The Commonwealth of Massachusetts

OPERATIONAL RESPONSE PLAN TO REDUCE THE RISK OF MOSQUITO-BORNE DISEASE IN MASSACHUSETTS

This document is open to continual review and evaluation and can be modified, if and when appropriate

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TABLE OF CONTENTS

Massachusetts State Reclamation and Mosquito Control Board

OPERATIONAL RESPONSE PLAN TO REDUCE THE RISK OF MOSQUITO-BORNE DISEASE IN MASSACHUSETTS

Introduction

Mosquito-borne viruses such as Eastern Equine encephalomyelitis virus (EEEv) and West Nile virus (WNv) have been and continue to be the cause of disease outbreaks in humans and animals in Massachusetts. These viruses can cause illness and death in humans, horses, as well as diverse kinds of native, exotic, and farmed birds such as emus. Even though vaccines exist to protect horses and repellants are available to protect humans, mosquito control can be a practical and meaningful method of protecting people especially when risk levels of virus become high or critical. Efforts to reduce risk of arbovirus transmission include but are not limited to public awareness and prevention, standard mosquito control methods utilized by established mosquito control projects applied to alleviate mosquito annoyance, as well as intensified ground-based treatments (when and where feasible) and aerial adulticide applications, whether targeted or over widespread areas, to suppress populations of infectious adult mosquitoes to reduce and/or halt a mosquito-borne disease episode or epidemic.

Purpose and Scope

This document (hereafter referred to as the Plan) describes the role and activities of the State Reclamation and Mosquito Control Board (SRMCB) to counter the threat of mosquito-borne diseases in Massachusetts such as EEEv and West Nile Virus (WNv). In particular, the plan identifies and highlights the important partnership between the Massachusetts Department of Public Health (MDPH), Mosquito Control Districts (MCP's), Mosquito Advisory Group (MAG) and the Executive Office of Energy and Environmental Affairs (EOEEA), in responding to a mosquito-borne disease event or emergency. This plan is intended to serve as a companion document to the most current version of the MDPH Arbovirus Surveillance and Response Plan (See Appendix 14). Invariably, the document is open to continual review and evaluation and can be modified, if and when appropriate. Currently, this document categorizes the roles of the key agencies responsible for characterizing risk and planning operational response. Finally, it provides protocols (see appendix 3) for evaluating efficacy and environmental impact of an intervention such as aerial adulticide application.

This plan:

- Describes the respective roles of SRMCB, MDPH, MCP's, MAG and others as well as the manner by which they shall interact and collaborate to ensure a coordinated and rational response to mosquito-borne disease risk.

- Contains a response structure (see Table 1 - Summary of Operational Response Plan Responsibilities and Appendix 1 - Detailed SRMCB Response Matrix to Prevent or Reduce Mosquito-Borne Disease) that summarizes the operating

characteristics and structural components needed to protect against, and respond to a mosquito-borne disease event.

- Outlines a multi-agency response when the threat of mosquito-borne illness warrants aerial application(s)

- Describes and highlights the specific activities and components that are being conducted and supervised by the SRMCB concerning any mosquito-borne incident.

Authority

The authorities of participating state and local agencies to respond to projected or current outbreaks of mosquito-borne disease and to exercise powers where necessary include:

- Chapter 252 of the Massachusetts General Laws (MGL) establishing the State Reclamation and Mosquito Control Board (SRMCB) and procedures for creating local control as well as eradicating (abating) mosquitoes in infested areas whenever it considers such activities to be necessary or useful. Under section 8 of Chapter 252, if the SRMCB concludes that certain improvements will benefit public health, the costs be paid by the Commonwealth, and the SRMCB must separately estimate that part of the expense, to be included with other estimates under MGL Chapter 29, Section 4.

- Chapter 132B of the Massachusetts General Laws (MGL), the Pesticide Control Act, designates the Department of Agricultural Resources as the lead state agency for implementing and administrating the Act and the Massachusetts pesticide program. Under this law, the DAR is responsible for registering all pesticides for use in the Commonwealth and for issuing all certifications and/or licenses in their legal use.

- Chapter 17 sections 2A of the Massachusetts General Laws states that upon declaration by the governor of a public health emergency, the Commissioner of Public Health may, subject to the approval of the governor and the public health council, take action to assure the maintenance of public health and the prevention of disease.

Roles and Responsibilities

Roles and responsibilities of key agencies involved in conducting mosquito-borne virus surveillance and response are outlined in the *Response Matrix* (*see Table 1 - Summary of Operational Response Plan Responsibilities* and *Appendix 1 - Detailed SRMCB Response Matrix to Prevent or Reduce Mosquito-Borne Disease*).

The matrix summarizes and identifies the duties of each agency, and their respective roles, as they relate to surveillance and intervention efforts. The MDPH and SRMCB are the two principal agencies responsible for the monitoring, detection, analysis, and implementation of operational interventions to protect public from mosquito-borne diseases in Massachusetts. In addition, a mosquito advisory group (MAG) has been established as a non-governmental partner to provide technical, expert advice to the SRMCB.

Massachusetts Department of Public Health (MDPH)
MDPH-SLI (State Laboratories Institute) responsibilities include performing surveillance of mosquito-borne viruses, providing risk assessments, disseminating public information relating to mosquito-borne disease, as well as providing advice to the SRMCB on appropriate risk management for these virus infections. MDPH's central responsibility is to characterize the severity of risk associated with mosquito-borne diseases such as EEEv and WNv. This characterization is based on the most current MDPH State Surveillance and Response Plan, which describe the steps and protocols for collecting and evaluating data for indications of a potential or current mosquito-related public health problem. MDPH Arbovirus staff analyzes surveillance data and issue weekly- summaries that include a current risk assessment on a dedicated MDPH website.

These arbovirus reports are also distributed to key state agency and MCP personnel via email. The SRMCB and the regional MCPs collaborate with MDPH surveillance effort by collecting additional field data for MDPH analysis.

The MDPH Bureau of Environmental Health (BEH) is responsible for addressing health concerns related to pesticide applications. If an aerial application is undertaken, the MDPH/BEH implements a surveillance system for possible pesticide related illnesses as reported by emergency departments in the area of application or the Poison Control Center, as well as by local health officials and individuals calling MDPH/BEH directly. In addition, MDPH/BEH works with MDEP and MDAR toxicology staff to develop recommendations on the choice of pesticide product for use in aerial application and develops a question and answer on health concerns related to the pesticide product used in aerial applications. This fact sheet is available on the MDPH/BEH web site

Once MDPH-SLI has characterized a situation of critical risk, justifying action to reduce transmission risk, the SRMCB weighs options and strategies for interventions. Intervention options may include source reduction, ground-or aerial delivery of larvicides, ground-or aerial application of adulticides, and public service advisories. The SRMCB would consult with MAG and after careful risk assessments based upon scrutiny of diverse ecological, epidemiological, operational, meteorological, and financial considerations, the SRMCB would advise its respective state commissioner and/or their representative of the intervention(s) that would be the most meaningful.

State Reclamation and Mosquito Control Board (SRMCB)
The State Reclamation and Mosquito Control Board is responsible for overseeing mosquito control in Massachusetts, whether in response to a public health situation or to reduce the overall annoyance caused by mosquitoes. The SRMCB provides a resource to municipalities statewide pertinent to mosquito-associated concerns, and works cooperatively with MDPH regarding all aspects of planning and response for mosquito-borne viruses that pose a risk to human health.

Pursuant to Chapter 252 of the MGL, the members of the SRMCB are appointed and represent the DAR, DCR, and DEP. The Board is based in the Department of Agricultural Resources.

The nine organized mosquito control districts or projects located throughout Massachusetts operate under the aegis of the SRMCB pursuant to the provisions of Chapter 252 of the Massachusetts General Laws and special legislation (individual and Resolves) that created them. Each MCP operates under the direction of a Commission. The SRMCB issues certificates and appoint Commissioners who carry out improvements on behalf of the SRMCB. The MCP Commissions represent the interests of the member communities of the MCP and their residents by providing oversight of MCP activities. The MCP Commissions strive to insure that the member communities receive services that are consistent with applicable laws and justified by tenets of Integrated Pest Management (IPM), public health, vector control, environmental safety, and fiscal responsibility. The MCP Commissions consider the input and respond to questions from community official and residents.

In accordance with the most current version of the MDPH Arbovirus Surveillance and Response Plan, MDPH notifies the SRMCB, MAG, and regional MCPs of surveillance data indicating increasing levels of arbovirus risk. The MDPH Arbovirus Surveillance Program (SLI) informs relevant MCP superintendents of positive isolations of EEEv and/or WNv. The MCPs, in turn, provide feedback to SRMCB and MDPH regarding abundance and developmental indices and trends for mosquito species of greatest epidemiological significance. MCPs may be directed by the SRMCB to increase or intensify ground control larvicide and/or adulticide applications when and where feasible to counter threats relevant to EEEv and/or WNv risk.

If risk of a mosquito-borne disease outbreak occurs or becomes widespread (covering multiple jurisdictions), MDPH will confer with local health agencies, SRMCB and MCPs to discuss the use of intensive mosquito control interventions beyond the standard measures employed by MCPs to reduce risk of human infection. The SRMCB will advise state agency Commissioners on interventions to reduce mosquito populations based on MDPH findings and characterization of risk. When a decision is finalized, the SRMCB's primary role is operational regarding the implementation and supervision of any state-funded aerial adulticide intervention.

SRMCB Mosquito Advisory Group (MAG)

The SRMCB created the Mosquito Advisory Group (MAG) to provide independent, scientific advice to the SRMCB regarding the justification, timing, location and options for intervention tactics such as to prevent and/or suppress and contain infected mosquito populations that may otherwise result in an outbreak of disease in people and animals. Members of the MAG are recognized experts in their fields and provide valuable independent assessments and recommendations to the SRMCB. The MAG members were selected primarily by the SRMCB; with some input from MDPH-BEH regarding individuals with toxicological expertise. **Current MAG members are listed in Appendix 13.**

A key role of MAG is to advise SRMCB whether to conduct or intensify proactive efforts to suppress certain mosquito populations ***before*** the force of transmission increases to pose enhanced risk to people. Based upon evaluation of assessments from MDPH, MCPs, MAG, and other agencies, *the SRMCB will advise its respective state agency Commissioners when it concludes that an aerial intervention is justified, and the details (timing, location, method) of the proposed effort*.

The MAG monitors entomological and epidemiological communications, data, and information regarding mosquito population species activity and abundance. MAG members participate in pre-season workgroups established by MDPH or SRMCB. MDPH, DAR, DCR, and other agencies are expected to communicate relevant data as well as their concerns to SRMCB, and these data/issues will subsequently be considered by MAG.

Mosquito Control Districts (MCPs)
Regional or local Mosquito Control Projects (MCPs) serve as critical elements in the surveillance network, and in performing and facilitating intervention efforts to reduce the burden of mosquitoes and mosquito-borne diseases. MCPs cooperate effectively with MDPH –SLI by coordinating the placement of traps, collecting, and identifying and submitting mosquitoes and associated data in a timely manner to MDPH-SLI. MCPs personnel have greater knowledge of local habitats and suitable field equipment that may be rapidly deployed to reduce populations of mosquitoes, and consequently, the transmission of mosquito-borne viruses. MCPs provide weekly summaries to the SRMCB on mosquito abundance, and diversity as well as on local conditions that may be conducive to mosquito development and survival. These summary reports of local conditions shall be provided to the MDPH Arbovirus program and incorporated in SRMCB/DAR analysis summary information.

Other EOEEA agencies
Other EOEEA agencies such as DEP, DFW, and the EOEEA Secretary and Public Relations Office along with DPH (BCDC, BEH, BSL) and DAR/SRMCB will engage and contact appropriate personnel as needed to participate in planning and facilitating interventions, particularly in terms of public relations and environmental monitoring.

Multi-Agency Response When the Threat of Mosquito-Borne Illness Warrants Aerial Application(s)

- DPH (BCDC) characterizes area of risk and delineates the spray area with a GIS map based on surveillance data relevant to mosquitoes and virus;

- DPH (BEH) contacts and provides pesticide illness surveillance protocol to Emergency Rooms, Poison Control Centers, and local health departments;

- DEP, DAR, and DPH (BEH/BSL) initiate plans for pre/post-monitoring for public drinking water reservoirs, honey bees, macro-invertebrates, and cranberries in designated spray area;

- DPH/BEH and DAR determine the type of pesticide to be used and obtain any EPA waivers, if necessary, for use in aerial application;

- DAR coordinates compilation of mosquito treatment sensitive areas data layers (no-spray zones) developed by DAR, DFW, and DEP within designated DPH spray area into a final GIS data layer;

- Mosquito treatment sensitive areas data layers (i.e. recommended no - aerial spray zones) include:
    - Certified organic farms
    - Priority habitats for spray sensitive state- listed rare species
    - Surface Water Supply resource areas
    - Commercial Fish hatcheries/aquaculture

- DPH (BCDC), in consultation with SRMCB, DAR, DEP, and DFW determines if spraying in mosquito treatment sensitive areas is necessary to protect the public health;

- If spraying in DFW-designated mosquito treatment sensitive areas is necessary to adequately reduce the risk to public health, DPH/BCDC requests a permit from DFW to be issued to DAR for taking endangered, threatened, or special concern species;

- DPH/BCDC requests Commissioner of Public Health issue a Certification that Pesticide Application is Necessary to Protect Public Health;

- DAR approves any needed emergency waivers to use pesticides on school property and ensure compliance with pesticide laws;

- DAR and DPH provide public notices regarding the locations, dates, and times of aerial spraying;

- DAR/SRMCB initiates aerial spray operations using collective guidance and consensus developed through multi-agency, cross secretariat process.

DPH- Department of Public Health
BCDC- Bureau of Communicable Disease Control
BEH- Bureau of Environmental Health
BSL- Bureau of State Laboratories

DAR- Department of Agricultural Resources
SRMCB- State Reclamation and Mosquito Control Board
DFG-Department of Fish and Game
DFW- Division of Fisheries and Wildlife

Internal Communication Processes
When mosquito-borne disease is projected to be a threat or during an outbreak, each of the SRMCB members report significant findings and concerns to another official within their respective agency to ensure that important mosquito-borne disease risk information flows to Secretary of EOEEA.

Diverse information relative to disease risk and mosquito control intervention options will be efficiently and freely communicated and carried out in three steps amongst the primary agencies of MDPH, SRMCB, and the MCPs.

1. MDPH Weekly Reporting
The MDPH SLI-Arbovirus Program generates and posts weekly Arbovirus Surveillance Program Reports. These reports summarize the results of mosquito trap collections from the prior week and other pertinent data. This information is forwarded to key personnel including but not limited to members of the SRMCB, mosquito control personnel, MAG members, state Commissioners from DAR, DCR, DEP and others within EOEEA.

The weekly reports comprise current and historical data including:
1) Avian Surveillance (Dead birds reported, tested, and infected (WNv);
2) Mosquito Surveillance (Cs. melanura abundance, number of pools tested and infected (EEEv and WNv) and Cs. melanura infection rates;
3) Veterinary cases (Number of infections and death by species (horse, emus, alpaca, etc) and virus (EEEv and WNv) ;
4) Human Cases (Number of infections and deaths by virus (EEEv and WNv) ;
5) Current Risk Classifications for EEEv and WNv by town and county.

2. *SRMCB/DAR Analysis*
The DAR entomologist (state entomologist) regularly reviews each MDPH/SLI generated Arbovirus Surveillance Program Report, in concert with other data provided by MCP superintendents to assess the extent of any risk, and form an opinion regarding the justification and urgency for a response. As the mosquito season evolves and when risk levels become a concern, brief abstracts or briefing on current conditions is distributed by e-mail to key personnel by the DAR entomologist (state entomologist). These reports may be sent bi-weekly and more frequently, if and when, required. Recipients will include SRMCB, MCP personnel, MAG members, state Commissioners from DAR, DCR, DEP and others within EOEEA as well as MDPH key personnel such as the state lab director and arbovirus surveillance program manager**.**

3. *MAG / SRMCB Analysis*
If an apparent or emerging risk appears imminent based on data and analyses from MDPH-SLI State Arbovirus program, DAR entomologist, MCPs or other entities, MAG will evaluate available data sets, describe, and prioritize strategies for intervention (method, location, timing), and advise SRMCB of their recommendations. Key MDPH Arbovirus staff such as the state lab director and arbovirus surveillance program manager shall be copied on the recommendations made by the MAG to the SRMCB. SRMCB will take these recommendations under advisement, and after consultation with

MDPH, MCPs, and other officials or senior managers within their respective state agencies, will decide whether to pursue the MAG recommendations.

If and when intensified interventions such as aerial adulticiding, are deemed justified, the SRMCB shall contract with credentialed mosquito control vendors to perform the service (See Appendix 12).

It is very important to note that this decision-making process can be quite rapid, and it may only be a few days from the MAG input and MDPH's risk assessment determination to the decision to conduct an aerial spray operation. The SRMCB has developed this plan to facilitate a rapid, and response as a result of a transparent decision-making process, given the short time and many steps needed to determine and implement best management practices to reduce projected or current mosquito borne disease threats.

Public Information, Communication, and Media Notification

The SRMCB will designate a spokesperson in advance of a potential mosquito-borne disease incident. This person will be knowledgeable, credible, and have good communication skills. This individual will not, however, be responsible for overseeing, or facilitating operational details for any such incident. MCP personnel can defer questions to the designated spokesperson and/or answer questions directly pertaining to the issues taking place in their own district area. Public information developed in collaboration with MDPH and others will be used in this plan and in media kits designed to communicate timely and accurate information to the public as far as in advance as feasible or during any mosquito-borne disease incident. Finally, SRMCB/DAR will work with the EOEEA Public Relations office and the MDPH Office of Public Health Strategies and Communication to ensure a standardized framework for communications and information sharing. The framework for communication include but are not limited to a system where the major media outlets are contacted via an electronic list of facsimile numbers by region, e-mail distribution lists, and web-based resources. The framework for communication will target messages that explain to the media, BOHs, and public a description regarding the kind, location, and extent of any mosquito-borne incident, instructions to public, benefits and risks of the planned intervention, fact sheets, frequently asked questions materials and contact lists for further information.

Notification of Key Contacts

In the event of a mosquito-borne disease event or emergency, the SRMCB will contact key personnel who will assist in any operational response, including the contact of entities requiring notification such as beekeepers, growers, certified organic farms and fish farms. Accordingly, GPS coordinates for certified organic farms; commercially licensed aquaculture operations and other sites to be excluded shall be available and uploaded into aircraft operational software (Appendix 9 and 10). Because beehives are frequently relocated throughout the season, the SRMCB has established a notification tree and will request the state chief apiary inspector contact County Association Presidents concerning the timing and location of aerial application activities; these representatives will, in turn, notify their members (See Appendix 11).

Environmental Monitoring

In the event that a decision is made to conduct aerial intervention(s), specific environmental monitoring to monitor possible effects on drinking water supplies, benthic macroinvertebrates, and honeybees will be conducted. The SRMCB through the respective agency each member represents (DAR, DEP, DCR) will activate and follow through with monitoring response protocols relating to **water supplies** (*even though water supply reservoirs are specifically excluded from the spraying operation*). Also, monitoring will be conducted on **aquatic macro invertebrates (benthos)**, since potential effects on aquatic biota cannot be ruled out (See Appendix 5 discussion of potential impacts from DEP-ORS). In addition, monitoring will be conducted to assess potential effects on **honey bees.** (See Appendix 6).

