

**QUALITY ASSURANCE PROJECT PLAN**

**EARLY DETECTION/RAPID RESPONSE OF HEMLOCK WOOLLY  
ADELGID WITHIN WEST MICHIGAN**

**Assistance Agreement Number: GL 00E02215-0**

**prepared by**

**West Michigan Shoreline Regional Development Commission**

**Project Director:**

**Kathy Evans**

**prepared for**

**United States Environmental Protection Agency Region 5**

**December 7, 2017**

# Quality Assurance Project Plan Identification and Approval Form

December 2017

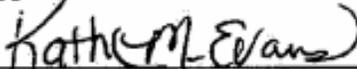
## West Michigan Shoreline Regional Development Commission

316 Morris Avenue Suite 340

Muskegon, Michigan 49440

Project: Early Detection/Rapid Response of Hemlock Woolly Adelgid within  
West Michigan

Approval:

 12/7/17

Kathy Evans Date

Project Director, West Michigan Shoreline Regional Development Commission

 12/7/2017

Daria Gosztyla Date

Project Coordinator, Ottawa Conservation District

 12/7/17

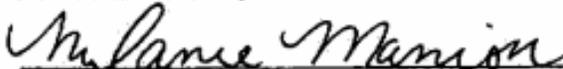
Jaime Way Date

Quality Assurance Manager and GIS Technician, West Michigan Shoreline Regional  
Development Commission

 12/8/17

Drew Rayner Date

Field Coordinator, Ottawa Conservation District

 12/18/17

Melanie Manion Date

West Michigan HWA Task Force Co-chair

\_\_\_\_\_  
Darlene Funches Date  
EPA Project Officer

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Louis Blume Date  
EPA Quality Manager

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## Project Abstract

The West Michigan Shoreline Regional Development Commission, with its West Michigan Cooperative Invasive Species Management Area partners, will launch efforts to control and potentially eradicate the Hemlock Woolly Adelgid, a devastating non-native, invasive species in Michigan. The project utilizes quality-assured Michigan Departments of Agriculture and Rural Development distribution data to begin treatments while expanding survey and treatment throughout Lake Michigan's coastal zone. The project includes outreach and education for public and private landowners; effective data management; early detection, rapid response and treatment of infested sites.

### A3. Distribution List

**Table 2. Project Distribution List**

<b>QAPP Recipient</b>	<b>Title</b>	<b>Organization</b>	<b>Telephone Number</b>	<b>Email Address</b>
Kathy Evans	Environmental Program Manager	WMSRDC	231-722-7878 ext. 17	kevans@wmsrdc.org
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Daria Gosztyla	HWA Project Coordinator	Ottawa Conservation District	989-992-3048	Daria.gosztyla@macd.org
Drew Rayner	WMCISMA Coordinator	Ottawa Conservation District	616-402-9608	Drew.rayner@macd.org
Melanie Manion	West Michigan HWA Task Force Co-chair	Ottawa County Parks & Recreation	616-738-4811	mmanion@miottawa.org
John Bedford	Pest Response Program Specialist	MDARD	517-284-5650	bedfordj@michigan.gov
Susan Tangora	Forest Health Section Manager	MDNR	517-420-0128	tangoras@michigan.gov
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Louis Blume	EPA Quality Assurance Manager	EPA	312-353-2317	blume.louis@epa.gov

TBD upon hire	Ecological Restoration Consultant	N/A	N/A	N/A
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#### A4. Organization of Project Participants

The West Michigan Shoreline Regional Development Commission (WMSRDC), as grant recipient, will be responsible for all aspects of project completion. WMSRDC is a federal and state designated regional planning and development agency serving 120 local governments in Lake, Mason, Muskegon, Newaygo, and Oceana Counties.

Kathy Evans, WMSRDC’s Environmental Program Manager, will act as the Project Director. Evans will be responsible for administering the project as well as overall leadership and coordination among project partners and contractors.

Daria Gosztyla of the Ottawa Conservation District, a sub-recipient of the Project, will serve as the HWA Project Coordinator. Gosztyla, with the assistance of the Project Director, Quality Assurance Manager & GIS Technician, and WMCISMA partners, will be responsible for:

