shaped mass wrapped around twigs; rough varnished texture. 	Similar to eastern tent caterpillar. 	Tan color; covered with fine hairs; 1 to 3 inches long; usually on tree bark. 
Preferred Host Trees	Black cherry, apple, crabapple.	Aspen, sugar maple, oaks, birch, black gum.	Oaks, aspen, birch, willow and more than 250 other species.
Populations	Native insect; silk tent is unattractive, but feeding rarely harms trees; common pest of ornamental trees in urban settings.	Native insect; outbreaks occur at roughly 10-year intervals and usually last 2 to 4 years; most common in forests, especially where aspen is abundant.	Exotic pest; severe defoliation during outbreaks can occur for 2 to 3 years in urban and forested areas, especially where oaks are abundant.

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Revised 6:02 - 10M - KMF - JP - Price: 30c, single copy free to Michigan residents. File Z1.35 (Pests and Pest Management)



Entomophaga maimaiga - A Natural Enemy of Gypsy Moth

Michigan State University Extension

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The gypsy moth (*Lymantria dispar* L.) is an exotic pest of urban and forest trees. Gypsy moth caterpillars feed on the leaves of oaks, aspens, and many other hardwood and conifer trees. During gypsy moth outbreaks, trees may be completely stripped of leaves. Although gypsy moth caterpillars rarely kill trees by themselves, trees weakened by heavy defoliation may become more susceptible to drought, disease or other insect pests. In addition, the large hairy caterpillars annoy people living or recreating in outbreak areas.

Managing gypsy moth requires the integration of a variety of control tactics. Biological control, the use of natural enemies to control a pest, can be an important part of an integrated pest management program for gypsy moth. One biocontrol agent that has recently shown much promise is a fungal pathogen, *Entomophaga maimaiga*.

Origin of *Entomophaga maimaiga*

Entomophaga maimaiga is a common disease in gypsy moth populations in its native country of Japan. The fungus was first released into the United States near Boston in 1910 as part of a program to introduce natural enemies of gypsy moth. Scientists could find no evidence that the fungus had become established and the project was abandoned a few years later. However, the fungus appeared unexpectedly in several northeastern states in 1989 and caused high mortality in many gypsy moth populations. Although scientists have several theories, the strange reappearance of the fungus is still a mystery.

Entomophaga maimaiga was first brought into Michigan in 1991 by scientists at Michigan State University and the USDA Forest Service. It was released in three sites in northern lower Michigan and monitored closely.

Additional introductions have since occurred and the fungus also is spreading naturally. *Entomophaga maimaiga* has now been found throughout most of Lower Michigan.

Life history of *Entomophaga maimaiga*

Entomophaga maimaiga passes the winter as a tough, thick-walled "resting spore" in the soil and on tree bark. In May and June, resting spores germinate and produce sticky spores at the end of a stalk that grows just above the soil surface. Gypsy moth caterpillars come into contact with these spores in the spring as they search for suitable leaves to feed on. The fungus digests its way through the exoskeleton of the caterpillar and grows inside the body of the caterpillar. Infected caterpillars may die within one week.

When young caterpillars are affected early in the summer, the fungus will produce a second type of spore called conidia. These microscopic spores are spread by the wind and can infect other caterpillars. The cycle of conidia production and infection may occur four to nine times during the summer. When the fungus develops in large caterpillars, it produces the overwintering resting spores.

Weather plays an important role in determining how effective *Entomophaga maimaiga* will be. Like most fungi, its spores need moisture and high humidity to germinate. Frequent rainfall during May and June contributes to the start and spread of *Entomophaga maimaiga* through a gypsy moth population. Temperatures of 50 to 80 degrees F enhance fungal growth.



Figure 1. Gypsy moth larva killed by NPV hanging in an inverted "V" position.