The sampling protocol for water supplies will assess any potential impact of the mosquito control spraying to drinking water. Monitoring activity will seek to assess the extent, if any, pesticide-related impacts to water supplies during and following aerial application operations. The monitoring plan for water supplies (See Appendix 8) specifies that post-spray water sample sets should be coordinated with the water supply sampling activities.

The sampling of surface waters and biota as outlined in the monitoring plan for pesticides/benthos should be conducted in conjunction with aerial application (See Appendix 7 Biomonitoring Protocol).

Finally, in addition to the above, MDPH (BEH-SLI) will conduct pre and post aerial adulticide application monitoring of cranberries in designated spray areas.

Certified Organic Farms

DAR will exclude all certified organic farms from aerial applications of adulticides, even under a declared emergency. DAR has worked with certifying organizations to identify certified organic farms, and to map these farms. Mapping is being done statewide. Mapping of all certified organic farms is an ongoing process and update annually.

The USDA National Organic Program (NOP) does not prohibit the application of pesticides for a public health emergency on certified organic farms. However, the NOP does require revocation of certification for 1 year should detectable residues be found after such a spray event.

DAR believes that this exclusion will have an insignificant impact on the efficacy of the spray operation. Certified organic farms are not prime habitat for adult mosquitoes and represent an extremely small area of land. Exclusion is necessary to protect the certification of the farm. As such, the risk benefit analysis favors exclusion.

There is no need to exclude transitional farms (Tfs) from spraying under the NOP. However, those Tfs that make known their status may be excluded. Transitional farms are those farms undergoing the process of becoming certified as organic. Under the NOP, when applications are done for public health purposes, there is no impact on the status of transitional farms or the timeline under which they become certified.

Creation of the Geographic Data for Aerial Adulticide Spray Operations

The MDPH SLI will make available a GIS polygon indicating the geographic area where human risk of EEEv or WNv is high to all agencies that are involved with the Commonwealth's mosquito control efforts. This GIS polygon will be circulated via email within 5 hours of its definition. Concurrently, hard-copy maps of the polygon will also be reviewed by MDPH/SEI using standard departmental cartographic templates and language and posted at the MDPH website.

The development, maintenance, sharing, and general stewardship of potential GIS data layers that demarcate areas that are sensitive to aerial spray operations, is the responsibility of the GIS staff in the agencies with respective authority for the these aerial spray sensitive areas. For example, the MDEP is responsible for the maintenance and provision of open water polygons that have been identified as spray sensitive areas. Similarly, certified organic farms and commercial aquaculture facilities are the responsibility of the MDAR GIS as are priority habitats the responsibility of the DFG NHES program. In anticipation of the mosquito season, agencies will create and maintain thematic GIS layers of areas that are sensitive to aerial adulticide spray operations and keep these layers up to date.

The release by MDPH of the GIS polygon indicating areas of high human risk of EEEv will be followed by the inclusion of aerial spray sensitive data layers from each agency within the designated polygon. The MDPH polygon and spray sensitive areas will be compiled by a GIS point person at DAR and re-circulated to DEP and DFG within 24 hours. Each agency must approve in writing (e.g., via email) to the GIS point of contact at DAR as to the accuracy of the delineation of the areas of high human risk and spray sensitive areas. With agreement from all agencies, DAR will send the final geographic data to the aerial applicator for conversion to appropriate navigational formats.

Mosquito Response Plan Funding and Costs

The cost of an emergency aerial intervention will be dependent on conditions identified as the mosquito season progresses, which includes but is not limited to the number of acres needing treatment, the amount of chemical necessary to cover the area of risk, calibrating and characterization of delivery apparatus of aircraft, environmental monitoring expenses, aircraft software (AGNAV) and Mapping Tech support, post-spray analysis, personnel expenses, and established contingency contracts for aerial application services.

Table 1: Summary of Operational Response Plan Responsibilities

MDPH Risk Category	MDPH	SRMCB
1- Remote	1. Standard surveillance activities. 2. Provide educational materials to the general public on personal prevention steps and emphasizing residential source reduction 3. Emphasize need for schools to comply with MA requirements for filing outdoor IPM plans 4. Conventional collection and testing of mosquitoes. 5. Passive human and horse surveillance 6. MDPH Epidemiological staff provide educational materials and clinical specimen submission protocols to targeted groups involved in arbovirus surveillance (including local boards of health, physicians, veterinarians, animal control officers, stable owners, etc.	Standard mosquito practices for monitoring and surveillance. Carry out Best Management Practices (BMPs) such as Integrated Mosquito Management (IMM) to reduce immature and adult mosquitoes. Maintain larvicide applications (where necessary) at designated sites; and adulticide applications based on Mosquito GEIR, MCPs surveillance, and other relevant data.
2- Low	Response as in category 1, plus: 1. Expand community outreach and public education programs, particularly among high-risk populations, focused on risk potential and personal protection, emphasizing source reduction.	Maintain larval control (where necessary when surveys or monitoring indicates need. Maintain adulticide applications based on Mosquito GEIR, MCPs surveillance, and other relevant data.
3- Moderate	Response as in category 2, plus: 1. Supplemental mosquito trapping and testing in areas with positive EEEV findings. Notify all boards of health of positive findings. 2. Public health alert sent out by MDPH in response to first pool of EEE virus positive mammal-biting mosquitoes detected during the season. The alert will summarize current surveillance information and emphasize personal prevention strategies. 3. HHAN (Health and Homeland Alert Network) alerts are sent to local boards of health upon confirmation of EEE virus in any specimen; health care facilities are advised of increased risk status and corresponding need to send specimens to SLI for testing.	Target Larviciding (if feasible) and adulticiding (where needed) at local municipal level including but not limited to multiple treatments via ground based truck mounted Ultra-Low-Volume (ULV) equipment depending on mosquito abundance and weather conditions.

MDPH Risk Category	MDPH	SRMCB
4- High	Response as in category 3, plus: 1. Intensify and expand active surveillance for human cases. 2. Local officials should evaluate all quantitative indicators mosquito including population density and time of year and may proceed with focal area aerial adulticiding. **3. MDPH will confer with local health officials, SRMCB and Mosquito Control Projects to determine if the risk of disease transmission threatens to cause multiple human cases and warrant classification as level 5.** 4. Intensify public education on personal protection measures including avoiding outdoor activity during peak mosquito hours, wearing appropriate clothing, using repellents and source reduction. a. Utilize multimedia messages including public health alerts from MDPH, press releases from local boards of health, local newspaper articles or cable channel interviews, etc b. Encourage local boards of health to actively seek out high-risk populations in their own communities (nursing homes, schools, etc.) and educate them on personal protection c. Increased advisory information on pesticides provided by MDPH- BEH d. Urge towns/schools consider rescheduling outdoor events.	Continue response as in Category 3 and expand or intensify where needed or around positive virus findings, location of residents near positive findings, type(s) of wetland habitat to target where treatment would be most effective. MCP's/BOH may proceed with focal area aerial adulticiding as approved by the SRMCB in order to suppress risk in these areas. The SRMCB considers "focal area" to include but not be limited to a multiple mile radius circle or larger around positive virus findings that could incorporate multiple communities, towns or cities. The delineation of a focal area at risk depends on a number of factors such as prior year isolations, timing of current virus isolations as well as the species of mosquitoes where virus is confirmed, location and density of residents near positive findings, type(s) of wetland habitat to target where treatment would be most effective, general mosquito habitat, and the cyclical and seasonal conditions that represent conditions conducive to risk of human disease Confer with MDPH and local health officials and determine if classification 5 is warranted. *If high health risk is declared, advise respective agency commissioners of appropriate pesticide, extent and route of treatment and targeted treatment areas and advise commissioners whether a more aggressive approach such as aerial application is necessary. When State Commissioners of DAR, DEP, and DCR agree that aerial adulticide is necessary, DAR Commissioner notifies Secretary of EOEEA.*

MDPH Risk Category	MDPH	SRMCB
5- Critical	Response as in category 4, plus: 1. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine if measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide. Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of EEE human disease. 2. MDPH Bureau of Environmental Health (BEH) will initiate active surveillance via emergency departments and with health care provides only if aerial spraying commences. 3. MDPH will designate high-risk areas where individual no spray requests may be preempted by local and state officials based on this risk level. Aerial adulticiding will override no-spray requests. If this becomes necessary, notification will be given to the public including those who have opted out. 4. MDPH recommends restriction of group outdoor activities, during peak mosquito activity hours, in areas of intensive virus activity. 5. MDPH will communicate with health care providers in the affected area regarding surveillance findings and encourage prompt reporting of all suspect cases.	Continue response as in Category 4. If critical health risk is characterized by MDPH notify respective agency officials of appropriate pesticide, extent and route of treatment, targeted treatment areas and advise commissioners whether full scale adulticide aerial spraying is necessary. Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by providing advice relative to: A. Appropriate pesticide B. Extent and route of treatment C. Targeted treatment areas State Commissioners of DAR, DEP, DCR agree that aerial adulticide is necessary and DAR Commissioner notifies Secretary of EOEEA. EOEEA Secretary and HHS/MDPH jointly notify Governor. Governor considers advisement to approve declaration of emergency to protect public health risk.

Conclusion

The overall goal of reducing and/or halting the transmission risk of mosquito-borne diseases to Massachusetts citizens during any mosquito season is ultimately achieved by having contracts in place such as aerial application service and insecticide vendor contracts, as well as essential personnel contact lists, and operations plan ready prior to a projected or current mosquito-borne disease outbreak or emergency. These contracts, contact lists, and plan ensure that aircraft, personnel, product, and other supports are available for a rapid and timely response.

This plan assures that the Commonwealth is ready to provide appropriate and as, quickly as practical, the most meaningful response based on entomological, epidemiological, meteorological, and ecological data backed up by both practical and scientific evaluation of this data by the MDPH-SLI, MDPH-BEH, SRMCB, MAG, and other state agencies such DAR, DCR, DEP, and DF & W.

Appendices

- Appendix 1: SRMCB Response Matrix to Prevent or Suppress Mosquito-Borne Disease
- Appendix 2: Chain Of Command Flow Chart
- Appendix 3: SRMCB Massachusetts Mosquito Control Surveillance Protocol For Evaluation of Efficacy of Aerial Adulticide Application(s) Regarding Mosquito-Borne Disease
- Appendix 4: Aerial Application and Insecticide ANVIL 10+10 Information Sheet
- Appendix 5: Water Quality Sampling for Mosquito Control Aerial Chemical Application
- Appendix 6: Honeybee Monitoring Protocol for Aerial Mosquito Adulticide Application
- Appendix 7: Biomonitoring Plan: Pesticide-Related Impacts to Macroinvertebrates (Benthos) Following Aerial Application
- Appendix 8: Water Supply Monitoring Plan to Assess Potential Impact of Mosquito Control Spraying During Any Public Health Emergency To Drinking Water
- Appendix 9: Certified Organic Farms List
- Appendix 10: Commercial Freshwater Fish Farm List
- Appendix 11: Bee Keeper Association Notification Tree Contact List
- Appendix 12: Contacts for Conducting Control of Adult Mosquitoes (Vector Species)
- Appendix 13: 2008 Mosquito Advisory Group (MAG) Members
- Appendix 14: 2008 Massachusetts Arbovirus Surveillance and Response Plan

Appendix 1: SRMCB Response Matrix to Prevent or Suppress Mosquito-Borne Disease[1]

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
Conduct surveillance (*Avian such as dead birds, native, exotic, and farmed birds such as emus, mosquitoes, veterinary such as horses, ponies, alpaca etc., and human*)	MDPH-SLI	- To trap, sort, and identify mosquitoes in the field at long-term sites; - To test submitted Dead Birds from Cities/Towns; - To obtain Data from Veterinarians; and - To obtain Clinical Data from Physicians/Hospitals.	June 1 through October 15th
Conduct standard or supplemental surveillance (*mosquitoes*)	MCPs/SRMCB	- To collect and submit mosquito pools to MDPH-SLI for virus detection from non MDPH-SLI sites; - To monitor and report on abundance or trends for both immature and adult mosquito population in local geographic area; - To monitor local climate and weather data; and - To provide weekly trap data.	June 1 through October 15th
Process and report laboratory analyses results	MDPH-SLI	- To perform screening and confirmatory testing of collected specimens (dead birds, mosquitoes, horse, humans etc.); - To maintain and transmit laboratory results via an Arbovirus software system to MCPs; - To distribute weekly arbovirus report regarding laboratory results and confirm positive isolations of EEEv and/or WNv to SRMCB and MCPs; and - To notify Boards of Health using the Health and Homeland Alert network (HHAN) to report Bird and mosquito results.	June 1 through October 15th
Characterize severity of human risk	MDPH-SLI	- To evaluate **current level of risk** geographically based on triggers outlined in the **MA Surveillance and Response Plan.**	June 1 through October 15th
Communicate severity of human risk to public	MDPH Office of Public Health Strategies and Communication	-To provide Guidance and Alerts to BOHs, general public, and media on ways to reduce risks.	June 1 through October 15th
Analyze, evaluate, and scrutinize all available data from MDPH-SLI and MCPs	MAG	- To advise SRMCB concerning mosquito control intervention(s) necessary to prevent or reduce human risk ***before*** it becomes significant or spreads.	Ongoing – May 15th to October 15th

[1] See Agency Key on Page 36.

NOTE: Due to the complexity of operations to prevent or suppress mosquito-borne disease, actions outlined in this matrix may be implemented concurrently or simultaneously in order to achieve the objectives. Moreover, the actions outlined, responsibilities, and associated time-lines may be subject to change without notice.

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
Submit summary report(s)	SRMCB/DAR	- To inform and advise SRMCB respective state agencies commissioners and EOEEA key personnel of arbovirus risk status and mosquito control response intervention being taken (if any).	Beginning when virus is first confirmed and Bi-weekly from July 15st-September 30th
Advise respective state agency stakeholders when necessary	SRMCB, MAG, and DAR	- To determine what mosquito control intervention will be most effective to **prevent or suppress** potential for human risk including but not limited to maintain standard mosquito and virus surveillance activities, increase mosquito and virus surveillance activities, intensify and increase localized control of immature (where practical) and/or adult mosquitoes, and/or accelerate, expand, and target control of adult mosquitoes in larger geographical areas.	Ongoing – May 15th to October 15th Or when virus is confirmed
Review, select and approve insecticide or product of choice	MDPH BEH, DEP, DAR including SRMCB	- To prepare and collaborate to select and approve the specific pesticide product to be used; and - To file and obtain Federal authorization to use a pesticide not registered for use over crops.	Ongoing-January 1st to December 31st
File application to EPA for public health emergency exemption (if required)	DAR/ SRMCB	- To file and obtain Federal authorization to use a pesticide not registered for use over crops.	Ongoing-January 1st to December 31st
Direct MCPs to respond locally	SRMCB	- To adjust, increase, or maintain standard mosquito surveillance and control activities to **prevent or suppress** potential for human risk.	Ongoing – May 15th to October 15th Or when virus is confirmed
Classify risk as Level 5 or (Critical)	MDPH-SLI	. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB, and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine if measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide. Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of EEE human disease. Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by providing advice relative to: A. Appropriate pesticide B. Extent and route of treatment C. Targeted treatment areas MDPH- (BEH) will initiate active surveillance via emergency departments and with health care provides only if aerial spraying commences	June 1 through October 15th

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
Notify respective state agency Commissioners of Level 5 (Critical) classification	SRMCB and DAR	- To advise SRMCB respective state agencies commissioners. DAR Commissioner notifies EOEEA Secretary when highest level of risk has been characterized by MDPH-SLI for purpose of considering the most effective interventions to **prevent or suppress** human risk including but not limited accelerating, expanding, and targeting adult mosquitoes in larger geographical areas such as aerial application.	Concurrent with virus characterization and mosquito control advice
Classify risk as Level 5 or (Critical) cont'd.	MDPH-SLI, MDPH-BEH, DAR, SRMCB, MAG, and DF& W	- To initiate emergency conference calls and meetings with multiple state agency stakeholders including but not limited to MDPH-SLI, MDPH-BEH, DAR, SRMCB, MAG, DF&W in order to reach consensus on most effective way to **prevent or suppress** human risk including but not limited accelerating, expanding, and targeting adult mosquito control in larger geographical areas such as aerial spray. SRMCB will notify respective their state agencies commissioners. DAR Commissioner notifies EOEEA Secretary regarding emergency conference call(s) and meeting consensus; and To invite Aerial Applicator Vendor, Insecticide vendor, BOHs to participate.	Concurrent with virus characterization and mosquito control advice
Contact emergency aerial applicator and insecticide contractor	SRMCB	- To facilitate the timely deployment of aircraft and pesticides required for an aerial intervention.	Immediately upon multiple stakeholder consensus and before declaration of Public Health Emergency
Notify and advise executive level administrators within State government	MDPH Commissioner's Office and EOEEA Secretariat Office	- To inform and advise of critical mosquito-borne risk level.	Concurrent with virus characterization and mosquito control advice
Notify and advise Governor	MDPH Commissioner's Office and EOEEA Secretariat Office	- To provide joint notification and advisement by MDPH Commissioner, EOEEA Secretary, EHHS Secretary, in order for Governor to consider declaration of public health emergency.	Concurrent with virus characterization and mosquito control advice
IMPLEMENT OPERATION **Send formal authorization to aerial applicator and pesticide contractor**	SRMCB and DAR	To confirm and formalize communications that authorize both aerial applicator and insecticide contractor to proceed for the purpose of making an aerial mosquito adulticide application over the populated areas identified in specified geographic portions of Massachusetts in response to increased mosquito populations and infection rates of EEEv and WNv on behalf of the Commonwealth of MA and State Reclamation and Mosquito Control Board.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Confirm federal authorization of pesticide product to be used for aerial intervention**	DAR	- To ensure compliance with state and federal pesticide laws.	Immediately and concurrently with declaration of public health emergency

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
IMPLEMENT OPERATION (Cont'd) **Notify the Federal Aviation Administration (FAA)**	SRMCB	- To complete notification of the FAA that an aerial intervention will be performed; and - To obtain approval to apply insecticides for mosquito control over Congested Areas (CAP) citing geographic area and beginning and end dates of treatments.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT **OPERATION (Cont'd)** **Notify the Massachusetts Aeronautics Commission (MAC)**	SRMCB	- To obtain the certificate of waiver from the Massachusetts Aeronautics Commission (MAC) pursuant to 702 CMR 4.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Forward all approval documents from FAA and MAC to aerial applicator**	SRMCB	- To assure compliance with state and federal aviation rules and regulations.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Notify pre-designated airport for conducting operations**	SRMCB and DAR	- To obtain approval to use facility as operational site as pre-designated; and - To insure secure site for aircraft and pesticide inventory at airport during operations.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Request Massachusetts Environmental Police Detail**	SRMCB and DAR	- To provide security for the aerial application operation at the airport.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Establish base of operations**	SRMCB and DAR	- To supervise the operation and facilitate the communication and decision-making in accord with the operational plans.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Calibrate and characterized spray delivery apparatus**	SRMCB/DAR and Contractor	- To ensure calibration and characterization of spray delivery equipment in compliance with product labeling and other operational parameters.	Concurrent with time of anticipated treatment
IMPLEMENT OPERATION (Cont'd) **Notify DF&W and DMF in accordance with Fish Impact MOU**	SRMCB and DEP and DAR	- To follow State Fish Impact Memorandum of Understanding (MOU).	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Notify MPAL that samples will be delivered**	SRMCB and DAR	- To arrange with the University of Massachusetts Pesticide Analysis Laboratory (MPAL) for the analyses of all samples collected pre- and post-application.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Implement Water Quality Sampling and other Environmental Monitoring Protocols**	SRMCB and DEP and DAR	- To carry out established Water Quality Sampling and other environmental monitoring protocols.	Immediately and concurrently with declaration of public health emergency