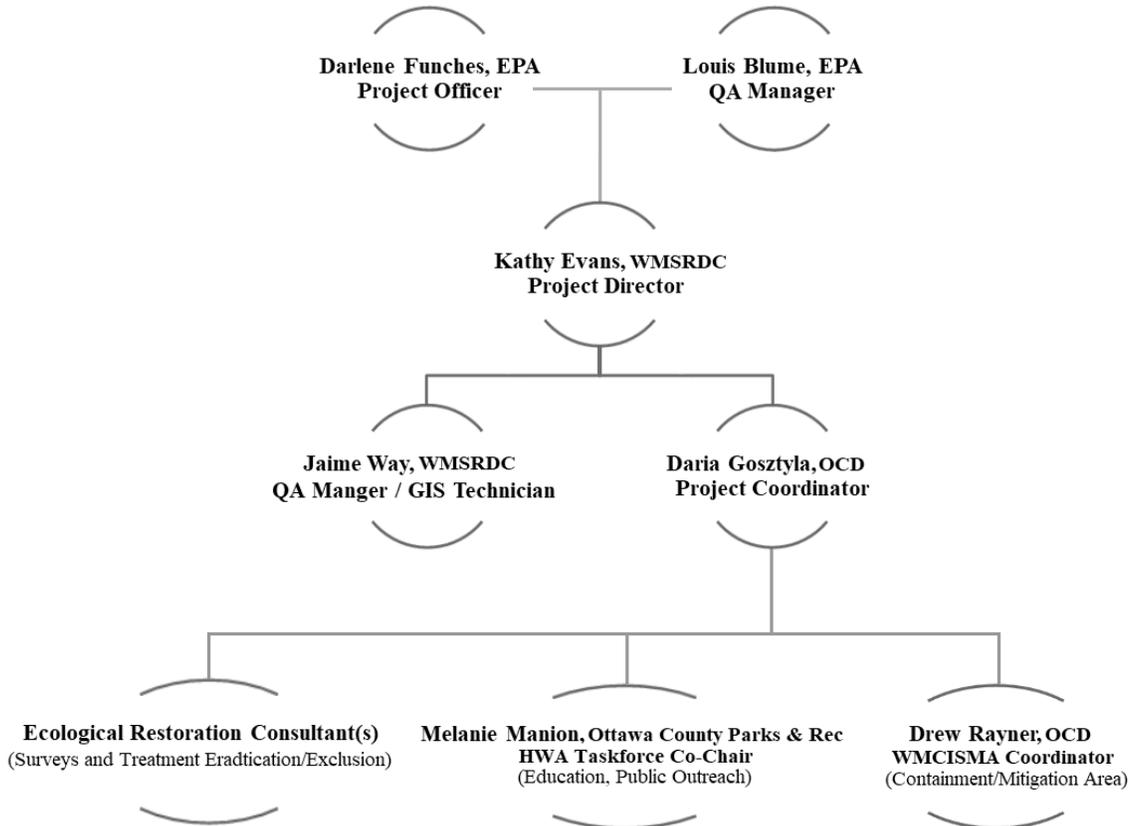
- Development of a competitive request for qualifications/proposals for both HWA survey and HWA treatment in Exclusion/Eradication Zones.
- Securing permissions and coordinating treatments of HWA in Exclusion/Eradication Zone and the Containment/Mitigation Zone.
- Overseeing consultants’ work to ensure data collection and treatment protocols are being carried out in accordance to the contractual agreement and QAPP. Gosztyla will be responsible for ensuring the survey and treatments are coordinated in such a way that the work is quickly prioritized to adapt to new information coming from surveys.
- Work with the WMCISMA, West Michigan HWA Task Force to conduct outreach and education within the community.
- Conduct extent surveys of known infestations with West Michigan CISMA Strike Team.

Jaime Way, WMSRDC’s GIS Technician, will be the Quality Assurance Manager for the duration of the Project. Way, with assistance from the Project Coordinator, will be responsible for:

- Creation of map of known distribution data of HWA
- Development of a three-year plan for HWA treatment based on known data and the prioritization process described in Section B1, B2, and B3 of this document.
- Consistently maintain and update Project data in appropriate formats.
- Storing HWA data, ensuring it meets spatial data standards and quality control standards.
- Provide administrative support for contracts and GIS support to document monitoring of outcomes.

Drew Rayner, WMCISMA Coordinator with the Ottawa Conservation District will manage staff to survey lands within the Containment/Mitigation Area and secure landowner permissions to conduct treatments. As WMCISMA Coordinator, Rayner and partners will help facilitate outreach efforts within the community and respond to resulting Midwest Invasive Species Information Network (MISIN) reports.

Melanie Manion, West Michigan HWA Task Force Co-chair, Ottawa County Parks and Recreation will lead the educational survey work conducted with local students and teachers while supporting public outreach endeavors.