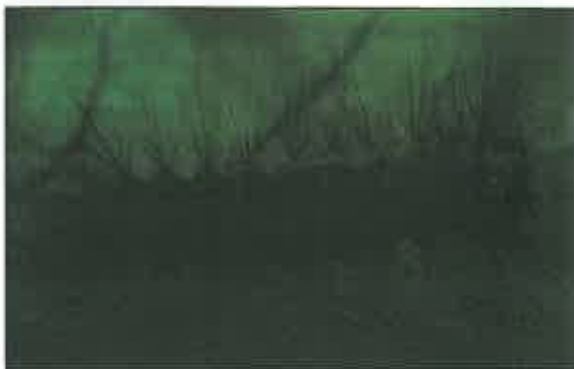


Figure 2. Dead larva covered with conidia of *Entomophaga maimaiga*.



Figure 3. Larvae killed by *Entomophaga maimaiga* often remain attached to trees.

Distinguishing *Entomophaga maimaiga* from NPV

Another disease is common in outbreak populations of gypsy moth. NPV (nuclearpolyhedrosis virus) is a virus disease that often causes gypsy moth outbreak populations to collapse. One important difference between the two diseases is that NPV is seldom prevalent until gypsy moth populations reach very high levels. In contrast, *Entomophaga maimaiga* may be found even when gypsy moth populations are low.

Caterpillars killed by NPV often remain attached to the stem or branches of trees. The bodies of the dead caterpillars are soft, filled with a brown liquid and disintegrate rapidly. Usually they hang limply in an upside-down "V" position (Fig. 1).

Caterpillars killed by *Entomophaga maimaiga* will also remain attached to tree stems or branches. However, the bodies tend to be stiff and straight, and the legs extend stiffly from the body. Some of the dead caterpillars may have tiny white conidia attached to the hairs on the body (Fig. 2). The cadavers may remain on the stem well into autumn (Fig. 3).

The future of *Entomophaga maimaiga*

Entomophaga maimaiga may become an important biological control of gypsy moth in both low and high populations. Infections may be more common in years with rainy spring weather than in years with dry spring weather. Scientists have found that the fungus is established in a number of areas in Michigan. Laboratory and field studies have shown that *Entomophaga maimaiga* is host specific and poses little risk to other insect populations. It will not affect other animals or humans. Introductions and evaluation will continue. Although there is not likely to be any "silver bullet" for gypsy moth, *Entomophaga maimaiga* should improve our ability to manage this pest in Michigan.

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Rep. 5.01-5M-IGMF-CP-Price \$1.50. Single copy free to Michigan residents. File 27.35 (Pests and Management)

Gypsy Moth Populations Growing

Robert Bricault, MSU Horticulture Educator

One of the hardest lessons I learned over the years is that information taught in the past may not be remembered tomorrow. Gypsy Moth management was the central focus of my career from 1985 through 1999. I worked in landscaping in Midland and Isabella Counties when Gypsy Moths caused the first defoliation in Michigan in 1985. During the 1990's the insect moved into Southeast Michigan where it continued it's destructive pattern of ravenous eating, stripping thousands of trees of their leaves.



By 1994, Extension worked with the Michigan Department of Agriculture mapping out areas with large Gypsy Moth egg mass counts for aerial spraying with the bacteria, Bt (*Bacillus thuringiensis*). Bt did not kill the caterpillars quickly, but made them sick by changing the pH in their stomachs. Eventually they stopped eating and starved to death.

Bt helped to reduce the population not eliminate it, giving parasites, predators and pathogens a chance to develop. A pathogen called NPV, nucleopolyhedrosis virus, began killing large number of caterpillars leaving them hanging in an upside down V on tree trunks. Unfortunately, NPV only worked well when populations of the insect were very high. A real break came when a soil borne fungus, *Entomophaga maimaiga* started to kill off large numbers of caterpillars in midsummer leaving them hanging straight down on tree trunks. The fungus was effective even in sites with low numbers of Gypsy Moths present. The fungus spreads during periods of consistent rainfall in late spring and early summer. Gypsy Moth populations have been at very low numbers for the past eight years in Washtenaw County mostly due to the *Entomophaga* fungus.