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
IMPLEMENT OPERATION (Cont'd) **Activate notification protocols for bee keepers, aquaculture facilities, and certified organic farmers, and honey bees**	SRMCB and DAR	- To activate the Bee Keeper Association Notification Tree and facilitate communication and provide information on the specific pesticide application operational details to the following previously identified agricultural parties: o Beekeepers; o Aquaculture Facilities; and o Certified Organic Farmers.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Assign MCPs personnel to observe and note aerial application characteristics and weather.**	SRMCB and DAR	- To have MCPs personnel observe flight paths, pesticide applications, conduct pre and post application sampling of mosquitoes to determine efficacy and evaluate/document weather conditions including wind and temperatures during the applications.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Activate SRMCB efficacy trapping protocol and convene meeting of efficacy-evaluation workgroup**	SRMCB, MDPH-SLI, MAG, and MCPs	- To have **efficacy-evaluation workgroup** confirm trap type, trap placement; target species; and distance from spray perimeter in accordance with the SRMCB Efficacy protocol and review the GIS maps representing the geographic area and habitats encompassed by the spray zone to determine specific trap sites that will be included in the IN/OUT to measure for efficacy evaluation	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Establish integrated communication strategy.**	SRMCB and DAR	- To ensure interoperability of communication equipment such as cell phones, radios, etc. such that all divisions within the operation maintain communication with each other and provide necessary and otherwise important information in a timely manner.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Designate official(s) who will communicate with the aerial pilot.**	SRMCB and DAR	- To designate state official(s) who will supervise the aerial spray operation and communicate with pilot(s) prior to, during, and after spraying operations	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Assign state personnel for on site inspection and monitoring**	SRMCB and DAR	- To designate state officials, in addition to contractor personnel, to inspect airplanes and spray equipment, monitor calibration and characterization of droplets, monitor pesticides being loaded into the aircraft.	Immediately and with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Notify and coordinate activities of Public Relations Office of EOEEA, EHHS, MDPH Office of Public Health Strategies and Communications**	DAR, MDPH Office of Public Health Strategies and Communications and Contractor PR services	- To insure coordination between Public Relations Office of respective state agency secretariat responsible to conduct media campaign for dissemination of public health risk communication information regarding specific areas that will be treated, timing of application, choice of pesticide, and information to mitigate personal and environmental risks through media outlet electronic fax notification system called BLAST and other means.	Immediately and with declaration of public health emergency

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
IMPLEMENT OPERATION (Cont'd) **Notify media relative to treatment areas**	MDPH Office of Public Health Strategies and Communications and DAR/SRMCB	- To provide the media with maps detailing treatment areas; - To provide the media with public health risk communication information; - To provide the media with information relative to the choice of pesticide to be used, the time of applications, and information to help mitigate environmental health risks in the specific towns to be treated; and - To make the above information also available via the state websites maintained by MDPH and DAR.	Immediately and with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Notify local Police Departments in treatment areas**	SRMCB and MCPs	- To help prepare local Police Departments in treatment areas; such that, they are aware of the spray operation to occur in their community and are able to direct individuals calling them to the State's informational resources via established informational hotlines, websites, etc.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Notify Local Boards of Health in designated treatment areas**	MDPH-SLI	- To notify Local Boards of Health in designated treatment areas utilizing the Health and Homeland Alert Network (HHAN); such that, they are aware of the spray operation to occur in their community and are able to direct individuals calling them to the State's informational resources via established informational hotlines, websites, etc.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Develop and Send final GIS mapping shape file data to SRMCB**	DAR	- To compile and develop the final comprehensive GIS maps with all exclusion zones delineated to EOEEA agencies such as DAR/SRMCB, DFW, DEP and DCR for consensus and approval; and - To allow for the SRMCB to provide the GIS maps to the aerial applicator/contractor no later than 48 hours prior the commencement of operation for navigation software preparation.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) Follow up to Ensure that GIS maps for aerial intervention are complete for operations	SRMCB	- To ensure final GIS shape file maps with the required exclusion zones and buffer zones for the specified treatment areas have been forwarded to aerial application service vendor in order to ensure pilot/aircraft navigation systems via AGNAV software uploaded in timely manner.	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) Obtain additional assistance from CDC to assist in aircraft and insecticide set up if necessary	SRMCB	- To obtain additional assistance from CDC to assist in aircraft and insecticide set up **(if necessary).**	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Implement active surveillance of potential health effects in area of treatment**	MDPH-BEH	- To activate and implement active surveillance of potential health effects in area of treatment	Immediately and concurrently with declaration of public health emergency
IMPLEMENT OPERATION (Cont'd) **Identify media Public Information Office (PIO)**	MDPH Office of Public Health Strategies and Communications and DAR/SRMCB	- To identify media Public Information Office (PIO), establish media center, and disseminate pre-prepared media kits	Immediately and concurrently with declaration of public health emergency

ACTION	RESPONSIBLE AGENCY	OBJECTIVE	TIME-FRAME
IMPLEMENT OPERATION (Cont'd) **Activate SRMCB surveillance protocol to evaluate efficacy**	SRMCB and DAR	- To activate surveillance protocol surveys in addition to MCP tasks within spray areas and in areas outside of the sprayed area for comparison purposes.	Upon completion of all other necessary logistical steps and cooperation of conditions supporting applications.
IMPLEMENT OPERATION (Cont'd) **Commence Aerial Spraying Operation weather dependent**	SRMCB and Contractors	- To commence Aerial Spraying Operation	Upon completion of all necessary logistical and operational preparatory steps and cooperation of conditions supporting applications.
ASSESS OPERATION	SRMCB	Provide 1-2 page summary report to respective state agency commissioners and other key state agency stakeholders Provide report of Intervention including but not limited to final number of acres treated, per cent efficacy results, environmental impairment sampling results, complaints, etc.	Complete Brief Summary Report within two weeks or as soon after operation as practical Complete final report within six months of receipt of all documentation and data analysis from operation.

Key to Massachusetts Agency Names:

BOH = (Local) Boards of Health;

EOEEA =Executive Office of Energy and Environmental Affairs;

EHHS = Executive Office of Health and Human Services;

DF&W = Division Fish and Wildlife;

DMF = Division of Marine Fisheries;

MAG = SRMCB Mosquito Advisory Group;

MCPs = Mosquito Control Projects;

DAR = Department of Agricultural Resources;

MDPH-BEH = Massachusetts Department of Public Health, Bureau of Environment Health;

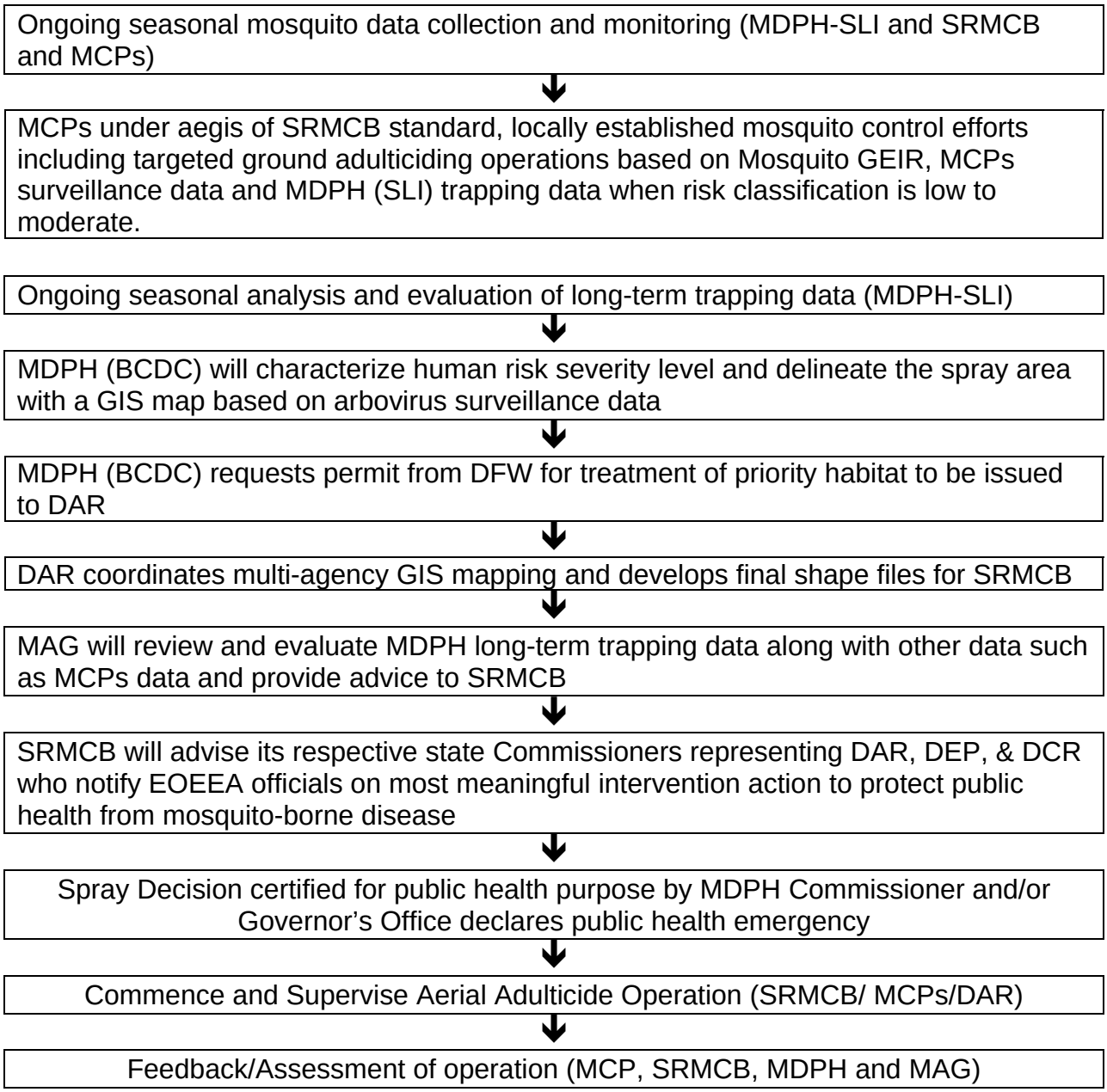
MDPH-BCDC = Massachusetts Department of Public Health, Bureau of Communicable Disease Control;

MDPH-SLI = Massachusetts Department of Public Health, State Laboratory Institute;

SRMCB = State Reclamation and Mosquito Control Board.

Appendix 2: Decision-Making Flow Chart

The Response Matrix or operational response is activated when MDPH issues a finding that there is a risk to the public health from mosquito arbovirus (level IV or V according to most current MDPH's Arbovirus State Surveillance and Response Plan) and when MDPH along with the MAG advise for risk reduction interventions. At that point, depending on the location(s) and extent of the problem, the type of virus involved and a number of other variables, a decision will be made by the SRMCB and the individual MCPs as to what specific measures will be implemented. As noted above, the Mosquito Advisory Group (MAG) will be asked for scientific advice based on specific current conditions. Because at any time, there are many data under review and there are many individuals and organizations that must be involved during a short time period to protect the public health, this appendix outlines the key components and responsible agency in the decision-making process expectations.



Appendix 3: SRMCB Massachusetts Mosquito Control Surveillance Protocol for Evaluation of Efficacy of Aerial Adulticide Application(s) Regarding Mosquito-Borne Disease

INTRODUCTION

Eastern Equine Encephalitis (EEEv) and West Nile Virus (WNv) are the most significant mosquito-borne public health threats in Massachusetts. In Massachusetts and elsewhere in the United States, established regional mosquito surveillance and control programs operate utilizing principles of, and components comprising, Integrated Pest Management (IPM), or more specifically, Integrated Mosquito Management (IMM). A basic tenet of IPM and IMM is that action thresholds and intervention decisions are based on surveillance.

Mosquito-Borne disease surveillance demands proper pest recognition and quantification as it attempts to define the local epidemiology of the disease: the presence, distribution, and prevalence of the causal agents and vectors. Surveillance of these populations, along with careful scrutiny of environmental influences, seasonal variations, facilitates the process of assessing risk of mosquito-borne disease, and provides a basis for intervention decisions.

In Massachusetts, the State Reclamation and Mosquito Control Board (SRMCB) and the mosquito control districts/projects (MCPs) it oversees collaborate with the Massachusetts Department of Public Health (MDPH) Arbovirus program to monitor ecological and epidemiological parameters, and to dynamically assign risk levels pertaining to EEEv and WNv transmission throughout any mosquito season.

PURPOSE

This document establishes a standardized protocol for use by SRMCB, MCPs and MDPH personnel to assess the efficacy of an aerially applied adulticide for the goal of reducing risk of EEEv and/or WNv transmission to the public. In pursing the goal previously stated, the overarching purpose of this protocol is to ensure the trapping of mosquito populations that have not been impacted by aerially applied adulticides in order to achieve a better interpretation and apply correctly conclusion(s) regarding the efficacy of the adulticide to reduce the threat of mosquito-borne disease. Finally, this particular document will address and place more emphasis on quantitatively measuring efficacy of interventions such as aerial adulticide application for purpose of suppressing EEEv.

Although the protocol places emphasis on EEEv, there is an established surveillance system for WNv using specific traps such as gravid traps to collect mosquitoes statewide for submission to the MDPH Arbovirus Laboratory in Jamaica Plains. The gravid trap is very effective in collecting live specimens of these species for virus analysis and could be used to quantitatively measuring efficacy of interventions such as aerial adulticide application. The MDPH in cooperation with the MCPs, boards of health and various state/local agencies have established a trapping protocol for deployment of traps (gravid traps) specific for the purpose of determining the presence of WNv in

geographically specific mosquito populations. During the mosquito season, MCPs deploy traps at predetermined locations for season long collection of primarily *Culex pipiens* and *Culex restuans*. The *Culex pipiens/restuans* complex of mosquitoes has been implicated in the transmission of the West Nile virus from bird-to-bird and bird-to-human during years of increased virus activity. Trapping protocols for deployment of these traps has evolved over time resulting in an elaborate network of traps covering many areas of the state. In concert with the long-term trapping sites, MDPH, in cooperation with the MCPs, has developed a rapid deployment trap protocol which is activated and geographically focused based on certain environmental parameters such as clusters of WNv positive birds and/or human cases.

LESSONS LEARNED IN 2006

The task of measuring efficacy is straightforward in terms of looking at the abundance of mosquitoes before a spray event and directly after to determine if the intervention such as an aerial adulticide intervention was successful. Data indicating decreases in numbers or abundance can support a conclusion that the intervention was successful where the spray was actually deployed and lead to conclusions that risk of arbovirus was reduced too. The analysis of the numbers or abundance would include areas outside of the treated areas or areas not sprayed and an intervention would be deemed successful if the data reflect a lesser reduction occurred or mosquito numbers rose. Although increases in mosquito density can occur after the intervention, this does not automatically mean the intervention was a failure since increases can be due to either/both immigration from outside the spray zone and/or emergence of new mosquitoes on a daily basis. However, one lesson learned in 2006 is that no resources were available to determine the parity or age of these mosquitoes in order to gain information that would help provide a clearer picture of the overall efficacy. In addition, although minimum infection rates (MIR) had increased in those mosquitoes being sampled, the MIR was evaluated within the context of the ranges of reductions in overall abundance and by species observed after the aerial adulticide intervention in 2006. Finally, the measuring of efficacy for future evaluations need to include the review of ongoing data collected each week beyond 24 hour post intervention period in order to gauge the results of the intervention.

During the 2006 mosquito season, surveillance data overwhelmingly indicated that the use of aerial adulticiding to parts of Southeastern Massachusetts would be a prudent intervention to reduce the emerging mosquito-borne threat of EEEv. In response to this emergency event, figuring out when and where to trap posed a significant challenge and difficult task in order to quantify the efficacy of the aerial adulticide intervention. The discrepancies and variability of the measured reductions seen in 2006 were attributable to differing methods of analysis as well as confounding factors such as weather changes between pre and post collections, terrain, locations and kinds of traps utilized, and mosquito species.

Another lesson learned was the need for a stronger protocol incorporating as much standardization to the extent feasible that could address as many of the aforementioned variables and complexities inherent in the sampling of adult mosquitoes. These inherent complexities include but are not limited to flight range of the target mosquitoes being sampled, location of traps and distance traps are placed outside treatment areas

to access efficacy. One way to strengthen the current protocol is to identify and select sites where specific trapping devices could be set prior to any decision to deploy an intervention such as an aerial application. As a result, the actual trap placements can be coordinated to insure placement within similar habitat to insure analysis uniformity.

Also, there are no additional or supplemental resources that can be utilized to run efficacy measures for a specific intervention. The same MCPs personnel responsible for several tasks including standard surveillance and data collection efforts are used to set additional traps in order to measure efficacy for a situation such as an emergency aerial adulticide intervention.

Another lesson learned was that there was no clear operational pre-assignment of the appropriate personnel from each MCP that would be responsible for sampling efforts. There was no established timeline between SRMCB, MCPs, and MDPH regarding the turnaround time pertaining to efficacy analysis, interpretation, and results reports. In this protocol, the SRMCB shall coordinate with its member MCP's and MDPH, the number of traps, acceptable trap type, and acceptable ranges for placement within and outside of spray zone perimeter. Once relevant data on these collections has been provided, the SRMCB shall determine the final efficacy measures for reporting purposes.

Due to the nature of the emergency conditions, changing weather conditions, and logistical uncertainties such as knowing in advance the number of aircraft that would be available as well as the size of the spray zone, communication challenges included less than desirable notification to all parties regarding fundamental changes to the proposed spray areas as the operation proceeded as well as delayed reports on the progress of the aerial spray. A standard sampling protocol will go a long way in improving the experience gained in 2006 especially communication between SRMCB, MCPs, and MDPH and ultimately result in better interpretation and application of the data derived from sampling efforts to assess efficacy of an aerial application intervention.

SPECIFIC SPECIES OF MOSQUITOES

More than 150 species of mosquitoes have been identified in the U.S.; of these, 51 are known to occur in Massachusetts. Whereas all mosquitoes require water in which their immature stages develop, each species of mosquito exploits a characteristic kind of habitat (e.g. fresh water wetland, salt marsh, cedar swamp, tree hole, etc), produces as few as one or as many as several generations each year, is active during a defined season, and quests for blood during defined intervals (e.g. daytime, nighttime or during dawn/dusk periods). Furthermore, mosquitoes of certain species feed predominately on one kind of host (e.g. birds or mammals), whereas others are less discriminating and feed on a number of different ones. Because of these and yet other differences, certain kinds of mosquitoes are better able to acquire, maintain and transmit disease-causing viruses between their vertebrate hosts. Accordingly, just a few kinds of mosquitoes are of particular concern to public health authorities and the mosquito control practitioner in Massachusetts. For EEEv, these include the maintenance vector *(Culiseta melanura*), and the likely bridge vectors (mainly *Aedes vexans, Ochlerotatus canadensis, and Coquilletidia perturbans).* For WNv virus, these include the maintenance vector *(Culex pipiens)*, and a long list of potential bridge vectors.