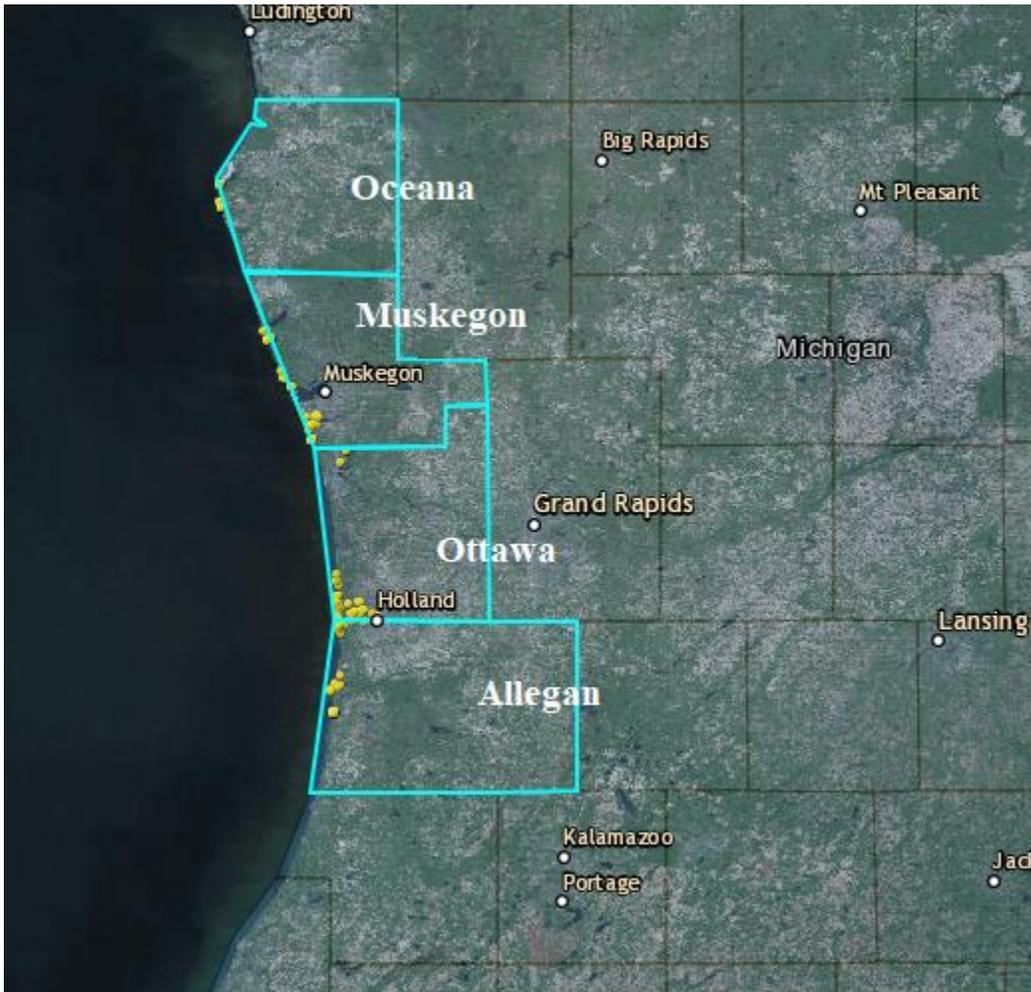
**Figure A4-1**

**A5. Problem Statement/Definition/Background**

The Eastern hemlock tree is a critical component to the mesic northern forests of Michigan. Hemlocks are long-lived evergreens that provide habitat for a significant number of Michigan fauna, such as deer and migrating and overwintering birds. The dense shade of hemlocks creates the abiotic parameters of the cold water streams needed for trout fisheries. Finally, hemlock trees are an essential part of the beauty of our northern forests and riparian corridors.

Hemlock Woolly Adelgid (HWA), *Adelges tsugae*, is a forest pest that has devastated hemlock forest along the East Coast of the United States from Maine to Georgia. In 2006,

Michigan Department of Agriculture and Rural Development (MDARD) documented the introduction of HWA in Michigan. MDARD has worked to prevent Hemlock Woolly Adelgid through monitoring nursery stock and eradicating reported sites. In 2016, eradication efforts transitioned from a few contained escapes from nursery stock to a more widespread problem. During the winter of 2017, staff from the Michigan Department of Natural Resources (MDNR) and Ottawa County Parks (OCP) conducted surveys on state lands and Ottawa County Park properties along the Lake Michigan shoreline to gain a better understanding of the distribution of HWA in West Michigan. HWA was detected at five state parks and one county park adjacent to a state park. Numerous additional reports from private landowners came in from early outreach efforts.



**Figure A5-1 Project Focus Areas (Oceana, Muskegon, Ottawa and Allegan counties)**

The current distribution of HWA is at the southern part of hemlock’s range. The effort to contain and slow the spread of the HWA will protect stands of hemlock trees in the northern part of its range, where hemlocks provide an essential part of the beech, maple, hemlock forests. By the end of 2019, this project will result in HWA being effectively eliminated or at a “maintenance level”. (Effective elimination/eradication and

“maintenance level” are terms that describe a reduction in invasive populations to a minimally- or non-threatening amount with regard to native species and/or systems, and also where future maintenance will require minimal resource allocation.) In doing so, WMRSDC and its partners will have protected the estimated 170 million hemlock trees within the state and the landscapes that are dependent upon them.

To achieve this, we propose surveying ½ mile around each of the currently known infested trees. As new infested trees are discovered, the shape and size of the infested area will be updated to create a management unit with ½ mile uninfested buffer. Within this management unit, all infested trees will receive at least one treatment over the course of the next three years. Additionally, hemlock trees within 800’ of an infested tree, with no detectable HWA, will receive treatment.

This project ties closely to both the Terrestrial Invasive Species State Management Plan, as well as the new Michigan Coordinated Statewide HWA Strategy that was adopted in July 2017. Within the Terrestrial Invasive Species State Management Plan, there are several objectives and strategic actions that this project will support, including collaboration. WMSRDC will be working in tandem with the West Michigan Cooperative Invasive Species Management Area (CISMA) and the West Michigan HWA Task Force. CISMAs are regional collaborative organizations that promote effective partnerships and shared management responsibilities. Because of the success the West Michigan CISMA has had to date, it has earned a reputation as being a key resource for invasive species work in the region. As such, the West Michigan CISMA is positioned to be a natural leader in HWA work. This project would continue to strengthen and expand the relationship between WMSRDC, the West Michigan CISMA, and other regional partners. These relationships are critical to having a coordinated, effective approach to the ongoing introduction of invasive species to the region. These relationships are also the backbone to creating a community that understands and supports the long-term management of invasive species. The new Michigan Coordinated Statewide HWA Strategy also recognizes the need to work with local and regional partners, like the WMCISMA to implement response tactics developed by the State HWA Coordinating Team.