The drought of 2007 reduced the development of the fungus allowing more caterpillars to survive, change into moths and lay eggs. The increasing population of caterpillars led to localized defoliation of trees. The worst damage was on Blue Spruces. Fortunately, we did experience good rainfall in June 2008, allowing the *Entomophaga* fungus to spread and kill many caterpillars. Enough Gypsy Moth did survive in 2008 to produce larger numbers of egg masses than we have seen in over six years. This may cause some localized defoliation of trees again this coming summer, increasing the need to educate residents on managing this pest.

Gypsy moth eggs hatch in mid spring usually about the time serviceberry is in bloom. People often confuse Gypsy Moth with other caterpillars that make tents or webs in trees. Gypsy Moth can hang from silk like strands from a branch but do not make webbed tents. They can spread by wind while hanging from this thread. At this early stage they are susceptible to Bt. Bt works well on young caterpillars, but is ineffective once they get beyond an inch long. Trees can be banded with burlap to trap caterpillars that seek shelter under the burlap during the day. Unfortunately, in blue spruces it is

hard to manage them through banding. Once in the moth stage Gypsy Moth does not feed. The brown male moths can be seen flying around searching for the white female moths that do not fly. The female leaves behind buff colored egg masses that are easy to see.



Fall and winter are great times to go hunting for the buff colored egg masses in trees. If you have spruces check under the branches for the egg masses. If you find egg masses on structures, outdoor furniture or trees, knock them off into soapy water. This sanitation practice greatly reduces the number of caterpillars the following year. Some of their favorite trees include oak, birch, apple, willow, hawthorn, white pine, blue spruce, serviceberry and poplars, but they will eat leaves from maples and other trees that are not their most preferred species. If large populations are found damaging trees it may become necessary to treat the trees with an insecticide. The greatest risk is to evergreens like blue spruces and white pines that do not come back from defoliation as well as deciduous trees will. If using a pesticide make sure it is labeled for control of Gypsy Moth.



We are often asked why the county is not still part of the state's suppression program. The need for the program in Washtenaw and across Michigan declined as Gypsy Moth levels dropped very low across the state. The State's Suppression program actually ended in 2006 and also the availability of federal dollars to assist communities in aerial spray programs. The suppression program did what it was supposed to do, reducing the insects population long enough for other forces that help control Gypsy Moth to develop in our ecosystem.

Through careful monitoring, sanitation practices, banding as well as localized pesticide treatment, you can help to keep Gypsy Moth in check while allowing natural pathogens, predators and parasites to gain back a balance of control. Our hope is that nature will continue to keep Gypsy Moth populations at low levels in most years and eliminate the need for large scale spray programs. If you find large local Gypsy Moth infestations please share this information with the Horticulture staff at the MSU Extension office: 734 997-1678 or contact the Master Gardener Hotline from mid April through October at 734 997-1819.

Gypsy moth and gardening questions phone:
Washtenaw County, MSU Extension
Master Gardening Hotline at: 734 997-1819
Master Gardener Volunteers are available:
mid April through October
Monday through Thursday
9:00 a.m. – 12:00 noon
1:00 p.m. – 4:00 p.m.

At other times phone the MSU Extension office at 734 997-1678

Bacillus thuringiensis

Fact Sheet No. 5.556

Insect Series | Home and Garden



by W.S. Cranshaw*

Bacillus thuringiensis (Bt) is an insecticide with unusual properties that make it useful for pest control in certain situations. Bt is a naturally occurring bacterium common in soils throughout the world. Several strains can infect and kill insects. Because of this property, Bt has been developed for insect control. At present, Bt is the only “microbial insecticide” in widespread use.

The insecticidal activity of Bt was first discovered in 1911. However, it was not commercially available until the 1950s. In recent years, there has been tremendous renewed interest in Bt. Several new products have been developed, largely because of the safety associated with Bt-based insecticides.