QUANTITATIVE MEASUREMENT FOR EFFICACY OF AERIAL APPLICATION OF PESTICIDES

Traps used for assessing the efficacy of an adulticidal application generally should be selected and deployed to maximize the sampling of mosquitoes of the target species. The larger the sample size, and the greater the proportion of the sample being composed of the target species, the greater the return on investment of time and labor.

The efficacy of an adulticiding effort can be assessed by noting a change in the

Local abundance of the target mosquito (es),
Age structure of that/those population(s), and
Proportion of vectors harboring the virus.

Traditionally, measurements have been limited to recording changes in abundance and infection rates. Whereas the abundance of a vector is most readily assessed, this parameter is of only limited significance as a component contributing to the transmission risk posed by that vector. For many kinds of mosquitoes, adults may emerge daily during the season. In these cases, the vast majority of adults will be just one or a few days of age. Thus, if a significant proportion of the adult population is killed by application of an adulticide, and if that same fraction of the population is soon replaced, in whole or part, by newly emergent adults, then the reduction might not be apparent simply by measuring vector abundance. The abundance of the vector population should be measured, but data is most valuable if considered along with other parameters that together better relate to risk.

Mosquitoes of any age may acquire EEEv and WNv infection from viremic vertebrate hosts. The virus survives and reproduces within, and may be transmitted by only certain kinds of mosquitoes. With few exceptions, such virus-competent mosquitoes can transmit infection to new hosts only after incubating the virus for a period of days or weeks. Young mosquitoes, even if infected, pose relatively little immediate threat. It is the aging mosquito population, composed in part of adults that may have acquired and incubated EEEv and WNv that pose risk of virus transmission. Thus, interventions based upon use of adulticides may reduce the abundance of vectors that may yet acquire virus as well as those that may already be infected or infectious. In the former case, the intervention may reduce risk of transmission for days or weeks. In the latter case, the intervention may have immediate effects on reducing transmission risk.

TRAP TYPE

Diverse kinds of traps exist for the surveillance of adult mosquitoes. Each kind of trap has attributes that make it more or less useful than other kinds for sampling certain kinds of mosquitoes.

In Massachusetts, the traps used most often for surveillance of adult mosquitoes include the *CDC light trap, the gravid trap, the New Jersey Light trap and the resting box.*

The *CDC Trap* was first designed in the late 1950's by the Centers for Disease Control. The trap is compact and portable, is powered by a battery, and can maintain sampled mosquitoes alive for the purpose of species identification and viral assay. A small incandescent lamp disorients flying insects, and a fan draws these into a collection chamber. The light may be augmented or replaced by a carbon dioxide (CO_2) source. Several modifications to the basic design are available; each configuration changes the attractiveness of the trap to different kinds of mosquitoes. Modified versions in use in Massachusetts include the American BioPhysics (ABC) trap (used by the Plymouth County Mosquito Control Project), and the UV light trap (used by MDPH), which is fitted with a blue-black light rather than the standard incandescent lamp.

Carbon dioxide ($CO_{2)}$ may be provided by a mass of sublimating dry ice, or as a metered flow from a pressurized cylinder. Standard use of a calibrated metered flow aids in comparing results between trap collections. This trap, baited with a CO_2 source, attracts the widest cross section of an existing, host seeking population. Generally, mosquitoes represent the largest fraction of insects collected within CDC traps. The primary enzootic vectors of EEEv (*Culiseta melanura)* and WNv (*Culex species*) are readily sampled with these devices. **Currently, the CDC Trap (even with the modified versions mentioned above augmented with CO2) is the most efficient or best standard surveillance device for assessing the efficacy of an aerial application because of its relatively low cost, portability, widespread use, and tendency to maintain captured insects alive and in good condition.**

The *Gravid Trap* is used almost exclusively to collect female *Culex pipiens and Cu. restuans* that have already taken a blood meal and are seeking a site to deposit eggs. These portable battery-operated traps are particularly useful for surveillance of virus-infected mosquitoes because they tend to collect the older (and thus infected) portion of the vector populations, and maintain the captured mosquitoes alive and in good condition for laboratory assay. **Gravid traps, therefore, are valuable for WNv monitoring efforts.**

The *New Jersey Light Trap* is a large, robust device powered by 120V AC. Consequently, these are best deployed as permanent installations. **Because they are not as portable as CDC traps, they are less suitable for rapid deployment in temporary sites.**

The *Resting Box* is used almost exclusively to sample adult *Culiseta melanura, particularly those that have already blood fed*. Because few other kinds of mosquitoes or insects visit such boxes, this surveillance device tends to be a selective and sensitive indicator of EEEv transmission in the immediate area. Resting Boxes, however, demand more time and labor for monitoring than do CDC traps. Arrays of resting boxes are operated in focal areas by some MCPs. Because resting boxes generally tend to sample relatively few mosquitoes, the sample sizes may not be sufficiently robust for statistical analyses. **Accordingly, they will not routinely be relied upon for evaluating efficacy of aerial applications of pesticides.**

Each kind (species) of mosquito exhibits its own specific host seeking preferences. These preferences relate to, amongst other characteristics, the kind of hosts attacked,

the habitats where they are most abundant, their vertical distribution (for questing, resting and ovipositing), the seasonality of their population dynamics, and their photoperiodicity (for questing and ovipositing). For instance, females of *Ochlerotatus trivittatus* tend to feed under tree canopies, whereas those of many tidal wetland *Ochlerotatus* species seek hosts in open fields. Vertical stratification of host-seeking behavior has been demonstrated, with several species (*Culiseta melanura*, *Culex restuans*) most frequently feeding high in the tree canopies. **To assure standardization of trap placement in emergency efficacy evaluations, traps shall be suspended at a height of about 4 feet off the ground.**

MOSQUITO IDENTIFICATION AND AGE ASSESSMENT

Correct identification of mosquito vectors is paramount to disease risk assessment and for justifying intervention efforts.

Published 'keys' to assist in identifying mosquitoes include:

1.Connecticut Key: (Andreadis, T.G., Thomas, M. C., Shepard, J. J., Identification Guide to the Mosquitoes of Connecticut 2005, New Haven, CT: The Connecticut Agricultural Experiment Station. 173p.)

2. Midwestern Key: (Siverly, R. E. (1972). Mosquitoes of Indiana. Indianapolis, Ind, Indiana State Board of Health)

3. New York Key: (Means, R. G. (1979). Mosquitoes of New York: Part I. The genus Aedes Meigen, with identification keys to genera of Culicidae. Albany, NY, The University of the State of New York, State Education Dept. State Science Service, New York State Museum and Means, R. G. (1987). Mosquitoes of New York: Part II, Genera of Culicidae other than Aedes occurring in New York. Albany, NY, University of the State of New York, State Education Dept.)

4. Northeastern Key: (Stojanovich, C. J. (1961). Illustrated Key to Common Mosquitoes of Northeastern North America, Stojanovich, Chester J., 750 East McGlincey Lane, Campbell, California 95008).

5. North American Key: (Darsie, R. F., Ward, Ronald A., Chang, Chien C. (1981). Identification and Geographical Distribution of the Mosquitoes of North America, North of Mexico. Fresno, Calif, Fresno, Calif.: American Mosquito Control Association**:** 313p and Darsie, R. F., Ward, Ronald A. (2005). Identification and Geographical Distribution of the Mosquitoes of North America, North of Mexico. Gainesville, FL, University Press of Florida.)

In Massachusetts, regional MCPs and MDPH employ entomologists to sort and identify sampled mosquitoes.

SURVEILLANCE CRITERIA

Trap Type

CDC light trap baited with CO_2. The CO_2 will be delivered either via a calibrated metered flow of 250-500cc/min from a secured pressurized cylinder, or as a non-metered flow from sublimating dry ice (2 lbs / trap/night)
UV Traps can be deployed as a non-CO_2 option, if these traps are arrayed in a manner in which meaningful comparisons can be made using the same kind of trap. Thus, collection data derived from UV traps operating in treated areas should be compared to data from UV traps operated in non-treated areas. The use of the UV trap to analyze efficacy for the purpose of this protocol is not recommended since the numbers of mammal biting mosquitoes may be under represented by lack of CO2 bait.

II. Trap Activation and Sample Collection

Traps:
Should ideally be installed at the surveillance site no later than one hour before astronomical sunset, or set to activate automatically at the assigned time if the location is a secure. **Note: Traps should be set so that collection period is no less than one full trapping night.**
Should be removed the following calendar day, ideally no earlier than 30 minutes after astronomical sunrise, or set to automatically stop collecting (and retain the sample).
Must be removed (or completely covered) during adulticide applications so that insecticide does not contaminate the trap and collecting vessel.

III. Trap Deployment

Traps:
Should be installed away from competing light sources and obstructions such as buildings.
should be located along the intersection of differing habitats to maximize local diversity
will be sited at geocoded locations, and be further identified by the name of the community, street address (if relevant) or other physical or ecological indicator.
used to compare treated and non-treated areas will be placed in similar habitats to the extent possible as coordinated by pre-planning efforts prior to an aerial adulticide intervention.
IV. Trap Density

Each treatment and comparison block will be monitored by not be less than two, and not more than four traps
Traps should be deployed so that, to the extent possible, their samples are representative of the density of adults of target species in geographically distinct areas.
Important Note: The number of traps described in the above passage should be adequate to meet the objective of evaluating treatment efficacy and exceeds the density typically required by FEMA, (24 hour windows pre and post trap within the spray block or area).

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V. Mosquito Identification

Female mosquitoes from traps will be identified to species.
Female mosquitoes will be counted, including damaged individuals, and reported on standard collection forms.
Trap contents will be subjected to aliquot reduction when sample size exceeds 400 mosquitoes / trap / night.
Collections should be stored chilled, and sorted on a chill table or on ice. Samples of female mosquitoes of target species should be assayed for virus as soon as possible, and other samples should be ideally deep-frozen (-20 degrees C or –4 degrees F) for subsequent dissection to assess parity rates for the purpose of obtaining additional data on the physiological age of collected mosquitoes. ***Note:*** *Mosquitoes should be knocked down with CO2 into tight tubes, frozen quickly, held in a freezer for months to be processed at a later time or in the case of analysis for mosquitoes collected pre and post intervention, thawed minutes before dissection for aging.*

CONCLUSION

For the purpose of moving toward uniformity in establishing meaningful measures to determine efficacy of interventions such as aerial adulticide applications, the best protocol will contain challenges and limitations when measuring impacts to biological organisms such as mosquitoes. During any given aerial adulticiding application, adult mosquitoes can be resting, digesting blood meals, or seeking hosts at varied times and may escape control. As outlined, various trap types can bias toward specific mosquito behavior such as the resting box which sample *Culiseta melanura* mosquitoes that have already blood fed. Similarly, gravid traps sample or collect mosquitoes that are ready to oviposit (lay eggs). These conditions may allow these mosquitoes to escape the impact of any single aerial adulticide application (only reducing those mosquitoes on the wing). Those mosquitoes escaping treatment will continue to be collected by sampling devices and effect meaningful comparisons. As a result, trap placement is critical to this protocols objective. Therefore, the emphasis of this protocol aims to achieve the proper placement of the least bias sampling device such as the CDC light trap baited with CO2 well within the spray zone at least 24 hours prior to the intervention and 24 hours after the intervention to assess impact on the target population.

Appendix 4: Aerial Application Service and Insecticide ANVIL 10+10 ULV Information Sheet

Aerial Application Service

Dynamic Aviation Group, Inc.
Post Office Box 7
1402 Airport Road
Bridgewater, VA 22812-0007

Aircraft Type: Specially Equipped Twin Engine, Turbine Powered King Air 90.
Speed of Aircraft: 150-knots/170 mph.
Altitude or height of aircraft: 300 feet AGL (Above Ground Level).
Swath Width: 750-1,000 ft.
Aircraft Capacity for Pesticide: 90 gallons per load when using Anvil 10+10 equating to covering 42,000 acres. *Note 640 acres equals 1 square mile*
Aircraft Contractor: Dynamic Aviation Group, Inc., Post Office Box 7, 1402 Airport Road, Bridgewater, VA 22812-0007, Telephone: (540) 828-2600,FAX: (540) 828-4031.
Aircraft Contract minimum acreage range: 5,000 to 24,999 acres.
Aircraft Contract maximum acreage range: 25,000 to 500,000 acres and greater.
Application Window: The "optimum" spray window depends upon the target species of mosquito, and the hours during which that species is most active. A "typical" spray window would begin approximately sunset and conclude after midnight.
Aircraft Flight Path: Flying at 170 MPH and assuming a 1,000-foot swath width, the King Air 90 is able to cover 343 acres per minute. *Note 640 acres equals 1 square mile. It would take approximately 2 minutes to treat a 1 square mile area*
Distinct Application System: Rotary or flat fan nozzles set up to provide optimized spray pattern for adult mosquito control.
Aircraft Noise: The twin turbine King Air is exceptionally quiet, and will likely be overhead and gone before most people hear it coming.
Aircraft Spray Visibility: The actual spray that comes out of the nozzles often is visible during daylight/dusk hours. However, if spraying takes place at night, it is unlikely that the spray would be visible.
Aircraft Operational Efficiency: The fewer blocks or zones that need to be excluded as "no spray" the more operational efficiency can be expected.
For More Information: Website: http://www.dynamicaviation.com/index.html

Insecticide Contractor

Clarke Mosquito Control Products, Inc.
P.O. Box 72197
159 N. Garden Avenue
Roselle, Il 60172

Pesticide of Choice: ANVIL 10 + 10 ULV
EPA Registration #: 1021-1688-8329
Active Ingredient: sumithrin 10.00% and Piperonyl Butoxide 10.00%
Note: This product is a synthetic pyrethroid in the Anvil formulation that replicates the mosquito fighting properties of pyrethrum, an extract of the chrysanthemum flower. Sumithrin is synergized with piperonyl butoxide (PBO) providing a fast knockdown of adult mosquitoes.
Signal Word: Caution
EPA Classification: Non-restricted or General Use
Target: Adult Mosquitoes
Use: Outdoor Residential and Recreational areas, woodlands, swamps, marshes, overgrown areas, and golf courses
Manufacturer: Clarke Mosquito Control Products, Inc., 159 N. Garden Avenue, Roselle, Illinois 60172, Phone: (630) 671-3128, Phone: (800) 323-5727, Fax: (800) 832-9344, Email: info@clarkemosquito.com
Max Rate of Application: 0.62 fluid ounces per acre
Dosage Rate: 0.0036 pounds of active ingredient per acre
Equipment: Ultra Low Volume (ULV) technology
Droplet Sizes: Volume Median Diameter produced is less than 60 microns and that 90% of the spray are contained in droplets smaller than 100 microns
Period droplets are airborne: Depending on environmental conditions, treatment block size, spray droplets should move through the target area 30-60 minutes after application is completed.
Optimum Ground Application Wind Speed: No greater than 10 MPH
Optimum Application Temperature Range: 65 degrees or greater but range of temperatures between 65 and 57 are acceptable.
For more information: Website: http://www.clarkemosquito.com/

Appendix 5: Water Quality Sampling for Mosquito Control Aerial Chemical Application

TO: Gary Gonyea, BRP/WW

CC: Dave Terry, Director DWP, BRP
Robert Nuzzo, BRP

THROUGH: Carol Rowan West, Director, ORS
FROM: Michael Hutcheson and Diane Manganaro, ORS
DATE: March 7, 2006
SUBJECT: Water Quality Sampling for Mosquito Control Aerial Chemical Application

Signed original on file in ORS

This memo is in response to your e-mail dated Tuesday, February 28, 2006 to Michael Hutcheson, in which you requested the opinion of the Office of Research and Standards (ORS) regarding if and how environmental monitoring recommendations would change if malathion were to be used for aerial spraying of mosquitoes instead of sumithrin to control the spread of Eastern Equine Encephalitis (EEE) virus or West Nile Virus (WNV). The monitoring plan that was developed in conjunction with proposed spraying of sumithrin, entitled "Water Supply Monitoring Plan to Assess Potential Impact of Mosquito Control Spraying During Any Public Health Emergency To Drinking Water", provides a protocol for sampling drinking water reservoirs and finished waters in order to evaluate potential public health effects as well as benthos and water chemistry in order to evaluate potential ecological effects. We reviewed this plan in light of the information we have on Malathion to determine whether it could be adapted to spraying with Malathion. Our recommendations regarding the extent of monitoring to be conducted to address human health and ecological concerns are presented below.

Recommendations:

1. Based on the discussions provided below, an evaluation of potential drinking water impacts indicates that neither sumithrin nor Malathion applied aerially would likely pose a threat to public health via ingestion of drinking water. An extensive water-monitoring program, such as detailed in the Monitoring Plan under the Design Protocol, may not be needed. However, confirmatory sampling of representative water supply areas and finished waters would nevertheless be a worthwhile endeavor for both informational purposes and to provide reassurance to the public that aerial spraying of either pesticide did not pose a threat to public health via contamination of drinking water. The Drinking Water Program is in the best position to determine the scale of such a sampling program with regard to how many and which water supplies should be sampled. We also note that the sampling intensity presently described is not needed. As a cost-cutting measure, sampling could be reduced from the three sampling points described in the protocol to two, including the intake water prior to treatment and the finished water. Sampling of untreated surface water seems unnecessary in this case since the intake water closer to the treatment/distribution facility is being sampled concurrently. Finished water need only be analyzed if the intake samples test positive for the insecticide. Samples need only be collected twice, once shortly after spray operations take place and approximately twenty-four hours later.

2. Based on the discussions below pertaining to potential ecological effects, an evaluation of potential effects on aquatic biota cannot be ruled out for either pesticide. It is our opinion that sampling of surface waters and biota as outlined in the monitoring plan for pesticides/benthos of August 2005 should be conducted in conjunction with aerial application of either pesticide. The monitoring plan specifies that pre-and post-spray water sample sets should be coordinated with the water supply sampling activities; however, it is unclear as to the timing of this sampling relative to other water and benthos sampling. We question the necessity of post-application water sampling for sumithrin to accompany post-spray benthos sampling one week after application. Predicted maximum sumithrin concentrations from aerial application are so low (near the method detection limit of 0.1 g/L) and the degradation so relatively rapid (half-life on order of a couple of days) that coupled with dilution over one week, there would seem to be no chance of detecting any residual sumithrin that far after application. Similar arguments would apply to Malathion, which has a similar half-life and higher predicted initial maximum surface water concentrations. Rather, we suggest that surface water be sampled shortly after spray operations takes place (i.e., 1-3 hours), as it is during this time that pesticide concentrations at the water surface would be at their highest and have the most potential to impact aquatic life. It is our opinion that the monitoring protocol discussed above that was originally developed in conjunction with a sumithrin application can be adapted for a Malathion application.

3. Given that aerial dispersion of pesticides is of particular concern to aquatic organisms; it is recommended that, if possible, measures be taken to minimize exposure of these organisms during pesticide application. For example, fish typically feed at the surface of the water during the early mornings and evenings. When they are not feeding, there is a lower probability that they will be at the surface of the water, thus a lower probability that they will be exposed to pesticide that has been deposited to the surface of the water, which would be at a higher, undiluted concentration. We therefore recommend that the pesticide application be made in the nighttime hours, utilizing night-vision technology if necessary. A night application would also reduce potential dermal and inhalation exposures to humans, as there would be a lower probability that people would be outside during this time.