This project also supports the Terrestrial Invasive Species State Management Plan which focuses on the importance of early detection and response. Surveying and determining the extent of infestations is a critical part of successful EDR programs. This project will provide the survey work needed to ensure all infestations are mapped in order to prioritize and treat them in a strategic manner that maximizes efficiency and minimizes costs. Additionally, the State HWA Coordinating Team and West Michigan West Michigan HWA Task Forces have determined that surveying to establish the extent of the current HWA infestations is of the utmost importance. As such, surveying for HWA is one of the highest priorities within the Michigan Coordinated Statewide HWA Strategy. This project also supports the EDR efforts by quickly implement a strategic, coordinated treatment regime. As HWA populations continue to spread beyond the few localized populations, the costs of treatment increases and the likelihood of containment decreases.

We are at a critical moment in the efforts to prevent the deleterious effects of HWA on our hemlock and mesic forest.

## **A6. Proposed Work**

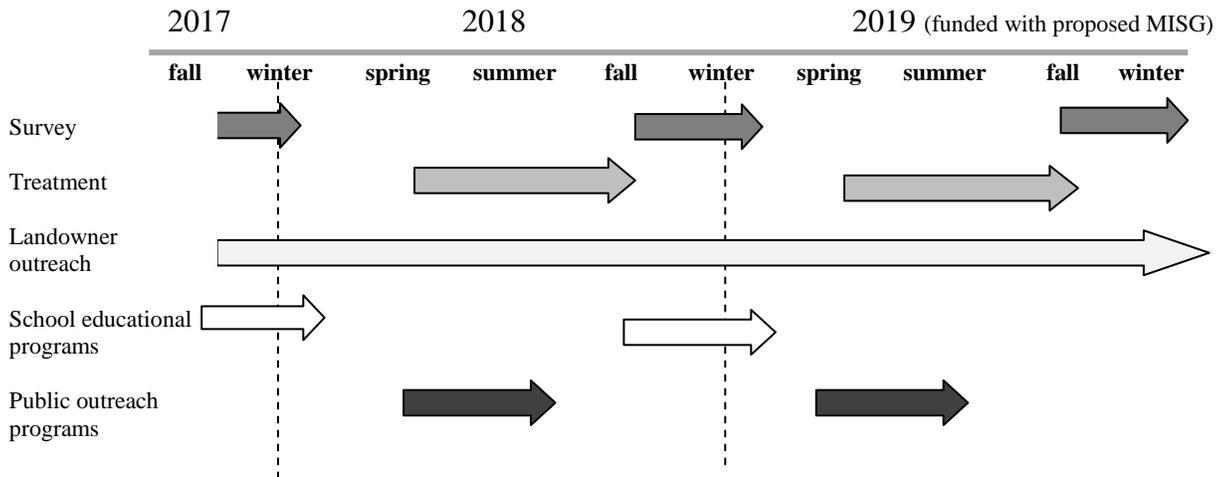
The project of “Early Detection/Rapid Response of Hemlock Woolly Adelgid within West Michigan” will:

- (1) Survey and/or re-survey all reported sites of HWA in the Containment/Mitigation Area. Surveys will include all sites currently documented in the Midwest Invasive Species Information Network database (MISIN) or reported to MDARD, OCD, WMSRDC, and Ottawa County Parks. All hemlocks within ½ mile from a known infested tree will be examined.
- (2) Contract 2,000 acres of presence/absence survey in areas within the Exclusion/Eradication Area for HWA. These sites are strategically chosen to include areas where HWA is not currently documented, but hemlocks are vulnerable to infestation. Surveys will be strategic to determine the northern and eastern extent of HWA. Focus will also be on riparian areas, which have a greater chance of HWA spread.
- (3) >90% of HWA populations from sites documented prior to May 2017 will be treated with the insecticide Imidacloprid or Dinotefuran. Treatment will be conducted by qualified contractors, and will occur on all infested trees and trees within 800’ of infested trees that do not have detectable HWA.

### **Treatments will be prioritized according to the following factors:**

1. To contain HWA to its current range, northernmost sites will be treated first. To date, those are located in Oceana County. However, if sites are discovered further north, those will become highest priority.
  2. Sites adjacent to conservation lands (such as state lands, forest service lands, parks, and preserves) will be prioritized to create a buffer to protect management efforts by those entities and the protection of those resources.
  3. Small, localized infestations that are outliers from the core infestation sites.
  4. Sites where the community is actively working to eradicate HWA.
- (4) Educate West Michigan communities about the benefits of the Great Lakes ecosystems and the effects of invasive species like HWA on these systems.