Properties

Unlike typical nerve-poison insecticides, Bt acts by producing proteins (delta-endotoxin, the “toxic crystal”) that react with the cells of the gut lining of susceptible insects. These Bt proteins paralyze the digestive system, and the infected insect stops feeding within hours. Bt-affected insects generally die from starvation, which can take several days.

Occasionally, the bacteria enter the insect’s blood and reproduce within the insect. However, in most insects it is the reaction of the protein crystal that is lethal to the insect. Even dead bacteria containing the proteins are effective insecticides.

The most commonly used strain of Bt (*kurstaki* strain) will kill only leaf- and needle-feeding caterpillars. In the past decade, Bt strains have been developed that control certain types of fly larvae (*israelensis* strain, or Bti). These are widely used against larvae of mosquitoes, black flies and fungus gnats.

More recently, strains have been developed with activity against some

leaf beetles, such as the Colorado potato beetle and elm leaf beetle (*san diego* strain, *tenebrionis* strain). Among the various Bt strains, insecticidal activity is specific. That is, Bt strains developed for mosquito larvae do not affect caterpillars. Development of Bt products is currently an active area and many manufacturers produce a variety of products. Effectiveness of the various formulations may differ.

Disadvantages

Bt is susceptible to degradation by sunlight. Most formulations persist on foliage less than a week following application. Some of the newer strains developed for leaf beetle control become ineffective in about 24 hours.

Manufacturers are experimenting with several techniques to increase its persistence. One involves inserting Bt toxic crystal genes into other species of bacteria that can better survive on leaf surfaces (e.g., the M-Trak formulation of *san diego* strain).

The highly specific activity of Bt insecticides might limit their use on crops where problems with several pests occur, including nonsusceptible insects (aphids, grasshoppers, etc.). As strictly a stomach poison insecticide, Bt must be eaten to be effective, and application coverage must be thorough. This further limits its usefulness against pests that are susceptible to Bt but rarely have an opportunity to eat it in field use, such as codling moth or corn earworm that tunnel into plants. Additives (sticking or wetting agents) often are useful in a Bt application to improve performance, allowing it to cover and resist washing.

Since Bt does not kill rapidly, users may incorrectly assume that it is ineffective a day or two after treatment. This, however, is merely a perceptual problem, because Bt-affected insects eat little or nothing before they die.

Bt-based products tend to have a shorter shelf life than other insecticides.

Quick Facts

- *Bacillus thuringiensis* (Bt) is a naturally occurring bacterial disease of insects. These bacteria are the active ingredient in some insecticides.
- Bt insecticides are most commonly used against some leaf- and needle-feeding caterpillars. Recently, strains have been produced that affect certain fly larvae, such as mosquitoes, and larvae of leaf beetles.
- Bt is considered safe to people and nontarget species, such as wildlife. Some formulations can be used on essentially all food crops.
- Bt is used in agriculture as a liquid applied through overhead irrigation systems or in a granular form for control of European corn borer.

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*Colorado State University Extension entomologist and professor, bioagricultural sciences and pest management. 12/2008



Figure 1: Alfalfa webworms killed by *Bacillus thuringiensis*.

Manufacturers generally indicate reduced effectiveness after two to three years of storage. Liquid formulations are more perishable than dry formulations. Shelf life is greatest when storage conditions are cool, dry and out of direct sunlight.

Advantages

The specific activity of Bt generally is considered highly beneficial. Unlike most insecticides, Bt insecticides do not have a broad spectrum of activity, so they do not kill beneficial insects. This includes the natural enemies of insects (predators and parasites), as well as beneficial pollinators, such as honeybees. Therefore, Bt integrates well with other natural controls. For example, in Colorado, Bt to control corn borers in field corn has been stimulated by its ability to often avoid later spider mite problems. Mite outbreaks commonly result following destruction of their natural enemies by less selective treatments.

Perhaps the major advantage is that Bt is essentially nontoxic to people, pets and wildlife. This high margin of safety recommends its use on food crops or in other sensitive sites where pesticide use can cause adverse effects.