4. The proposed spraying protocol calls for an 800-foot buffer from surface water bodies. Although some drift within the 800-foot margin will likely occur, this setback is designed to minimize the amount of pesticide that will reach surface waters. One presumed rationale for employing this approach is to minimize possible effects on surface waters used for drinking water purposes. However, if direct aerial applications of these pesticides were to occur, we predict that water concentrations of the chemicals would be so far below drinking water guideline values that setbacks would not be needed. Mosquitoes tend to preferentially breed near sources of water. The margins of surface water bodies would be among these preferred breeding locations. By using a large setback distance from all surface water bodies, the area-wide application is essentially being riddled with large “holes” around surface waters, which may contain potential EEE virus-carrying mosquito populations. A smaller or zero setback distance would permit more comprehensive vector eradication with the tradeoff of a more certain risk to aquatic organisms, especially those in more shallow waters. Other measures could be taken to reduce exposures such as the one discussed in item #3 above. We recognize that making a decision on the most appropriate setback to use has its tradeoffs and is ultimately a management decision where improved mosquito control for

public health protection must be balanced against public perception issues associated with direct application of these insecticides near surface waters used as drinking water sources.

Discussion:

The above recommendations are made based on our evaluation of available information that we have compiled to date on sumithrin and malathion relative to potential impacts to public health via drinking water and to aquatic organisms. This information is summarized below.

1. Potential for Sumithrin Application to Impact Human Health via Drinking Water

An evaluation of potential human health risks posed by sumithrin exposure through drinking water surface water sources sprayed during pesticide application was presented in Hutcheson (2005). The memo concluded that any human exposure via drinking water to sumithrin aerially deposited to surface water during spraying would not pose a public health threat since concentrations would be well below any concentrations of toxicological and public health concern. This conclusion assumes that aerial spraying takes place in accordance with specified operational plans and that application rates do not exceed the application rate for the product provided to us for our evaluation.

> **Carcinogenicity** - Since the Hutcheson (2005) memo was written, the U.S. Environmental Protection Agency (EPA) Cancer Assessment Review Committee has designated resmethrin (another pyrethroid insecticide, having a similar mechanism of action as sumithrin) "likely to be carcinogenic to humans". There has been some suggestive evidence of an increased incidence of liver tumors in rodents as well as a potential for sumithrin to increase expression of a gene involved in the proliferation of mammary tissue leading to the development of breast cancer (Cox et al., 1987 as cited in WHO, 2002; SCDHS, 2005; Kasat et al., 2002 as cited in SCDHS, 2005; Cox, 2003). The EPA has not yet evaluated sumithrin for carcinogenicity and any information is still speculative. However, even if we assumed that sumithrin is also likely to be carcinogenic to humans, our calculations indicate that predicted concentrations of sumithrin in the field are not expected to exceed the recommended benchmark RfDs and drinking water levels determined for this chemical. The Department's policy with regard to developing a drinking water guideline for a possible carcinogen for which there is no quantitative potency information, is to apply an uncertainty factor of 10 to the drinking water guideline, thereby numerically reducing the value by 10. Given that ORS' evaluation indicated that drinking water guidance for sumithrin is several orders of magnitude greater than predicted field concentrations, an additional factor of 10 will not change the conclusion reached above that a public health or ecological threat would not be expected from an application of sumithrin at maximum application rates.

2. Potential for Malathion Application to Impact Human Health via Drinking Water

– Massachusetts conducted an aerial application of Malathion in the late summer of 1990. In conjunction with this application, ORS conducted an evaluation of potential human health and ecological risks posed as a result of exposure to Malathion. As presented in two memos (Hutcheson, 1990a; Hutcheson, 1990b), ORS concluded that drinking water should not be adversely affected by spraying conducted under the assumed spraying conditions. The evaluation concluded that after direct spraying (if

that inadvertently were to have occurred) field concentrations of Malathion in surface waters should have been an order of magnitude lower than the drinking water guideline for Malathion. In practice, measured field concentrations of Malathion immediately after spraying using a 300-foot buffer in most lakes sampled agreed closely with predicted concentrations.

Assuming that spraying methodology and insecticide application rate of malathion are the same as those assumed for the 1990 application, potential future applications of malathion are also not expected to pose a public health threat from exposure to malathion in drinking water.

3. Potential for Sumithrin Application to Impact Non-Target Organisms – ORS has not conducted a formal evaluation of the potential for an aerial application of sumithrin to impact biota in the area of application. However, as indicated in Hutcheson and Manganaro (2005), our review of sumithrin has indicated that it has high non-target toxicity potential to aquatic life, particularly fish. The sumithrin product, Anvil 10+10, has a label warning against use directly on water or near surface water. In addition, sumithrin formulated products are typically mixed with the synergist piperonyl butoxide (PBO), which enhances toxicity by inhibiting metabolism of the insecticide. Thus, the potential for ecological effects resulting from an aerial sumithrin application cannot be ruled out should drift occur.

4. Potential for Malathion Application to Impact Non-target Organisms – An evaluation for potential ecological effects was also conducted for the 1990 Malathion application. This application conservatively assumed that Malathion would be deposited directly over a body of water. The evaluation concluded that, based on the estimated concentrations of malathion in surface water, toxicity to invertebrates (aquatic insects and crustaceans) would be likely under this scenario. In addition, while the evaluation found that most fish should not be affected by the surface water concentrations of Malathion that would result from an aerial application; there are several species that would likely be affected. In general, those species that inhabit shallow waters or that remain near the water's surface would most likely be exposed to the highest concentrations of Malathion and would thus be most adversely affected. In practice, there were a number of fish kills that occurred along flight paths shortly after Malathion application.

Again, assuming that spraying methodology and the insecticide application rate of malathion are the same as those used for the 1990 application, it can be concluded that the potential for ecological effects resulting from an aerial malathion application cannot be ruled out should drift occur.

References:

Cox, R.H., Sutherland, J.D., Voelker, R.W., Alsaker, R.D., Vargas, K.J., Lewis, S.A., and Hagen, W.J. 1987. Chronic toxicity study in dogs with sumithrin technical grade. Vienna, Virginia. Hazleton Laboratories, Inc. (Unpublished report submitted to WHO by Sumitomo Chemical Co., Ltd).

Cox, Catherine. Summer, 2003. Sumithrin (D-Phenothrin). Journal of Pesticide Reform. Northwest Coalition for Alternatives to Pesticides. Insecticide Factsheet. Vol 23, No. 2.

Hutcheson, M. August 16, 1990a. Non-target species exposure assessment and hazard assessment for Malathion spraying. Memorandum from Michael Hutcheson, ORS, to file. Department of Environmental Protection. Office of Research and Standards.

Hutcheson, M. September 12, 1990b. Addendum to non-target species exposure assessment and hazard assessment for Malathion spraying. Memorandum from Michael Hutcheson, ORS, to file. Department of Environmental Protection. Office of Research and Standards. Boston, MA.

Hutcheson, M. and Manganaro, D. August 23, 2005. ORS comments on use of Malathion versus resmethrin or sumithrin for aerial application in mosquito control efforts. Memorandum from Michael Hutcheson and Diane Manganaro, ORS to Elaine Krueger, MDPH. Department of Environmental Protection. Office of Research and Standards. Boston, MA.

Hutcheson, M. September 29, 2005. Evaluation of potential human health risks from sumithrin exposure through drinking water from surface water sources inadvertently sprayed during mosquito control operations. Memorandum to Dave Terry, DWP from Michael Hutcheson, ORS. Department of Environmental Protection. Office of Research and Standards. Boston, MA.

Kasat, K., V. Go, and B.G. Pogo. 2002. Effects of pyrethroid insecticides and estrogen on WNT10B proto-oncogene expression. Environ. Int. 28:429-432.

SCDHS (Suffolk County Department of Health Services). February 2005. Suffolk County Vector Control & Wetlands Management Long Term Plan & Environmental Impact Statement. Task 3 Literature Review Book 6 Part 1: Human Health and Domestic Animal Toxicity. Cashin Associates, P.C. Prepared for: Suffolk County Department of Public Works, Suffolk County Department of Health Services, Suffolk County, New York.

WHO (World Health Organization). 2002. d-Phenothrin. WHO Specifications and Evaluations for Public Health Pesticides. Evaluation Report 356/2002.

Appendix 6: Honeybee Monitoring Protocol for Aerial Mosquito Adulticide Application

Introduction

Honey bees and other insect pollinators generally forage when temperatures are above 55-60 degrees Fahrenheit during daylight hours. Honey bees, bumble bees, and solitary bees do not forage at night or during very cool weather. Insecticides applied during the day at optimal temperatures inadvertently to melliferous (honey bearing) bloom will cause severe pollinator losses. Treatments made during the night and very early morning in the proximity of desirable flowering nectar and pollen sources are the safest for pollinators.

Mosquito Adulticide Applications and Honeybees

Mosquito adulticiding can progress from sun set to sunrise with little honey bee mortality because of honey bee flight inactivity and the short half-life of sumithrin. None-the-less, the Department of Agricultural Resources (DAR) will carryout the following protocol as a part of any SRMCB supervised aerial mosquito adulticide operation.

Protocol to Monitor Honeybees

In the event aerial adulticiding is necessary, DAR will monitor selected honeybee hives in proximity of proposed application areas to evaluate hive health prior to Anvil 10+10 ULV application for potential impacts on domestic bees. Approximately 10-15 hives will be inspected inside the spray area, and 10-15 will be inspected outside the spray area as a control group. Hives registered with DAR will be chosen at random. Contacts with the appropriate and area specific beekeeper associations (e.g. Bristol and Plymouth County Beekeepers Associations) have been made.

Pre-Spray Inspections

Pre-spray inspections will be made as close to the spray event as possible, although if time does not permit, DAR may rely on data from inspections made earlier in the season.

Post-Spray Inspections

Post-spray inspections will occur at two time periods to evaluate acute and delayed impacts on colonies. Post spray evaluations will occur at the following intervals:
Days 1-3 Post-Spray
Day's 7-10 post

Reporting of Results

DAR will issue a report between 21 and 30 days after the spray operation ceases. This will be posted on the DAR website (http://www.mass.gov/agr/).

Appendix 7: Biomonitoring Plan: Pesticide-Related Impacts to Macroinvertebrates (Benthos) Following Aerial Application.

For purposes of monitoring the non-target effects of aerial insecticide application to control the mosquito vectors of EEEv and WNv, MassDEP's Division of Watershed Management (DWM) will sample lentic water bodies within the designated spray zone(s). The included waterbodies may be lake littoral zones, emergent vegetation areas of depressional wetlands, or the wet margins of streams where there is emergent vegetation and unidirectional flow is not evident. The following protocol is intended to detect acute reductions in the richness and impairment of ecological integrity of the aquatic macroinvertebrate community.

Sample Procedure

Sample collections will be made within days of the announced date for aerial spraying and again after aerial spraying to provide a basis for before/after comparisons (Before-After-Control-Impact or BACI). Samples will be collected by sweeping with a kick-net in areas of less than 1 m depth. Two to three sweeps will be performed by reaching forward approximately 1 m and vigorously pulling the net through the vegetation and water column toward the sampler's body while bouncing the net along the sediment surface without penetrating it. The contents of the net will be emptied into a basin or deep tray along with a small amount of water. This procedure will be completed at three to five points within the waterbody.

Sample Processing

Macroinvertebrates will be extracted from the sample while on-site. Picking through the sample will continue until no new taxa are being detected provided the sample has been searched for a minimum of 30 minutes. The taxa present will be recorded and vouchers will be placed in labeled vials and preserved in 70% EtOH. The frequency a taxon is encountered in the sample will be characterized as "rare," "common," or "hyperabundant." Voucher specimens will be brought back to the lab for examination under a microscope to verify the taxonomic determinations made in the field.

Results and Reporting

Taxa lists generated from the collections will be compared between pre- and post-spray events using statistical analysis of the BACI results. The before and after pairs will be examined for changes in taxonomic make up as well as changes in trophic relationships. The conditions that will be regarded as indicative of serious impacts if absent in the control waterbodies are:

1. A reduction in richness of 20% or greater;

2. A reduction in a population sufficient to change its status from "hyperabundant" or "common" to "rare";

3. Loss of the top invertebrate predator;

4. A significant change in the proportions of the various functional feeding groups.

If none of these conditions is met the macroinvertebrate community in the waterbody will be considered to have "no acute response" to the aerial insecticide application.

Water Chemistry

In addition to the benthos sampling, a water quality grab sample will be collected by DEP Regional or DAR staff the morning after an aerial spray event from all biomonitoring stations in the spray area. DEP/DAR staff will also collect surface water quality samples from up to six additional stations within the spray zone. These surface water samples will be collected in acid-washed, 1L brown, Teflon capped, wide-mouth glass bottles, kept on ice and transported to DEP Regional office for shipment to UMASS PAL. The surface water samples will be analyzed for both pesticides and PBO by UMASS PAL. The results of this analysis will provide useful information for discussing the biological monitoring results and putting these results in perspective.

BIOMONITORING PLAN SUMMARY

1) DWM personnel will conduct reconnaissance within and near the expected spray path to identify potential study sites and control sites; aquatic macroinvertebrate samples will be collected prior to commencement of aerial spraying and again at least one week after the completion of spray operations.

2) DWM personnel will use the results to assess impacts from the aerial spray application on the aquatic macroinvertebrate communities.

3) DWM personnel will collect pre and post application sediment samples from the macroinvertebrate sampling sites.

4) DEP Regional or DAR personnel will collect water samples at the selected benthos monitoring sites, coordinated with sampling in water supplies; all water samples to be delivered to the coordinator of the water-sampling program (water supplies).

Nuzzo, R.M. 2003. Standard operating procedures: Water quality monitoring in streams using aquatic macroinvertebrates. Massachusetts Department of Environmental Protection, Division of Watershed Management. Worcester, MA. 36 pp.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, R.M. Hughes. 1989. Rapid bioassessment protocols for use in streams and rivers: Benthic macroinvertebrates and fish. U.S. Environmental Protection Agency. Washington, D.C. EPA/444/4-89-001. 162 pp.

Appendix 8: Water Supply Monitoring Plan to Assess Potential Impact of Mosquito Control Spraying During Any Public Health Emergency to Drinking Water

INTRODUCTION

In the event of a public health emergency as determined or declared by the Department of Public Health (MDPH) regarding mosquito-borne disease potential, the area(s) identified by MDPH for coordinated mosquito control efforts under the direction of the State Reclamation and Mosquito Control Board will be sampled to assess potential impact. The following protocol will be utilized to insure successful operational outcomes and avoidance of environmental impacts.

Coordination Of Water Supply Monitoring Will Involve The Following Programs And Staff:

AGENCIES: Department of Environmental Protection (DEP)
- Bureau of Resource Protection (BRP)
- Drinking Water Program (DWP)
- Division of Watershed Management (DWM)
- Northeast Regional Office (NERO)
- Southeast Regional Office (SERO)
- Central Regional Office (CERO)
- Western Regional Office (WERO)

Department of Agricultural Resources (DAR)
State Reclamation and Mosquito Control Board (SRMCB)
Massachusetts Pesticide Analytical Laboratory (MPAL)
Division of Fisheries and Wildlife (DFW)

STAFF:		
	Gary Gonyea, BRP	617-556-1152
	David Terry, DWP Boston	617-292-5529
	Kathy Romero, DWP Boston	617-292-5727
	Richard Rondeau, DWP SERO	508-946-2816
	Jim Dillon, DWP NERO	617- 654-6622
	Marielle Stone, DWP CERO	508-767-2733
	Deirdre Cabral, DWP WERO	413-755-2148
	Robert Nuzzo, DWM	508-767-2809
	John Fiorentino, DWM	508- 767-2862
	Taryn LaScola, DAR Pesticide Bureau	617-828-3793
	Mike McClean, DAR Pesticide Bureau	617-828-3792
	Mark Buffone, SRMCB, DAR	617-626-1777
	Ray Putnam, MPAL	413-545-4369

DESIGN PROTOCOL FOR COLLECTION, STORAGE, AND TRANSPORT OF WATER SAMPLES:

Post spray water samples will be collected from: the raw water sample at the tap of the intake (prior to treatment) to the treatment/ distribution facility; and the finished water sample following all treatment/filtration steps and prior to the first consumer intake.

Public Water Systems will each collect two 1-liter water samples:

1) From both the raw and finished water taps twelve to twenty-four hours (12 to 24) before the spray operation;
2) From both the raw and finished water taps within three (3) hours of the end of the spray operation;
3) From both the raw and finished water taps eighteen to twenty-four hours (18 to 24) after the spray operation.

Comment: Both raw, untreated surface water and finished treated water samples will be collected and analyzed to assess the success of the water treatment facilities to remove residues.

DEP staff will:

1) Ensure acid-washed sample collection bottles (1L brown, Teflon capped *wide-mouth* glass bottles) are available in timely fashion to DWP Regional Office staff (via DEP courier delivery) for pickup/and or delivery to water systems, and for collection of surface water samples at benthos monitoring sites;

2) Contact water systems, coordinate distribution of sample collection bottles, and coordinate collection of water samples;

3) Ensure that ice chest(s) and ice/cold packs are available for use by each DEP Regional Office for transportation and storage of water samples;

4) Identify available staff from either the Pesticide Bureau (Boston Office) or DEP offices that will be responsible for water sample pickups from the DEP Regional Offices and delivering them to the Massachusetts Pesticide Analysis Laboratory (MPAL) at the University of Massachusetts (UMASS) Amherst, for analysis;

5) Will pickup ice chests at 11 A.M. for transport to UMASS each morning, if more than one day of spraying is planned. DAR staff may substitute;

Laboratory analyses of water samples will be conducted by UMASS MPAL using standard QA/QC procedures with analytical costs assessed to both DAR and DEP.

1) Samples will be analyzed using gas chromatography (GC) at a limit of detection of 0.1 ug/L (micrograms/liter) (parts per billion). The detection of the chemical with GC will be reconfirmed using GC/mass spectroscopy (GC/Mass Spec). If pyrethroid pesticide is used the samples will also be analyzed for PBO (Piperonyl butoxide) at a limit of detection of 0.1 ug/L (micrograms/liter) (parts per billion)

HEIRARCHY OF DECISION MAKING FOR SAMPLING, COLLECTION, STORAGE, AND TRANSPORTATION

1. Gary Gonyea (SRMCB; DEP Boston) contacts Glenn Haas and David Terry then Gary Gonyea calls:

   A. DEP Regional Offices and the DEP/DWM with information on what will be sprayed, along with the how, when and where. Gary Gonyea will also call DFW and DWM to alert fisheries biologists.

   B. Pesticide Enforcement personnel (DAR) prior to spraying to make sure both agencies have an adequate supply of sample bottles on hand or in case bottles need to be ordered; to have sample bottles shipped to SERO and/or NERO via DEP courier at the appropriate time.

   C. Pesticide Enforcement personnel (DAR) to work and coordinate with the DEP Regions for the collection and transport of sample bottles between the DEP Regions and the UMASS-Amherst Pesticide Analytical Laboratory.

2. Richard Rondeau & Michael Quink (DWP/SERO), James Dillon (DWP/NERO), Marielle Stone (DWP/CERO), and Deirdre Cabral (DWP/WERO):

   A. Establishes standardized sample identification for samples collected from the program (use DEP/DWP source IDs and, if available, established sample location IDs);

   B. Coordinates and educates water systems on the sampling, labeling and transportation procedures;

   C. Contacts all surface water systems at least a week prior to any spraying to have them pick up the bottles and to prepare them for collecting water samples.

   D. Informs water systems within two days of spraying to be ready to collect (1) two POST SPRAY samples: 0- 3 hours, and 18-24 hours. Pass along sample number scheme to DAR.