## Work Schedule



## Project Implementation and Outcomes

The implementation and outcomes of this project are envisioned as a critical phase of a long-term program, in which the WMCISMA and its partners work with state officials to contain and locally eradicate HWA. The Project anticipates the following outcomes:

1. Increased awareness of HWA and other forest pests within West Michigan.
2. Increased involvement in the monitoring of HWA by West Michigan CISMA partners, homeowners, and the general public.
3. An effective system to track infestations of new invasive forest pests.
4. A functioning, efficient Regional Response Advisory Team (RRAT) that specifically addresses HWA in the region called the West Michigan HWA Task Force. A RRAT, as described within the Great Lakes Basin Aquatic Invasive Species Response Plan, is responsible for the local risk and management assessment of a new invasive. Although HWA is not an aquatic species, the RRAT model can be adapted for a terrestrial species.
5. Expansion of current community-based invasive species control projects through West Michigan CISMA.
6. Implementation and enhancement of the HWA programs developed along the East Coast.
7. Prevent the spread of HWA by stopping pathways like bird feeders and contaminated yard waste through education and outreach. The general public and partners will be asked to remove bird feeders during the months of April through July to prevent the spread of HWA by birds. They will also be asked not to move hemlock clippings from the Containment/Mitigation Area.
8. Development and implementation of a short-term management strategy for HWA in addition to the development of a sustainable long-term eradication plan.
9. Lakeshore communities that value and steward hemlocks and other species of the Great Lakes coastal forests.

10. Protection of Great Lakes through preventing the loss of hemlock, a critical component of coastal forests and tributaries of the Great Lakes.
11. Continued development of relationships needed for responding to new forest pests that can be replicated when new pest, such as Asian longhorn beetle, arrive to the region.

## **A7. Data Quality Objectives**

The primary data quality objective is to create and continually update the most complete infestation map of hemlock woolly adelgid within West Michigan utilizing spatial data stored in GPS and GIS.

Data collection will largely be based on the ongoing surveys performed by field staff and qualified contractors. GPS information will be re-evaluated, refined, and updated to make the most accurate and comprehensive database possible.

Data quality acceptance criteria for important variables are as follows:

1. Hemlock Distribution (5 codes) – Based on a MDNR HWA survey variable. MDNR has successfully used this code to conduct HWA surveys on state land. The 5 codes are ST=Single Tree, FT=Few Trees, CL=Clumped, SC=Scattered, CO=Continuous. It is expected that correct determination of this variable will be made at a frequency of 95%, as this variable may be susceptible to subjectivity of observer. To counteract frequency of wrong determination, a pre-survey analysis of leaf-off aerial photography, hemlock model data, or Michigan Natural Features Inventory (MNFI) hemlock stand data will be utilized, where provided, to determine expected hemlock distribution on survey sites.
2. Hemlock Decline (Y/N) – Based on a MDNR HWA survey variable. MDNR has successfully used this variable to conduct HWA surveys on state land. Hemlock decline will be noted if the individual tree shows signs of decline. This would include needle loss, discoloration, or dieback. It is expected that correct determination of this variable will be made at a frequency of 95% to account for error in subjectivity of observer.
3. Extent Lower (Y/N), Extent Mid (Y/N), Extent Upper (Y/N) – Work will be conducted in conjunction with State and Federal forest resources professionals to continue to develop and refine methods to accommodate issues associated with partial tree infestations that may be present in one area of a tree and not another. Surveys will take place on multiple sides of the tree at all three levels to increase our chances of detection. It is expected that correct determination of this variable will be made at a frequency of 90% to account for survey error.

4. DBH –Observer will determine diameter at breast height (DBH) of each hemlock tree surveyed. DBH is measured in inches with a diameter tape. DBH will be used to determine the amount of pesticide to be used upon treatment. Diameter tape is measured to the 0.1 inch, allowing for an expected accuracy of +/- 0.1 inches. Measuring DBH will be guided according to American Forests Champion Trees Measuring Guidelines Handbook.
5. GPS Location – According to Global Positioning System Standard Positioning Service Performance Standard Service Performance Standard by the United States Department of Defense, Standard Positioning Systems (SPS) Signals in Space (SIS) have accuracy in the 95th percentile. This will allow for 95% accuracy of the GPS unit when taking coordinates. To ensure even greater accuracy and to avoid human error, observers will perform a GPS location test once per week. GPS Location test is explained in Section B6, B7, B8: Instrument Testing, Maintenance, and Calibration; Inspection of Supplies.
6. Insecticide Use – Insecticide will be applied according to specific label rates. Standard units that will be used for basal bark application and trunk injections are as follows:
  - Basal bark application: ounces of chemical / DBH (inches)
  - Trunk Injections: ounces of chemical / DBH (inches)

The rate of application will vary between each application method and each type of pesticide used, as each pesticide has different label rates and amount of active ingredient.

In the event of any discrepancy, GPS information can be referenced against a variety of sources. Infestation data will all be stored and maintained in an online database, the Michigan Invasive Species Information Network (MISIN) which allows competent members of the public to share GPS data they've collected on invasive populations. All public reports will be verified by trained staff. It can also be compared to not only the data collected in years past and the applied treatments (and their projected outcomes), but also against the non-direct, secondary measurements included in Section B9.