Bt-based products tend to have a shorter shelf life than other insecticides

Unlike most insecticides, Bt insecticides do not have a broad spectrum of activity, so they do not kill beneficial insects.

Perhaps the major advantage is that Bt is essentially nontoxic to people, pets and wildlife.

Table 1. Primary strains of *Bacillus thuringiensis* used in managing insects.

<i>Bacillus thuringiensis</i> strain (Common name)	Susceptible insects
<i>aizawi</i>	Many Lepidoptera larvae
<i>kurstaki</i>	Many Lepidoptera larvae
<i>israelensis</i>	Larvae of mosquitoes, black flies, fungus gnats
<i>japonensis</i>	Larvae of scarab beetles (Coleoptera: Scarabaeidae)
<i>tenebrionis (sandiego)</i>	Larvae of leaf beetles (Coleoptera: Chrysomelidae)
<i>CryIAb delta-endotoxin</i> ¹	Many Lepidoptera larvae
<i>Cry3Bb1 variant</i> ¹	Corn rootworm larvae (Coleoptera: Chrysomelidae)

¹Only used in production of genetically modified crops

Insects Controlled by Bt

Kurstaki strain (Biobit, Dipel, MVP, Steward, Thuricide, etc.):

Vegetable insects

- Cabbage worm (cabbage looper, imported cabbageworm, diamondback moth, etc.).
- Tomato and tobacco hornworm.

Field and forage crop insects

- European corn borer (granular formulations have given good control of first generation corn borers).
- Alfalfa caterpillar, alfalfa webworm.

Fruit crop insects

- Leafroller.
- Achemon sphinx.

Tree and shrub insects

- Tent caterpillar.
- Fall webworm.
- Leafroller.
- Redhumped caterpillar.
- Spiny elm caterpillar.
- Western spruce budworm.
- Pine budworm.
- Pine butterfly.

Israelensis strains (Vectobac, Mosquito Dunks, Gnatrol, Bactimos, etc.)

- Mosquito.
- Black fly.
- Fungus gnat.

San diego/tenebrionis strains (Trident, M-One, M-Trak, Foil, Novodor, etc.)

- Colorado potato beetle.
- Elm leaf beetle.
- Cottonwood leaf beetle.

Application

The greatest use of Bt involves the *kurstaki* strain used as a spray to control caterpillars on vegetable crops. In addition, Bt is used in agriculture as a liquid applied through overhead irrigation systems or in a granular form for control of European corn

borer. The treatments funnel down the corn whorl to where the feeding larvae occur.

Many formulations (but not all) are exempt from pesticide tolerance restrictions and may be used up to harvest on a wide variety of crops. This also makes Bt useful in applications where pesticide drift onto gardens is likely to occur, such as treating trees and shrubs. The exceptional safety of Bt products also makes them useful where exposure to pesticides is likely during mixing and application.

To control mosquito larvae, formulations containing the *israelensis* strain are placed into the standing water of mosquito breeding sites. For these applications, Bt usually is formulated as granules or solid, slow-release rings or brickettes to increase persistence. Rates of use are determined by the size of the water body. Make applications shortly after insect eggs are expected to hatch, such as after flooding due to rain or irrigation. Bt persistence in water is longer than on sun-exposed leaf surfaces, but reapply if favorable mosquito breeding conditions last for several weeks. Although the *israelensis* strain is quite specific in its activity, some types of nonbiting midges, which serve as food for fish and wildlife, also are susceptible and may be affected. For information on mosquito control, see fact sheet 5.526, *Mosquito Management*.

Use of Bt (*israelensis*) for control of fungus gnat larvae involves drenching the soil. Bt applied for control of elm leaf beetle or Colorado potato beetle (san diego/tenebrionis strain) is sprayed onto leaves in a manner similar to the formulations used for caterpillars. Bt does **not** control shore flies, another common fly found in greenhouses.

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