   E. Contacts the DAR Pesticide Bureau person or DEP staff responsible to make sure that sample are picked up each morning at 11 A.M. for transport to the Pesticide Lab at UMASS Amherst.

   F. Informs water systems on the standard way of filling out the chain of custody and bottle labels (Date/Time of Collection/location of sample/Name of Surface Water Source Water; PWS ID number).

   G. Identifies a central location for the ice chest and provides ice for storing sample bottles after they have been delivered to DEP.

   H. Contacts DAR, and the water systems about any matters related to the sample-bottle pickup and delivery logistics during pre and post spraying activities;

3. Mark Buffone (DAR) and Gary Gonyea (DEP/BRP) will:

   A. Make the necessary arrangements with the UMASS Pesticide Laboratory (MPAL) to provide the analytical testing with costs borne by participating agencies or paid from emergency funding.

   B. Provide the chain of custody paperwork for shipping all water samples;

   C. Ensure that MPAL performs the appropriate QA/QCs on the analytical results, including recovery results on spiked samples.

   D. Report the results of water analyses to SRMCB within 1 Business Day of reports received by DAR/DEP. **Note: Anticipated turnaround time for test results is three days.**

EPA APPROVED SAMPLING METHODOLOGY

Sample Collection, Preservation, and Handling

Grab Sample Bottle: One liter or 1 quart wide mouth, amber glass, fitted with a screw cap lined with Teflon. The bottle and cap liner must be acid-washed, rinsed with acetone or methylene chloride, and dried before use to minimize contamination.

Grab samples must be collected in glass containers, labeled, and kept on ice for transport to DEP Regional Office and MPAL.

Appendix 9: Certified Organic Farms List

FARM NAME	CITY
Allen Farms	Westport
Apex Orchards	Shelburne
Astarte Farm	Hadley
Atlas Farm	S. Deerfield
Bagdon Brothers Farm	Sunderland
Bay End Farm	Buzzards Bay
Bear Mountain Farm	Charlemont
Blue Heron Farm	Charlemont
Belkin Family Lookout Farm and Market	Natick
Blue Heron Organic Farm	Lincoln
Blue Heron Organic Farm	Charlemont
Butter Brook Farm	Acton
Cape Cod Organic Farm	Barnstable
Cape Farm Supply and Cranberry Co.	N. Harwich
Chamutka Farm	Whately
Chang Farm	Whately
Chase Hill Farm	Warwick
Collins Bog	Waquoit
Colrain Dairy Farm	Colrain
Couch Brook Farm	Bernardston
Crabapple Farm	Chesterfield
Cranberry Acres - Vineyard Open Land Foundation	Vineyard Haven
Cranberry Hill	Plymouth
Delta Organic Farm	Amherst
Enterprise Farm	South Deerfield
Eva's Garden	South Dartmouth
Farm School Apprentice Program at Maggie's Farm	Orange
Full Bloom Market Garden LLC	Whately
Golden Rule Farm	Plymouth
Goshen Hill Garlic Farm	Carlisle
Great Oak Farm	Berlin
Green Meadow Farm	S. Hamilton
Harvest Moon Organics	Southwick
Heaven's Harvest Farm	New Braintree
Heirloom Harvest CSA	Westborough
Holly Hill Farm	Cohasset
Hutchins Farm	Concord
Kelly Farm	Cummaquid
Kettle Pond Farm	Berkley
Lakeside Organic	Hadley
Left Field Farm	Middlefield
Lifeforce Growers	Waltham
Lindentree Farm	Lincoln
Long Plain Organics	Acushnet
Lucky Field Organics	New Bedford
Maiewski Farm	Whately
Many Hands Organic Farm	Barre
Maribett Farm/Colchester Neighborhood Farm	Kingston

Misty Brook Farm	Hardwick
Morning Sun Farm	Rehoboth
Nantucket Conservation Foundation, Inc.	Nantucket
Natick Community Organic Farm	Natick
New England Wild Edibles	Colrain
Old Friends Farm	Amherst
Old Frog Pond Farm	Harvard
Old Town Organics	Newbury
Orcranics	Buzzards Bay
Out of the Woods Farm	Hardwick
Plainville Farm	Hadley
Plato's Harvest	Middleboro
Pleasant Lake Farm LLC	Harwich
Prospect Hill Farm	Plympton
Raehurst Farm	Belchertown
Red Fire Farm	Granby
River Rock Farm	Westport
Riverland Farm	Sunderland
Robinson Farm	Hardwick
Russell's Garden Center	Wayland
Savory Farm	Plymouth
Serving Ourselves Farm	Boston
Shaw Farm Dairy	Dracut
Sidehill Farm	Ashfield
Silferleaf Farm	Concord
Silverbrook Farm	Dartmouth
Simple Gifts Farm	Belchertown
Sloan Farm	Orleans
Spencer Brook Farm	Concord
Squanit Bog	E. Freetown
Standish Farms	Duxbury
Stannard Farms	Vineyard Haven
Stillman Farm	New Braintree
Sweet Earth Farm	Belchertown
Sweet Water Farm	Pertersham
The Clover Path Garden	Acushnet
The Farm	Winchester
The HERB FARMacy	Salisbury
Tripp Farm	Westport
Upinngil	Gill
Web of Life Farm	Carver
West Branch Farm Products	Chester
Wise Acre Farm	Sunderland
Wolfe Springs Farm	Sheffield

Appendix 10: Commercial Freshwater Fish Farm List

FIRSTNAME	LASTNAME	ORGANIZATION	COUNTY	CITY	DISTRICT
PETER A.	UHLMAN	Owner	PLYMOUTH	BRIDGEWATER	SE
BRADFORD	MORSE	DOUBLE M CRANBERRY	PLYMOUTH	ROCHESTER	SE
ROBERT J.	HANSON	HANSON FARM, INC.	PLYMOUTH	BRIDGEWATER	SE
WAYNE A.	MILLER	BLUE STREAM HATCHERY, INC.	CAPE	WEST BARNSTABLE	SE
GERALD G.	ANCTIL	Owner	BRISTOL	BERKLEY	SE
PATRICK	ZECCO	Owner	CENTRAL	NORTHBORO	CE
PHILLIP S.	CRONIN II	NOOK FARM FISHERIES	PLYMOUTH	PLYMOUTH	SE
ROBERT	LAHTI	Owner	CENTRAL	LUNENBURG	CE
ROBERT	MCGRATH	Owner	PLYMOUTH	CARVER	SE
WATIE	AKINS	ROBBINS TROUT FARM	PLYMOUTH	WAREHAM	SE
WILLIAM A.	CHOUINARD	SPRINGBORN SMITHERS LABS, INC.	PLYMOUTH	WAREHAM	SE
JOHN R.	NICKERSON	GILBERT TROUT HATCHERY	PLYMOUTH	PLYMOUTH	SE
RODMAN E.	NICKERSON	BREWSTER HATCHERY	PLYMOUTH	PLYMOUTH	SE
LELIO	MARINO	LOOKOUT FARM	CENTRAL	SOUTH NATICK	NE
EDWARDC	OSMUN, SR.	E & T FARMS, INC.	CAPE	WEST BARNSTABLE	SE

Appendix 11: Bee Keeper Association Notification Tree Contact List

County Association	President	Secretary
Barnstable	Marte Ayers	Claire Desilets
Bristol	Greg Boyd	Bill Russell
Essex	Pete Delaney	Candace Levy
Franklin	Dan Conlon	
Hampden	Jim Stefanik	Pam Rys
Hampshire	No President	Dan Conlon
Middlesex	Rick Reault	
Norfolk	Ray Hennessey	Tony Lulek
No Berkshire	Tom Stefanik	
Plymouth	Chuck Marchewka	
Worcester	Bob DeBoer	
Massachusetts Beekeeper Association	Dan Conlon	Paul Desilets

Appendix 12: Contacts for Conducting Control of Adult Mosquitoes (Vector Species)

Contact Aerial Applicator Service (Dynamic Aviation Group, Inc.)
The decision to conduct an aerial spraying operation will trigger the immediate contacting of the aerial applicator, Dynamic Aviation, to implement emergency and/or area-wide vector control services for the purpose of preventing significant human risk or expansion of disease to other areas. The decision will be based upon thresholds or risk factors outlined in the 2007 State Surveillance and Response Plan and recommendations by the Mosquito Advisory Group (MAG).

Dynamic Aviation has the capacity to meet the needs of any aerial intervention recommended whether it is smaller targeted acreage at a minimum of 5,000 acres or larger wide-area adulticide treatments upwards to 500,000 acres. The SRMCB has renewed the approved state contract with Dynamic Aviation with options to renew this contract through May 31, 2016.

Dynamic Aviation will employ twin-engine turbine aircraft - King Air-65-A90 - that typically fly at an altitude of 300 feet at a speed of 170 mph carrying 90 gallons of the approved product of choice, Anvil 10+10 (sumithrin) delivering a swath width of 750 –1,000 feet. These aircraft are configured for nighttime operation, and applications will take place in the late evening – early nighttime hours when most mosquito species are active and treatment efficacy will be enhanced (see Appendix 4).

Contact by SRMCB will begin deployment and mobilization of aircraft including determining how many aircraft would be required, when the aircraft will arrive, and when operations will commence and be completed. Aerial adulticiding may take one or more evenings depending on weather conditions, the number of acres needing treatment, the number of aircraft, and an approved multi-hour spray window (i.e. approximately sunset through shortly after sunrise) to treat large spray blocks. If weather is not acceptable or deteriorates after the spraying has begun or should the blocks be small or scattered due to exclusions, or if a 6-hour spray window (minimum) is not available, applications will take more than one evening to complete the operation.

Contact Insecticide Contractor (Clarke Mosquito Control Products, Inc.)
The decision to conduct an aerial spraying operation also will trigger the immediate SRMCB contacting of the company approved on the current state contract for mosquito control insecticide, renewed recently to insure the delivery of insecticides for emergency wide-area adulticide operations. The product of choice for any operational response will be Anvil 10+10 distributed by Clarke Mosquito Control Products, Inc.

Identification and Pre-designation of Base of Operations for Various Locations
Base of Operations have been cleared with the following airports and established for aerial application treatments. These bases of operation are located in Essex, Norfolk, and Plymouth counties where EEE infection has historically occurred.

If aerial adulticiding operations are necessary in Essex County, the SRMCB through its regional mosquito control district (Northeast Mosquito Management and Wetlands District) has pre-designated the Lawrence Airport as a base of operation. A Memorandum of Understanding is being developed for both these airports addressing the specific needs and requirements of the Northeast Mosquito Control District and the Airport. The SRMCB would contact both the Director of the Northeast Mosquito Control District and the Airport Managers depending on suitability of location of operation.

The only functioning airport in Norfolk County is the Norfolk Municipal Airport and if needed, the SRMCB would contact the Airport Manager.

The SRMCB has identified through Norfolk County Mosquito Control Project several sites that can be used for landing zones for helicopters that are town owned, mostly old dumps, which can be utilized if necessary (See Appendix 4).

If aerial adulticiding operations are necessary in Plymouth County, the SRMCB through its regional mosquito control district (Plymouth County Mosquito Control Project) has pre-designated the Plymouth Airport as a base of operation. The Plymouth County Mosquito Control Project Headquarters would be used for equipment and insecticide delivery.

Appendix 13: 2008 Mosquito Advisory Group (MAG) Members

The five-member Mosquito and Mosquito-Borne Disease Advisory Group are comprised of the following independent experts:

1. Dr. Asim Ahmed specializing in Pediatric Infectious Disease at Children's Hospital-Boston

Asim A. Ahmed, MD
Division of Pediatric Infectious Diseases
Children's Hospital Boston
Department of Microbiology and Molecular Genetics
Harvard Medical School

2. Mr. Jere Downing, Executive Director of the Cranberry Institute who has exceptional experience in mosquito control and arbovirus issues;

Jere Downing, Executive Director
Cranberry Institute
3203-B Cranberry Highway
East Wareham, Massachusetts 02538

3. Dr. Anthony Kiszewski an epidemiologist at Bentley College;

Anthony (Tony) Kiszewski
Department of Natural and Applied Sciences
Bentley College
175 Forest Street
Waltham, MA 02452

4. Mr. James Leach, Research Scientist for the New York State Health Department, Bureau of Toxic Substance Assessment

James Leach, Research Scientist IV
New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square, 547 River Street, Room 330
Troy, NY 12180-2216

5. Dr. Richard Pollack who is a research associate in the Department of Immunology and Infectious Disease at the Harvard School of Public Health.

Richard Pollack
Research Associate
Department of Immunology and Infectious Diseases
Harvard School of Public Health
665 Huntington Avenue
Boston MA 02115

Appendix 14: 2008 Massachusetts Arbovirus Surveillance and Response Plan [1]

Massachusetts Department of Public Health

Mary Gilchrist, Ph.D.
Director, William A. Hinton State Laboratory Institute
Massachusetts Department of Public Health

Alfred DeMaria, M.D.
State Epidemiologist
Massachusetts Department of Public Health

Executive Summary

The 2008 MDPH Massachusetts Arbovirus Surveillance and Response plan provides surveillance and phased response guidance for both West Nile virus (WNV) and eastern equine encephalitis virus (EEE). The year 2007 was witness to continued West Nile virus activity across the state. In the past five years there have thirty-four cases of WNV infection reported in Massachusetts and thirteen human cases of EEE resulting in six deaths. This plan reflects a comprehensive review of surveillance activities, mosquito control efforts, public information and risk communication related to arbovirus control in Massachusetts.

The purpose of the plan is to provide guidance on operational aspects of surveillance and response by state and local agencies responsible for the prevention of mosquito-borne disease in the 2008 season. The Department of Public Health will continue to seek advice from its partners and collaborators and modify the plan, as appropriate. This document is open to continual review and evaluation. Information is provided to guide planning and actions to reduce the risk of human disease from EEE virus and WNV.

Key objectives contained in this plan provide for:

- the monitoring of trends in EEE virus and WNV activity in Massachusetts;
- the timely collection and dissemination of information on the distribution and intensity of WNV and EEE virus in the environment;
- the laboratory diagnosis of WNV and EEE cases in humans, horses and other mammals;
- the effective communication, advice and support of activities that may reduce risk of infection.

This document provides information about EEE and WNV disease and program goals, and specific guidelines for mosquito, avian, equine and human surveillance. Additionally, this document provides guidance for the dissemination of information, including routine information; media advisories of positive EEE virus and WNV findings in birds and mosquitoes, as well as public health alerts related to positive EEE and WNV human cases.

This plan describes MDPH's public outreach efforts to provide helpful and accurate communications to Massachusetts' citizens about their risk from arboviral diseases and specific actions that individuals and communities can take to reduce this risk.

Recommendations regarding the WNV phased response plan appear in Table 1 and incorporate components presented in the "Massachusetts Surveillance and Response Plan for Mosquito-Borne Disease", May 2004; as well as those presented in the Centers for Disease Control and Prevention (CDC) document, "Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance Prevention, and Control", 3rd Revision, 2003. Recommendations regarding the EEE virus phased response plan appear in Table 2 and incorporate information provided in the MDPH document, "Vector Control Plan to Prevent Eastern (Equine) Encephalitis", 1991, as well as analyses of additional surveillance data collected in Massachusetts since that time.

1 – Most recent DPH surveillance and response plan can be found at:
http://www.mass.gov/Eeohhs2/docs/dph/cdc/arbovirus/arbovirus_surveillance_plan.pdf

I. INTRODUCTION

The Massachusetts Department of Public Health (MDPH), in collaboration with regional mosquito control projects (MCPs), conducts surveillance for mosquito-borne viruses that pose a risk to human health. The Massachusetts Arbovirus Surveillance Program (MASP)

- tests mosquitoes, birds, veterinary specimens from horses and other mammals, and humans for evidence of infection; identifies areas of disease risk;
- provides information to guide decision-making to reduce the risk of disease;
- informs the public of where and when there is an increased risk of infection.

The MASP currently focuses on West Nile (WNV) and eastern equine encephalitis (EEE) viruses, which are found in the local environment and are capable of causing serious illness and death in human, horses and other mammals.

The 2008 Massachusetts Surveillance and Response Plan for mosquito-borne diseases is based on a comprehensive plan initially developed for WNV in 2001 in collaboration with local health agencies, other state agencies, academic institutions, the Centers for Disease Control and Prevention (CDC), and interested groups and individuals. It incorporates components of the state's EEE surveillance activities, which began in the 1950's and have continued since that time. The Massachusetts Arbovirus Surveillance Program (MASP) began monitoring for WNV following a 1999 outbreak of human WNV disease in the New York City area, the first known occurrence of this disease in North America. WNV was identified in birds and mosquitoes in Massachusetts during the summer of 2000 and has been found during each consecutive season.

The updated 2008 plan is the result of analyses of surveillance data collected in Massachusetts and the United States. In addition, in order to manage the complexity of the human disease risk posed by these viruses, MDPH convened four workgroups that advised MDPH and promoted collaborative efforts by multiple agencies and interest groups. The purpose of the plan is to provide guidance on operational aspects of surveillance and response by the state and local agencies with responsibilities for the prevention of mosquito-borne disease. MDPH will continue to seek advice from its partners and collaborators and modify the plan, as appropriate. This document is open to continual review and evaluation with changes made when there is opportunity for improvement.

II. DISEASE BACKGROUND

The two principal mosquito-borne viruses (also known as arboviruses, for **ar**thropod-**bo**rne viruses) recognized in Massachusetts and known to cause human and animal disease are eastern equine encephalitis virus with the first human cases identified in both the United States and Massachusetts in 1938, and West Nile virus, with the first human case identified in the United States in 1999, and in Massachusetts in 2001.

Eastern Equine Encephalitis Virus

Background

Eastern equine encephalitis is a serious disease with 30-50% mortality and lifelong neurological disability among many survivors, which occurs sporadically in Massachusetts. The first symptoms of EEE are fever (often 103º to106ºF), stiff neck, headache, and lack of energy. These symptoms show up three to ten days after a bite from an infected mosquito. Inflammation and swelling of the brain, called encephalitis, is the most dangerous and frequent serious complication. The disease gets worse quickly and some patients may go into coma within a week. There is no treatment for EEE. In Massachusetts, approximately half of the people identified with EEE have died from the infection. People who survive this disease will often be permanently disabled. Few people recover completely.

Historically, clusters of human cases have occurred in cycles lasting 2-3 years, with a hiatus of 10-20 years between outbreaks. In the years between outbreaks, isolated cases may occur. Outbreaks of human EEE disease in Massachusetts occurred in 1938-39 (35 cases, 25 deaths), 1955-56 (16 cases, 9 deaths), 1972-74 (6 cases, 4 deaths), 1982-84 (10 cases, 3 deaths), 1990-92 (4 cases, 1 death), 2004-06 (13 cases, 6 deaths).

Massachusetts Eastern Equine Encephalitis Experience		
Year(s)	Human EEE Cases	Human EEE Deaths
1938-39	35	25
1955-56	16	9
1972-74	6	4
1982-84	10	3
1990-92	4	1
2004-06	13	6

The Massachusetts Department of Public Health, with CDC funding, initiated a field surveillance program in 1957; following a 1955-56 outbreak of EEE. The purpose of the program was to gather data to guide prevention and risk reduction of this disease.