Data will also be collected on treatment of infested trees and buffer trees in GIS. This will allow for analysis of treatment efforts through annual monitoring. It will also facilitate the implementation of a long-term plan that will require phased treatments to protect ground water and other resources.

The Project aims to survey 70% of parcels with known infected trees, treat 90% of known infested trees, prophylactically treat 90% of uninfested trees within 800' buffer of known trees, and survey 100% of private lands that respond to outreach.

#### **A8. Special Training Requirements or Certification**

WMSRDC and its partners will ensure that surveyors utilize a slightly modified version of the Hemlock Woolly Adelgid Detection Survey protocols set forth by the Michigan

Department of Natural Resources (MDNR) Forest Resources Division. These guidelines encompass data collection in the form of manual documentation, hand map protocols, as well as GPS protocols. This mapping protocol will be further explained in Sections B1, B2, and B3.

The Project Coordinator's minimum requirements will include a Bachelor of Science degree in Natural Resource Management, or a related field. WMSRDC has an extensive GIS program with staff experienced in GIS, and hold a license for the use of ESRI GIS products.

All pesticides will be applied by a State of Michigan "Certified Applicator" and in accordance with the product label. There are no state and federal permits required for the project. Landowner permission and any required local permits will be acquired.

All staff and project members will attend an annual survey kickoff day to ensure that all staff have a base knowledge on expectations of what is needed and how to perform field work in a manner that meets the quality acceptance criteria. All data collected will be reviewed on several levels to ensure quality and accuracy. All documented field data will first be reviewed by the Project Coordinator and once that is completed, will be passed off to the Field Coordinator to do spot checks. The final review will be by the Quality Assurance Manager / GIS Technician who will have the final version of all data. If any issues are identified throughout this project, follow up training will be conducted to ensure issues are corrected. All training certifications and records will be kept by the Field Coordinator.

## **A9. Documents and Records**

It is the responsibility of the Project Coordinator and GIS Technician/Quality Assurance Manager to ensure contractors and partners are adhering to the QAPP as well as notifying the Project Director if any revisions are required as progress is made toward data collection. The Project Director will review any reports compiled by the Project Coordinator and GIS Technician/ Quality Assurance Manager and ensure that they comply with the QAPP. An updated version of the QAPP will be available upon request from WMSRDC. The GPS data collected by WMSRDC and its partners will be made available to authorized users of the MISIN website as well as upon request to USEPA.

The list of documents and records to be tracked by the Project are as follows:

- HWA Consolidated List – List of all known infested points
- Map of all known infestations
- HWA Survey form (for contractors)
- HWA Survey form (in-house crew)
- Survey Quality Control Check form
- Letter to landowners in areas of known infestation
- Letter to landowners in areas of no known infestation, with high risk
- Letter to owner's associations, property associations, etc.

- Survey permission form for landowners in areas of known infestations
- Survey permissions form for landowners in areas of unknown infestations
- Survey permissions form for owner’s associations, property associations, etc.
- HWA Communication Plan
- Map and associated list of all selected contractual survey areas
- Map and associated list of all known private campgrounds
- Map and associated list of all known brush dump sites
- Request for Qualifications/Proposals for contractual survey
- Request for Qualifications/Proposals for contractual treatment
- Inquiry Intake Form
- Field Quality Control Check Form

All data will be stored on servers housed within the County of Muskegon’s IT Department, which WMSRDC utilizes on a daily basis. The entire GIS server, including all drives and data is backed up every night at 6:00 PM, Eastern Time. These backups are kept for one week (7 days), allowing the project team to restore data. The GIS database housing all SDE data is included in these backups. Landowner permission data will be stored in a secure online platform, such as Salesforce. All electronic landowner data and permission forms, whether having incurred changes or not, will be backed up weekly (SyncBack) or on-demand (Box) both on- and off-site.

Each record shall be kept and maintained for a minimum of 7 years from the date of creation. The records shall be maintained in such a manner as to protect their integrity, to ensure their confidentiality and proper use, and to ensure their accessibility and availability to entities perusing HWA eradication/control efforts, or as required by law. HWA geospatial databases will be kept up to 7 years, or in perpetuity.

**Group B: Data Generation and Acquisition**

**B1, B2, B3. Design/Methods for Data Use or Collection**

The location of each HWA infestation will be determined and recorded using handheld GPS devices. Depending on the size of the infestation, different mapping techniques will be utilized. With small infestations each tree will be marked. Larger infestations will have a border traced by walking their perimeter with information taken on density of hemlocks within the stand. The project team will be provided with a multi-point shapefile that conforms to Midwest Invasive Species Information Network data fields. All GIS data must be submitted in this format with corresponding attributes tables containing (at a minimum) the fields of:

- OBSERVER
- LATITUDE
- LONGITUDE
- PARCEL #
- COMMON
- SPECIES

- SPECIES CODE
- OB\_AREA
- OB\_DENSITY (5 Codes)
  - ST=Single tree
  - FT=Few Trees
  - CL=clumped
  - SC=scattered
  - CO=continuous
- HWA\_UPPER CROWN (>20ft)? (YES OR NO)
- HWA\_MID CROWN (~9ft)? (YES OR NO)
- HWA\_LOWER CROWN (<5ft)? (YES OR NO)
- EHS\_UPPER CROWN? (YES OR NO)
- EHS-LOWER CROWN? (YES OR NO)
- LANDUSE (4 codes)
  - Private Residential
  - Private Forested
  - Public/Park
  - Private/Forested
- COUNTY
- TOWNSHIP
- COMMENT (treatment status prior to project may be included here)
- DBH
  - Inches (in)

Treatment data that will be collected to include:

- LATITUDE
- LONGITUDE
- PARCEL #
- DATE (of treatment)
- CHEMICAL CODE
  - I = Imidacloprid
  - D = Dinotefuran
- TREATMENT METHOD
  - BA = Bark Application
  - TI = Trunk Injection
- EPA REGISTRATION NUMBER
- TEMPERATURE
  - Degrees Fahrenheit (°F)
- AMOUNT USED
  - For Bark Application: ounces of chemical per inch of tree diameter
  - For Trunk Injection: ounces of chemical per inch of tree diameter
- APPLICATORS NAME
- TREE TAG (Y/N)
- PHOTO TAKEN (Y/N)

The specific GPS devices used may vary but include Garmin eTrex 20 and Garmin 60csx. Data collection will also be carried out on Apple or Android tablets/smartphones utilizing ArcGIS Collector software or Survey 123. Accuracy of devices will be monitored in the field. If the built in GPS chip is not sufficient a stand-alone GPS receiver will be added and connected via Bluetooth 4.0 (BTLE). The accuracy of the GPS units is based on whether they are using standard GPS, Differential Global Positioning System (DGPS), or Satellite Based Augmentation System (SBAS) such as Wide Area Augmentation System (WAAS). While GPS relies on satellite information alone to establish location, DGPS augments that data with a network of fixed, ground based systems provided by the United States Coast Guard, and WAAS transmits range corrections from land-based reference stations provided by the Federal Aviation Administration.

The Garmin units have a nominal accuracy of less than 15 meters using standard GPS, three to five meters using DGPS corrections, and less than 3 meters using WAAS corrections. Michigan has between 99 and 100 percent WAAS satellite availability as well as DGPS augmentation. All GPS data collected will include the type of device used (source) and then known level of precision.

The tree tag system would consist of one tag per tree, post treatment, and will be decided on competitively by the chosen Treatment Contractor. At a minimum, each tag will have a corresponding number utilizing a numbering system (1, 2, 3, etc.) and chemical code.

Photo documentation will be named using a location identifier and time stamp (date): Parcel#\_yyyy-mm-dd. Although this process can be time consuming as it requires manual input, the descriptive nature of the file name ensures that anyone who is searching for a specific page or date will have some ease in locating it from among other images. A software, such as GPSPhotolinker, or Gpicsync will be utilized to track data (from a GPS device) and match it with photos via the time stamps.

The Project Coordinator will work with the Quality Assurance Manager / GIS Technician should corrective action be needed following the collection of field data. The Project Coordinator will create a report of any discrepancies, the Field Coordinator will approve the need for corrective action, and the Quality Assurance Manager will implement the identified actions.

#### **B4. Analytical Methods**

The effectiveness of treatment will be measured by comparing the pre and post-treatment areas of invasive infestations as logged by GPS. Comparisons of population size and density will provide information on treatment effectiveness as well as the ability to project and plan the timeline to reduce infestations to maintenance levels at different sites. All GPS data will be imported to ESRI ArcGIS 10.5, specifically ArcMap 10.5, which will be running on a Microsoft Windows 7 platform. These data and any resultant information will be backed-up nightly and stored on the Muskegon County GIS server and accessed by WMSRDC, as mentioned previously in Section A9.

## **B5, B10. Quality Control Requirements / Data Management**

As mentioned in section B4, GPS data will be incorporated into a GIS database for mapping and analysis. All GPS data will have notation regarding what device it came from (source) and associated level of precision. All mapping in GIS will be referenced against a known aerial source which will allow obviously erroneous data to be rejected. The source maps will come from ArcGIS online's aerial basemaps. Any newer imagery that becomes readily available during the course of the project will be utilized. The GIS coordinate system reference will be the NAD 83 Michigan Georef projection which has an acceptable tolerance of four parts in ten thousand.

The continual monitoring nature of this project enables excellent quality control. The re-visiting of sites, both during as well as before and after the season, allows for on-the-spot assurance of proper treatment methodology. In some cases, a two person survey team will split responsibilities of GPS device usage and data collection utilizing the DNR's Hemlock Woolly Adelgid Detection Survey protocols. Rotation of those responsibilities will increase quality control on acquired data.

The Hemlock Woolly Adelgid crew members and contractual crew will be responsible for digitizing written field records. In addition to instilling into crew members the value of checking their own work for completeness and accuracy, all data will be re-checked by the Project Coordinator and Field Coordinator who will cross reference data for accuracy. The Project Coordinator will submit digitized data to the GIS Technician/Quality Assurance Manager, who will implement it into the database and will re-analyze data for discrepancies. Forms with omissions and obvious errors will be returned to the crewmember for correction or revisits. At the point of data entry a further checking of the forms is performed and forms that have errors or inconsistencies will be returned to fieldworker via his/her supervisor. If conflicts with digitizing field records arise, corrective action with crews will be implemented by the Field Coordinator.