Risk Factors for Disease Transmission

Eastern equine encephalitis virus is an alphavirus enzootic in some passerine bird species found in fresh-water swamp habitats. The virus is transmitted among wild birds in these areas primarily by *Culiseta melanura*, a mosquito species that feeds predominantly on birds. This mosquito-borne virus has a cycle of natural infection among bird populations with occasional ‘‘incidental” symptomatic infections of humans, horses, llamas, alpacas, emus and ostriches. The prevalence of infection among birds is related to the prevalence in bird-feeding mosquitoes. When infections become more prevalent among birds, infection rates may also rise in mosquitoes that feed indiscriminately on birds and other animals. Thus, infection within these bridge vector mosquitoes seems to enhance the risk of infection to people.

Outbreaks involving two or more human infections associated temporally and spatially; occur with the convergence of several factors. A major factor that affects the risk of disease in humans is the prevalence of immunity to EEE virus in the birds that serve as the enzootic reservoir of the virus. EEE virus infection in passerine birds usually results in a mild infection. Following infection, birds become immune to the virus and will not harbor it. Following a year of increased viral transmission, the prevalence of EEE immunity in birds increases and in subsequent years, the virus may not be able to spread rapidly among these reservoir hosts due to the establishment of ‘herd immunity’. Thus, elevated levels of herd immunity in birds reduce the amplification of EEE virus in the bird-mosquito-bird cycle, which in turn reduces the chance of incidental infections in humans.

The risk of infection in humans is a function of exposure to infected human-biting mosquitoes. Certain kinds of mosquitoes are highly selective as to the kind of host they will seek and feed upon. *Culiseta melanura* (*Cs. melanura*) mosquitoes feed primarily on birds and are recognized as the predominant vector of EEE virus transmission between the passerine birds that are the reservoir of the virus. Thus, the intensity of enzootic EEE virus transmission correlates with the abundance of this enzootic vector. If the herd immunity level against EEE virus of these birds is high, (i.e. few susceptible birds) due to several years of prior exposure, then there is little opportunity for the virus to perpetuate or amplify within the bird population. When herd immunity is low and there are many susceptible birds; EEE virus infections can spread more rapidly and more widely among the birds. This condition may enhance the potential for transfer of EEE virus to humans by a ‘bridge vector’ mosquito, i.e., a species that is indiscriminant and will feed on birds or humans, such as *Coquillettidia perturbans, Ochlerotatus canadensis, Aedes vexans and Culex species.*

The risk of EEE virus infection in humans varies by geographical area in Massachusetts, as well as in the United States. EEE is more prevalent in areas that support dense populations of passerine birds and have favorable breeding conditions for the enzootic vector. In Massachusetts, these areas consist mainly of large wetlands containing mature white cedar and red maple swamps that are more common in southeastern Massachusetts. The majority of EEE cases have occurred in Norfolk, Bristol, and Plymouth counties with some cases also occurring in Middlesex County, rarely in Essex County and very rarely in Worcester County or further west. Historically, Cape Cod and the Islands of Martha's Vineyard and Nantucket have not had human cases of EEE.

Other major factors that affect the risk of EEE virus infections for humans are the abundance of specific kinds of mosquitoes at critical periods of the transmission season, groundwater levels and the timing of rainfall and flooding during the mosquito season. Participation in outdoor activities increases the risk of exposure while the use of personal protective measures (e.g., avoidance of mosquitoes, use of repellent) helps to reduce the risk of exposure.

Long-term weather patterns during the fall and winter that include high ground water levels and snow cover may enhance survival of *Cs. melanura* larval populations. The abundance of these larval populations may serve as an early indicator of the potential for human disease later in the year. Multiple factors affect the development, survival, and abundance of mosquitoes. It is not currently possible to predict either the abundance of mosquitoes or the risks of encountering an infected vector later in the season. The best control approach to reduce these vectors must consider multiple factors. One approach calls for beginning integrated pest management (IPM) control activities early in the season and targeting both the enzootic and human biting vector species.

West Nile Virus

Background

West Nile Virus (WNV) first appeared in the United States in 1999. Since its initial outbreak in New York City, the virus has spread across the US from East to West. WNV infection may be asymptomatic in some people, but it leads to morbidity and mortality in others. WNV causes sporadic disease of humans, and occasionally results in significant outbreaks. Nationally, over 3600 human cases of WNV neuroinvasive disease (West Nile meningitis and West Nile encephalitis) and WNV fever were reported to the CDC in 2007.

The majority of people who are infected with WNV (approximately 80%) will have no symptoms. A smaller number of people who become infected (~ 20%) will have symptoms such as fever, headache, body aches, nausea, vomiting, and sometimes swollen lymph glands. They may also develop a skin rash on the chest, stomach and back. Less than 1% of people infected with WNV will develop severe illness, including encephalitis or meningitis. The symptoms of severe illness can include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis. Persons older than 50 years of age have a higher risk of developing severe illness. In Massachusetts, there were six fatal WNV human cases identified between 2001-2007, all in individuals eighty years of age or older.

Following the identification of WNV in birds and mosquitoes in Massachusetts during the summer of 2000, MDPH arranged meetings between local, state and federal officials, academicians and the public to develop recommendations to improve and strengthen key aspects of the state plan for mosquito-borne virus surveillance and prevention of mosquito-borne disease. Four workgroups addressed the issues of surveillance, risk reduction interventions, pesticide toxicity and communication.

Risk Factors for Disease Transmission

West Nile (WN) virus is amplified by a cycle of continuous transmission between mosquito vectors and bird reservoir hosts. Infectious mosquitoes carry virus particles and infect susceptible bird species. WNV infection is often fatal in some species of birds, particularly American crows and blue jays (corvids). Confirmation of WNV in dead birds provides sentinel information useful for assessing risk of human WNV infections.

The principal mosquito vector for West Nile virus on the East coast is the Culex species. These species may be abundant in urban areas, breeding easily in artificial containers such as birdbaths, discarded tires, buckets, clogged gutters, and other standing water sources. *Culex pipiens* feeds mainly on birds and occasionally on mammals. It will bite humans, typically from dusk into the evening. *Culex restuans* feeds almost primarily on birds but has been known to bite humans on occasion. Brackish and freshwater wetlands are the preferred habitat for *Culex salinarius* which feeds on birds, mammals, and amphibians and is well known for biting humans. *Ochlerotatus japonicus* may be involved in the transmission of both WNV and EEE virus. Natural and artificial containers such as tires, catch basins, and rock pools are the preferred larval habitat of this mosquito. It feeds mainly on mammals and is a fierce human biter.

Activity of the West Nile virus zoonotic cycle varies from year to year. When a large number of infected birds and a high rate of infected mosquitoes are found in a relatively small geographic area, the risk of transmission of virus to humans will increase.

A summary of current and historical surveillance information for EEE virus and WNV in Massachusetts is available at **www.mass.gov/dph**.

III. PROGRAM GOALS

Timely and accurate information provided by the MDPH based on surveillance information can be used to provide an indication of the level of risk of human disease from WNV and EEE. Based on this surveillance information, plans and actions to reduce risk can be developed and implemented when needed.

Specific Program Priorities

1. Test mosquitoes, birds, horses, humans and other animals to identify EEE virus and WNV infections.
2. Track trends in incidence and prevalence of EEE virus and WNV infections by geographic area.
3. Estimate viral infection rates in birds and mosquitoes.
4. Stratify risk o geographic areas as a function of their relative risk of human disease.
5. Conduct surveillance for human and equine disease.
6. Educate human and animal medical practitioners on the appropriate procedures for detecting and identifying infections and disease caused by mosquito-borne viruses.
7. Recommend measures to reduce virus transmission and disease risk.
8. Provide information to the public on mosquito-borne diseases and disease risk, and on common-sense precautions to reduce the risk of infection.
9. Participate in the national Arbovirus surveillance network coordinated by the CDC.

Roles

1. Massachusetts Department of Public Health (MDPH)

The central purpose of the Massachusetts Arbovirus Surveillance Program (MASP) is to provide information that will guide planning and actions to reduce the risk of human disease from EEE virus and WNV. To achieve this, the main objectives are to monitor trends in EEE virus and WNV in Massachusetts; provide timely information on the distribution and intensity of WNV and EEE virus in the environment; perform laboratory diagnosis of WNV and EEE cases in humans, horses and other mammals; communicate effectively with officials and the public; provide guidelines, advice and support on activities that effectively reduce risk of disease; and provide information on the safety, anticipated benefits and potential adverse effects of proposed prevention interventions.

MDPH works cooperatively with the Massachusetts State Reclamation and Mosquito Control Board (SRMCB) and with regional mosquito control projects to identify and support the use of safe and effective mosquito control measures based on integrated pest management (IPM) principles. The application of pesticides as a means to reduce human risk is one of several methods/strategies to attain this goal.

2. State Reclamation and Mosquito Control Board (SRMCB)

The State Reclamation and Mosquito Control Board (SRMCB) oversee mosquito control in the Commonwealth of Massachusetts. The SRMCB consists of three (3) members representing the Department of Agricultural Resources (DAR), Department of Conservation and Recreation (DCR), and Department of Environmental Protection (DEP). Additionally, the SRMCB advises its respective state agency Commissioners on actions to reduce mosquito populations based on MDPH findings and characterization of risk.

The SRMCB 'Operational Response Plan to Reduce the Risk of Mosquito-Borne Disease in Massachusetts' addresses the issues related to the operational aspect of adult mosquito surveillance and control to prevent and/or reduce the risk of mosquito-borne diseases.

In 2006, the SRMCB created an SRMCB Mosquito Advisory Group (MAG). The MAG provides independent scientific advice to the SRMCB to assist them in evaluating and assessing data from both DPH and mosquito control projects

3. Mosquito Control Projects (MCP)

There are nine (9) organized mosquito control projects or districts located throughout Massachusetts. All of the mosquito control activities of these organized agencies are performed under the aegis of the State Reclamation and Mosquito Control Board (SRMCB). Mosquito Control Projects collaborate with local boards of health in their jurisdictions to control mosquitoes. These locally authorized efforts employ a variety of targeted activities for source reduction, larviciding and adulticiding that are in compliance with the SRMCB Operational Response plan.

IV. SURVEILLANCE

A. Mosquito Surveillance for West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE) Virus

Surveillance of mosquitoes for arboviruses is one of the core functions of the MASP. Monitoring mosquitoes for the presence of virus provides a direct estimate of risk to humans. Massachusetts has a long-term field surveillance program that was initiated in 1957 for EEE virus and was modified in 2000 to include WNV surveillance. The extensive experience in Massachusetts with surveillance for mosquito-borne disease provides expertise and capacity to guide risk reduction efforts. The MASP uses a

comprehensive and flexible strategy that modifies certain surveillance activities in response to trends in disease risk.

On an ongoing basis, MASP will continue to monitor national and regional surveillance data and current scientific literature to assess risk of newly emerging arboviruses in Massachusetts. In addition, defined subsets of mosquito pools will be evaluated by MDPH for the presence of new or emerging viruses

1. Fixed and Long-Term Trap Sites: MASP will collect mosquitoes from areas with activity during the previous year, and from long-term trap sites maintained in the EEE virus high-risk areas of southeastern and eastern Massachusetts (Figure 1). Trapping of gravid mosquitoes for testing of WNV is conducted both by mosquito control projects and MDPH staff at various locations throughout the state during the arbovirus season. At the State Laboratory Institute (SLI), samples (pools of 1- 50 specimens) of trapped mosquito collections are assayed for WNV and EEE virus. Test results from routine mosquito collections are available within 24-48 hours. Fixed and long-term trap sites provide the best available baseline information for detecting trends in mosquito abundance and virus prevalence and for estimating the relative risk of human infection from EEE virus and WNV. MDPH will monitor larvae from select sites in late fall and early spring to determine end-season and pre-season larval abundance. Monitoring of larval abundance from these sites will continue on a weekly basis during the arbovirus season.

2. Supplemental Trap Sites: When EEE virus or WNV activity, or increased WNV bird deaths, are detected in an area, additional trap sites and/or trap types will be used to obtain more information regarding the intensity of virus activity in mosquitoes. The following risk indicators may result in the implementation of more intensive mosquito trapping: 1) virus isolations in mosquitoes; 2) increasing or significant numbers of bird deaths associated with WNV; 3) emergence of large numbers of human-biting mosquitoes in an area with a high rate of virus activity and 4) human or equine cases

3. Mosquito Control Project Trap Sites: Massachusetts mosquito control projects (MCP's), are organized under the State Reclamation and Mosquito Control Board (SRMCB), located within Department of Agricultural Resources. The SRMCB is composed of three members; representing the Department of Agricultural Resources; the Department of Environmental Protection; and the Department of Conservation and Recreation. MCP's and the SRMCB communicate collaboratively with the MASP. The mosquito control projects employ comprehensive, integrated mosquito management (IMM) programs based on integrated pest management (IPM) principles.

The IMM program uses a variety of available control strategies to impact mosquito abundance. Monitoring mosquito abundance is accomplished through various surveillance methods including but not limited to larval dip counts, the use of light/ CO_2 baited traps and gravid traps.

B. Avian Surveillance: West Nile Virus (WNV) and Eastern Equine Encephalitis Virus (EEE virus)

1. Dead Bird Reports: Because WNV causes death in certain species of birds, and the mortality rate from infection for the American crow is high, we expect that dead birds may be the first warning of WNV activity in an area. The association between corvid deaths and WNV activity is well established. The MASP tracks dead bird reports provided by local and state officials, and from the public. MASP will request that crows and blue jays, representing the species most likely to experience mortality due to WNV, be submitted for testing, and will provide a pickup service for designated regional repositories to assist local communities in the transport of specimens to MDPH. Most kinds of birds that are infected with EEE virus survive the viremia, making dead bird EEE virus monitoring impractical. Thus, MASP does not utilize dead bird reports for EEE virus monitoring.

MASP will record and analyze dead bird reports, which will be used to identify areas for intensified surveillance of WNV activity including bird testing, and mosquito trapping. Reports of dead birds are taken via a toll-free telephone number at MDPH (866 MASS WNV, or 866-627-7968), which may be used by local officials and the public. At the time of the report, information on the location and type of bird will be collected and entered into a surveillance database. The caller will be informed if the reported bird is to be tested, and arrangements will make for pickup and delivery if needed. Otherwise the caller will be informed of proper disposal procedures for the dead bird.

These reports are summarized daily and provided to local health agents, the public and the media via a public website (**www.mass.gov/dp**h.)

2. Laboratory Testing of Dead Wild Birds for West Nile Virus (WNV) and Eastern Equine Encephalitis Virus (EEE virus): The MASP will collect and test dead birds, primarily crows and blue jays, for WNV. Routine testing is generally completed within 24-48 hours. Confirmatory testing, when necessary, may take approximately four working days**.** After WNV infection of a bird population has been established by confirmation of two WNV avian specimens within a focal area, further routine bird testing will discontinued in that area. Boston and areas defined as 'Boston neighborhoods' are considered to be one geographic focal area. Therefore, avian testing will continue until two positives are identified within this focal area. Following the finding of two WNV specimens, and in the presence of continued bird deaths, a limited sample of dead birds may be tested to confirm that additional bird deaths are the result of WNV infection. In addition, ongoing evaluation of reports of dead birds may indicate the need for increased testing of birds and/or mosquitoes to better assess virus transmission among the bird and mosquito populations at particular times throughout the season.

Most birds that are infected with EEE virus generally survive the viremia, making dead bird EEE virus monitoring impractical. MASP does not conduct routine surveillance of EEE in birds for public health surveillance purposes because it does not provide additional information useful for determining levels of human risk. Testing of individual bird specimens for EEE infection will be determined on an as-needed basis as determined by the MDPH Public Health Veterinarian and the MASP. The MDPH Pubic Health Veterinarian will determine the appropriateness of testing specimens from dead bird clusters for both for WNV and EEE infections.

3. Laboratory Testing of Live Birds: The MASP may capture, bleed and release birds during the season to collect supplemental information about virus activity in an area where infections in birds are increasing.

C. Animal Surveillance: West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE) Virus

Testing for WNV and EEE virus: Specimens from horses and other domestic animals that have severe neurological disease suspected of being caused by EEE virus or WNV infection are tested at SLI. Confirmatory testing, when necessary, may take up to nine working days. Massachusetts' veterinarians, the state Department of Agricultural Resources, USDA and Tufts University School of Veterinary Medicine collaborate with the MASP to identify and report suspect animal cases. In addition, blood samples from other sources such as zoos, horse stables or wild animals may be tested. Current information on WNV and EEE virus infections in horses along with clinical specimen submission procedures are disseminated to large animal veterinarians, stable owners, and other populations as needed, through mailings and postings on the MDPH Arbovirus website at www.mass.gov/dph. Many horses are immunized against infection with WNV and EEE virus with available veterinary vaccines. This is the primary means of preventing infection in horses.

D. Human Surveillance

1. Passive surveillance: Specimens from clinical cases of encephalitis and meningo-encephalitis are submitted to MDPH and screened for possible causes of infection, including WNV and EEE virus. Confirmatory testing, when necessary, may take three to seven working days. Selected cases of other human disease, such as aseptic meningitis, may be screened, if appropriate. Current information on WNV and EEE virus infections in humans along with clinical specimen submission procedures are disseminated to physicians (infectious disease, emergency medicine and primary care), emergency room directors and hospital infection control practitioners through mailings, broadcast faxes, and postings on the MDPH Arbovirus website at www.mass.gov/dph.

2. Active surveillance: If surveillance data indicate a high risk of human disease, active surveillance may be instituted in targeted areas. Active surveillance involves regularly contacting local health care facilities to communicate current surveillance information, prevention strategies and specimen submission procedures. HHAN (Health and Homeland Alert Network) alerts are sent to local boards of health upon confirmation of EEE virus or WNV virus in any specimen; health care facilities are advised of increased risk status and the corresponding need to send specimens to SLI for testing.

3. Pesticide related surveillance: Outreach on pesticide illness reporting will be coordinated by the MDPH Bureau of Environmental Health. In the event of an aerial pesticide application, active surveillance efforts will be implemented with emergency departments and intensified outreach efforts will be made to health care providers.

V. Prevention and Control

The MASP will provide information to guide planning and actions to reduce the risk of human disease from EEE virus and WNV. MDPH works to identify and support the use of risk reduction and disease prevention methods that are specific to the causes of disease; and supports planning and practices which incorporate the most appropriate prevention methods and appropriate use of pesticides.

Communication of Information

1. Routine Information:

Prior to the beginning of the Arbovirus season, general disease information and specimen submission procedures will be provided to local boards of health via electronic messages from the Massachusetts Health and Homeland Alert Network (HHAN). General information and fact sheets are posted on the MDPH Arbovirus website and available for Mosquito Control Projects, physicians, veterinarians, animal control officers, and other agencies.

2. Positive EEE Virus and WNV Findings in Mosquitoes, Birds, Horses (and other Veterinary Specimens), and Humans:

Laboratory confirmation of a human WNV or EEE case is immediately reported by telephone to the submitting physician, and Local Board of Health (LBOH) in the town where the case resides. If the LBOH cannot be reached via telephone in a timely manner, a severe level HHAN alert will be sent.

Laboratory confirmation of a horse (or other veterinary specimen) with WNV or EEE virus infection will be immediately reported by telephone to the submitting veterinarian, the Department of Agricultural Resources- Bureau of Animal Health, Biosecurity and Dairy Services and the LBOH. As with human cases, if the LBOH cannot be reached in a timely manner, a severe level HHAN alert will be sent.

Initial positive findings in birds (WNV) and mosquitoes (WNV and EEE) from a given town will be reported to the LBOH by telephone. Adjacent towns will be notified via a moderate level HHAN alert. Any

additional positive findings in birds or mosquitoes will be reported simultaneously to the town and adjacent towns via a moderate level HHAN alert.