## **B6, B7, B8. Instrument Testing, Maintenance, and Calibration; Inspection of Supplies**

All GPS units will be calibrated by testing against known reference points. While stationary, a significant number of points will be taken to provide proof that the receivers are within their recorded level of precision.

Observers will perform a GPS location test once per week. GPS location test will occur at observer headquarters and will be cross-referenced against a given coordinate determined by an independent source of higher accuracy as defined by the National Standard for Spatial Data Accuracy by the Federal Geographic Data Committee. Location of GPS location test will be determined prior to commencement of surveys. Observer will ensure all GPS units are set to the map datum "WGS 84" to ensure all data is easily transferrable to GIS platform without distortion. In addition, individual GPS unit accuracy can be determined by referring to NTDP GPS Receiver Accuracy Reports.

### Instrument Testing Protocol for GPS unit(s)

GPS Location Test will be performed once per week, preferably at the beginning of the week.

- 1) Turn on all GPS to be used in the field during data collection
- 2) Proceed to pre determined GPS test location
- 3) While located at pre determined GPS test location, record coordinate given by each GPS unit
- 4) Cross reference test coordinate with pre determined coordinate of higher accuracy
- 5) If test coordinate differs from pre-determined coordinate of higher accuracy, ensure observer is positioned in the correct location and try again. If test coordinate still differs from that of pre-determined coordinate of higher accuracy, ensure the inaccurate GPS unit is set aside until unit inaccuracy can be addressed.

Chemicals will be chosen based on recommendations from industry professionals who have been controlling HWA in its eastern range of the United States. These chemicals are known to be very effective in controlling HWA. Mix rates of chemicals will vary depending on several factors such as application method, concentration of product, and the number of inches present to treat. Treatments will be carried out at the lowest mix rate possible for the application while still be high enough to effectively control the infestation. All applications will be carried out by certified applications who will be working under a licensed firm and it will be the applicators responsibility to ensure the proper mix rate is used with a product that meets the standard for treatment.

The treatment Contractor shall provide and maintain an inspection system approved by WMSRDC for acceptance of supplies that have been inspected in accordance with the inspection system. As part of the system, the Contractor shall prepare records evidencing all inspections made under the system and the outcome. These records shall be kept complete and made available to WMSRDC during contract performance and for as long afterwards as the contract requires. WMSRDC and the Field Coordinator may perform reviews and evaluations as reasonably necessary to ascertain compliance with this paragraph. These reviews and evaluations shall be conducted in a manner that will not unduly delay the contract work.

### **B9. Use of Existing Environmental Data**

This project will utilize previously recorded GPS information of known HWA sites. As these data were recorded in the same way as defined in Sections B1, B2, and B3 they are of an acceptable quality level and their sources have been well documented in the accepted fashion.

**Group C: Assessment and Oversight**  
**C1, C2. Management Assessment and Oversight**

The Project Coordinator and GIS Technician/Quality Assurance Manager will review technical reports from the subcontractors to ensure the quality of data gathered is within the accepted range defined in this QAPP. The Project Coordinator will also provide monthly updates to the Project Director regarding QAPP compliance, project progress, data source evaluations, and information on subcontractors and personnel. Further modifications to the project can be discussed and implemented.

As field workers operate with a high degree of independence and flexibility, random and unannounced field check visits will be conducted by the Field Coordinator once a month during the duration of the survey season and may be used to check on time management and rate of data collection activities. Field check visits also provide an opportunity for field workers to interact with supervising staff and address field safety issues, as well as the opportunity for receiving more field supplies.

In the event that a problem is identified with quality assurance, the Project Coordinator will make recommendations to the Project Director. Any necessary changes in either data acquisition methodology or the QAPP itself will be implemented. Examples of solutions to poor data quality may include upgrading GPS equipment used, alternate surveying methods, and improved training of surveyors.

**Group D: Data Validation and Usability**

**D1, D2, D3. Data Review, Validation, Verification, and Reconciliation with Data Quality Objectives**

All data gathered will be subject to the validation criteria outlined in Sections B5 and B10. Using high quality aerial maps will provide an excellent baseline for whether or not the GPS data are accurate. In addition, inaccurate or mis-mapped GPS information will be readily apparent upon entry into GIS. Any data that are of an uncertain nature will be re-checked in the field and compared to secondary data from either within the organization or from outside sources.

A number of people will be responsible along a chain-of-custody for these accumulated data. Surveyors in the field will be able to see all GPS data points logged along their transects in real-time on the device's screen along with the information recorded concurrently to the points regarding species population size and density. The partners and contractors will also be able to compare the data they are entering against both known areas from previous years and aerial maps. Finally, the Project Coordinator will receive the partners GIS maps and evaluate the accuracy, precision, and completeness of data alongside similar information collected by TNC.

## REFERENCES

1. EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)  
<http://www.epa.gov/quality/qs-docs/g5-final.pdf>
2. EPA Requirements for QA Project Plans (EPA QA/R-5)  
<http://www.epa.gov/quality/qs-docs/r5-final.pdf>