At the time of notification, MDPH will encourage local Boards of Health to share the information with other local agencies and high-risk populations in their community as appropriate. MDPH provides local Boards of Health with sample press releases for their use. Depending on the circumstances, MDPH may also issue a public health alert. In addition, weekly summaries of results from avian samples submitted and tested will be posted as News Items on the HHAN by town.

All laboratory confirmed results for WNV and EEE virus in humans, horses, other veterinary specimens, mosquitoes and birds are provided to the regional health department representative, mosquito control projects and members of the State Reclamation and Mosquito Control Board (SRMCB) once the LBOH has been notified.

After all appropriate individuals and agencies have been sent notification, positive surveillance findings are made available to the media and general public on the MDPH Arbovirus website at www.mass.gov/dph. This website, which also includes a variety of educational materials related to preventing mosquito-borne diseases, is updated on a daily basis throughout the Arbovirus season. Results are also reported to the CDC's Arbonet reporting system.

3. Public Health Alerts and Media Advisories: MDPH issues public health alerts through the media when surveillance information indicates an increased risk of human disease or if a significant surveillance event occurs (for example, the first arbovirus activity of the season). In general, alerts will include current surveillance information and emphasize prevention strategies. Alerts will be drafted in consultation with outside state and local agencies, as indicated.

VI. Recommendations for a Phased Response to EEE virus and WNV Surveillance Data

The recommendations provided here are based on current knowledge of risk and appropriateness of available interventions to reduce the risk for human disease. Multiple factors contribute to the risk of mosquito-transmitted human disease. Decisions on risk reduction measures should be made after consideration of all surveillance information for that area at that time.

Recommendations regarding the WNV phased response plan (Table 1) incorporate several components presented in the "Massachusetts Surveillance and Response Plan for Mosquito-Borne Disease", May 2004, as well as those presented in the CDC document, "Epidemic/Epizootic West Nile virus in the United States: Guidelines for Surveillance Prevention, and Control", 3rd Revision, 2003.

Recommendations regarding the EEE virus phased response plan (Table 2) incorporate information provided in the MDPH document, "Vector Control Plan to Prevent Eastern (Equine) Encephalitis", 1991, and results of analyses of additional surveillance data collected in Massachusetts since that time.

Public awareness of what can be done to reduce risk of infection is of utmost importance. The level of EEE virus and WNV activity may occasionally present a potential for increased virus transmission to humans. Typically, risk is expected to be relatively low, and the routine precautions taken by individuals may be sufficient to reduce opportunities for infection. These guidelines take into consideration the complexity of reducing risk of human disease from EEE virus and WNV infection and form a framework for decision-making.

2. Phased response

General guidelines are provided for an array of situations that are noted in the Surveillance and Response Plan Tables that follow. Specific situations must be evaluated individually and options discussed before final decisions on specific actions are made. The assessment of risk from mosquito-borne disease is complex and many factors modify specific risk factors. MDPH works with local public health agencies, mosquito control projects, and the SRMCB to develop the most appropriate prevention activities to reduce the risk of human disease. There is no single indicator that can provide a precise measure of risk, and no single action that can assure prevention of infection.

When recommending the use of mosquito larvicides or adulticide, MDPH works collaboratively with SRMCB and with regional mosquito control projects to identify and support the use of safe and effective mosquito control measures based on integrated pest management (IPM) principles.

A. MDPH Guidance:

The MDPH Arbovirus Program will determine human risk levels as outlined in the phased response tables of this plan. Risk levels are defined for focal areas. “Focal Areas” may incorporate multiple communities, towns or cities. Factors considered in the determination of human risk in a focal area include: mosquito habitat, prior isolations, human population densities, timing of recent isolations of virus in mosquitoes, the cyclical nature of human outbreaks (EEE), current and predicted weather and seasonal conditions needed to present risk of human disease.

If the risk of an outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB, MCP’s, and MAG to discuss the use of intensive mosquito control methods and determine whether measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide. Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of WNV or EEE human disease.

Once significant human risk has been identified in a focal area by MDPH, MDPH will coordinate with the SRMCB to determine the adulticide activities that should be considered and implemented in response. The SRMCB will provide recommendations on appropriate pesticide(s), extent, route and means of treatment, and the location of specific treatment areas.
Based on historical experience with EEE virus, MDPH has identified specific critical indicators for EEE virus and provides specific risk reduction and prevention guidance for seasons with an anticipated increased EEE risk.

3. Risk Reduction and Prevention Guidance for Seasons with Indicators of Increased EEE Risk:

a. MDPH may increase the number of public health alerts throughout the season to remind the public of the steps to take to reduce their risk of exposure to mosquitoes.

b. MCP’s may increase their source reduction activities to reduce mosquito-breeding habitats and to reduce adult mosquito abundance. This may include ground and aerial larviciding.

c. After sustained findings of positive mosquito isolates, if not already in progress, adult mosquito control efforts including targeted ground adulticiding operations should be considered. The decision to use ground-based adult mosquito control will depend on critical modifying variables including the time of year, mosquito population abundance and proximity of virus activity to at-risk populations.

d. Other intensified efforts may be implemented following coordinated recommendations from MDPH and other agencies including DEP, MDAR, and DCR.

Table 1. Guidelines for Phased Response to WNV Surveillance Data

Risk Category	Probability of human outbreak	Definition of Risk Category for a Focal Area[2]	Recommended Response
1	Remote	All of the following conditions must be met: Prior Year No prior year WNV activity detected in the focal area. And Current Year No current surveillance findings indicating WNV activity in birds or mosquitoes in the focal area And No horse or human cases.	1. MDPH staff provides educational materials and clinical specimen submission protocols to targeted groups involved in arbovirus surveillance, including, but not limited to, local boards of health, physicians, veterinarians, animal control officers, and stable owners. 2. Educational efforts directed to the general public on personal prevention steps and source reduction, particularly to those populations at higher risk for severe disease (e.g., the elderly). 3. Routine avian surveillance activities: Dead bird reporting and recorded information via MDPH Public Health Information Line. 4. Assess mosquito populations, monitor larval and adult mosquito density. 5. Routine collection and testing of mosquitoes. 6. Initiate source reduction; use larvicides at specific sites identified by entomologic survey. In making a decision to use larvicide consider the abundance of *Culex* larvae, intensity of prior virus activity and weather. 7. Locally established, standard, adult mosquito control activities are implemented. No specific supplemental control efforts are recommended. 8. Passive human and horse surveillance. 9. Emphasize the need for schools to comply with MA requirements for filing outdoor IPM plans.
2	Low	Prior Year Any WNV activity in birds or mosquitoes in the community or focal area Or Current Year Sporadic WNV activity in mosquitoes in the focal area. Sporadic activity is defined when 1-2 isolates are found within 1-2 weeks of routine	Response as in category 1, plus: 1. Expand community outreach and public education programs, particularly among high-risk populations, focused on risk potential and personal protection, emphasizing source reduction. 2. Increase larval control and source reduction measures. 3. Public health alert sent out by MDPH in response to first WNV virus positive bird and mosquito pool detected during the season. The alert will summarize current surveillance information and emphasize

[2] Focal Area- May incorporate multiple communities, towns or cities. Factors considered in determination of human risk in a focal area include mosquito habitat, prior isolations, human population densities, timing of current isolations of virus in mosquitoes, the cyclical and seasonal conditions needed to present risk of human disease

		collections; or, one WNV positive bird And No horse or human cases	personal prevention strategies. 4. Locally established standard adult mosquito control activities continue.
3	Moderate	**<u>Prior Year</u>** **Confirmation of one or more human or horse WNV cases; or sustained WNV activity in mosquitoes and/ or birds for 2 or more weeks.** Or Current year Sustained WNV activity for 2 or more weeks in birds* and /or mosquitoes (<15 mosquito isolates from routine collections) * Two confirmed WNV positive birds in a community or focal area And No horse or human WNV cases	Response as in category 2, plus: 1. Outreach and public health educational efforts are intensified including media alerts as needed. 2. If not already in progress, standard, locally established adult mosquito control efforts including targeted ground adulticiding operations should be considered against *Culex* mosquitoes and other potential vectors, as appropriate. The decision to use ground-based adult mosquito control will depend on critical modifying variables including the time of year, mosquito population abundance and proximity of virus activity to at-risk populations. 3. Duly authorized local officials may request that DPH Commissioner issue a certification that pesticide application is necessary to protect public health in order to preempt homeowner private property no-spray requests. 4. Supplemental mosquito trapping and testing may be performed in areas with positive WNV findings. 5. Local boards of health are contacted via phone or HHAN (Health and Homeland Alert Network) upon confirmation of WNV in any specimen. Advise health care facilities of increased risk status and corresponding needs to send specimens to SLI for testing.

4	High	Current Year Sustained or increasing WNV activity in mosquitoes with mosquito isolates ≥ 15 from routine collections in a community or focal area. Sustained elevated minimum infection rates for MDPH WNV trap sites And/or MDPH confirmation of WNV in a horse at any time And/or, MDPH confirmation of WNV in a human at any time	Response as in category 3, plus: 1. Intensify public education on personal protection measures including avoiding outdoor activity during peak mosquito hours, wearing appropriate clothing, using repellents and source reduction. a. Utilize multimedia messages including public health alerts from MDPH, press releases from local boards of health, local newspaper articles, cable channel interviews, etc. b. Encourage local boards of health to actively seek out high-risk populations in their communities (nursing homes, schools, etc.) and educate them on personal protection d. Advisory information on pesticides provided by MDPH Center for Environmental Health. e. Urge towns and schools to consider rescheduling outdoor events. 2. Intensify and expand active surveillance for human cases. 3. Intensify larviciding and/or adulticiding control measures where surveillance indicates human risk. Local, ground- based ULV applications of adulticide may be repeated as necessary to achieve adequate mosquito control. Town or city may request preemption of homeowner private property no-spray requests. 4. Local officials should evaluate all quantitative indicators including population density and time of year and may proceed with focal area aerial adulticiding. 5. Duly authorized local officials may request that the DPH Commissioner issue a certification that pesticide application is necessary to protect public health in order to preempt homeowner private property no-spray requests. 6. MDPH will confer with local health officials, SRMCB and Mosquito Control Projects to determine if the risk of disease transmission threatens to cause multiple human cases and warrants classification as level 5.
5	Critical	Current Year More than 1 confirmed human case in a community or focal area Or More than 1 confirmed horse case in a community or focal area Multiple quantitative measures indicating critical risk of human infection (e.g. early season positive surveillance indicators, and sustained elevated field mosquito infection rates, and horse or mammal cases indicating escalating epizootic activity)	Response as in category 4, plus: 1. Continued highly intensified public outreach messages on personal protective measures. Frequent media updates and intensified community level education an outreach efforts. 2. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine if measures need to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide. Factors to be considered in making this decision

			include the cyclical, seasonal and biological conditions needed to present a continuing high risk of WNV human disease. Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by making recommendations on: A. Appropriate pesticide B. Extent, route and means of treatment C. Targeted treatment areas 3. MDPH Center for Environmental Health (CEH) will initiate active surveillance via emergency departments and with health care provides only if aerial spraying commences. 4. MDPH will designate high-risk areas where it has issued a certification that pesticide application is necessary to protect public health in order to preempt homeowner private property no-spray requests. If this becomes necessary, notification will be given to the public. 5. MDPH recommends restriction of group outdoor activities, during peak mosquito activity hours, in areas of intensive virus activity. 6. MDPH will communicate with health care providers in the affected area regarding surveillance findings and encourage prompt sample submission from all clinically suspect cases.

Table 2. Guidelines for Phased Response to EEE virus Surveillance Data

Risk Category	Probability of human outbreak	Definition of Risk Category for a Focal Area[3]	*Recommended Response*
1	Remote	All of the following conditions must be met: Prior Year No EEE virus activity detected in a community or focal area And Current Year Sporadic EEE virus activity in mosquitoes after August 1. Virus activity is considered to be sporadic when 1-2 isolates in *Cs. melanura* are found within 1-2 weeks of routine collections. And No animal or human EEE cases.	1. MDPH staff provides educational materials and clinical specimen submission protocols to targeted groups involved in Arbovirus surveillance, including, but not limited to, local boards of health, physicians, veterinarians, animal control officers, and stable owners. 2. Educational efforts directed to the general public on personal prevention steps and source reduction, particularly to those populations at higher risk for severe disease (e.g., the elderly). 3. Routine collection and testing of mosquitoes. 4. Assess mosquito populations, monitor larval and adult mosquito density. 5. Initiate source reduction; use larvicides at specific sites identified by entomologic survey and targeted at the likely amplifying bridge vector species. In making a decision to use larvicide consider the prevalence of Culiseta and bridge vector larvae, intensity of prior virus activity, and weather. 6. Locally established, standard, adult mosquito control activities are implemented. No specific supplemental control efforts are recommended. 7. Passive human and horse surveillance. 8. Emphasize the need for schools to comply with MA requirements for filing outdoor IPM plans.

[3] Focal Area- May incorporate multiple communities, towns or cities. Factors considered in the determination of human risk in a focal area include: mosquito habitat, prior isolations, human population densities, timing of current isolations of virus in mosquitoes, and the cyclical nature of human EEE outbreaks, current weather and seasonal conditions needed to present risk of human disease.

2	Low	Prior Year EEE virus activity in mosquitoes in the prior year in the focal area Or Current Year Sporadic EEE Cs. melanura mosquito activity in the community or focal area between July 1-July31. Virus activity is considered to be sporadic when 1-2 isolates in *Cs. melanura* are found within 1-2 weeks of routine collections And No animal or human cases.	Response as in category 1, plus: 1. Expand community outreach and public education programs, particularly among high-risk populations, focused on risk potential and personal protection, emphasizing source reduction. 2. Increase larval control and source reduction measures. 3. Locally established standard adult mosquito control activities continue 4. Public health alert sent out by MDPH in response to first EEE mosquito isolate detected during the season. The alert will summarize current surveillance information and emphasize personal prevention strategies.
3	Moderate	**Prior Year** **Confirmation of one human EEE case in the community or focal area; or 1 or more EEE horse case(s); or sustained EEE virus activity in mosquitoes. Sustained activity' is defined as 2 or more positive isolations found for 2 or more weeks.** Or Current year No animal or human EEE cases in current year And Total EEEV isolates in *Cs. melanura* found after July 1 as a result of routine collections are between 10-15 in the community or focal area Or A single EEEV isolate from mosquitoes likely to bite humans (bridge vector species) Or A single EEEV isolate in mosquitoes of any species, prior to July 1.	Response as in category 2, plus: 1. Outreach and public health educational efforts are intensified including media alerts as needed. 2. If not already in progress, standard, locally established adult mosquito control efforts including targeted ground adulticiding operations should be considered. The decision to use ground-based adult mosquito control will depend on critical modifying variables including the time of year, mosquito population abundance and proximity of virus activity to at-risk populations. 3. Duly authorized local officials may request that the DPH Commissioner issue a certification that pesticide application is necessary to protect public health in order to preempt homeowner private property no-spray requests. 4. Supplemental mosquito trapping and testing in areas with positive EEEV findings. Notify all boards of health of positive findings. 5. Public health alert sent out by MDPH in response to first pool of EEE virus positive mammal-biting mosquitoes detected during the season. The alert will summarize current surveillance information and emphasize personal prevention strategies. 6. HHAN (Health and Homeland Alert Network) alerts or phone calls are provided to local boards of health upon confirmation of EEE virus in any specimen; advise health care facilities of increased risk status and corresponding needs to send specimens to SLI for testing.
4	High	Current Year Total EEEV mosquito isolates numbering more than 15 from routine collections with sustained or increasing activity in the community or focal	Response as in category 3, plus: 1. Intensify public education on personal protection measures including avoiding outdoor activity during peak mosquito hours, wearing appropriate clothing,

		area. Sustained elevated weekly mosquito minimum infection rates. Virus activity is considered to be sustained when isolates are found for 2 or more consecutive weeks. And/or Isolation of EEEV in more than 1 pool of bridge vector mosquitoes And/or Confirmation of EEE in an animal at any time And/or Confirmation of EEE in a human at any time	using repellents and source reduction. a. Utilize multimedia messages including public health alerts from MDPH, press releases from local boards of health, local newspaper articles, cable channel interviews, etc. b. Encourage local boards of health to actively seek out high-risk populations in their communities (nursing homes, schools, workers employed in outdoor occupations, etc.) and educate them on personal protection d. Advisory information on pesticides provided by MDPH Center for Environmental Health. e. Urge towns and schools to consider rescheduling outdoor events. 2. Intensify larviciding and/or adulticiding control measures where surveillance indicates human risk. Local, ground- based ULV applications of adulticide may be repeated as necessary to achieve adequate mosquito control. Town or city may request preemption of homeowner private property no-spray requests. 3. Active surveillance for human cases is intensified. Health care facilities are advised of increased risk status and corresponding needs to send specimens to SLI for testing. 4. Local officials should evaluate all quantitative indicators including population density and time of year and may proceed with focal area aerial adulticiding. 5. Duly authorized local officials may request that the DPH Commissioner issue a certification that pesticide application is necessary to protect public health in order to preempt homeowner private property no-spray requests. **6. MDPH will confer with local health officials, SRMCB and Mosquito Control Projects to determine if the risk of disease transmission threatens to cause multiple human cases and warrants classification as level 5.**
5	Critical	<u>Current Year</u> More than 1 confirmed human EEE case Or Multiple EEE animal cases Or Multiple quantitative measures indicating critical risk of human infection (e.g. early season positive surveillance indicators, and sustained high mosquito infection rates, and horse or mammal case indicating escalating epizootic activity)	Response as in category 4, plus: 1. Continued highly intensified public outreach messages on personal protective measures. Frequent media updates and intensified community level education an outreach efforts. 2. The MDPH Arbovirus Program will determine human risk levels as outlined in this plan. If risk of outbreak is widespread and covers multiple jurisdictions, MDPH will confer with local health agencies, SRMCB and Mosquito Control Projects to discuss the use of intensive mosquito control methods and determine the measures needed to be taken by the agencies to allow for and assure that the most appropriate mosquito control interventions are applied to reduce risk of human infection. These interventions may include state-funded aerial application of mosquito adulticide.

			Factors to be considered in making this decision include the cyclical, seasonal and biological conditions needed to present a continuing high risk of EEE human disease. Once critical human risk has been identified, the SRMCB will determine the adulticide activities that should be implemented in response to identified risk by making recommendations on: A. Appropriate pesticide B. Extent, route and means of treatment C. Targeted treatment areas 3. MDPH Center for Environmental Health (CEH) will initiate active surveillance via emergency departments and with health care provides only if aerial spraying commences. 4. MDPH will designate high-risk areas where individual no spray requests may be preempted by local and state officials based on this risk level. If this becomes necessary, notification will be given to the public. 5. MDPH recommends restriction of group outdoor activities, during peak mosquito activity hours, in areas of intensive virus activity. 6. MDPH will communicate with health care providers in the affected area regarding surveillance findings and encourage prompt sample submission from all clinically suspect cases.

Appendix 1: Mosquitoes Associated with Arboviral Activity in Massachusetts

Aedes vexans – Is a common nuisance mosquito. Temporary flooded areas such as woodland pools and natural depressions are the preferred larval habitat of this mosquito. It feeds on mammals and is a fierce human biter. This species is typically collected from May to October. *Ae vexans* is an epizootic vector of Eastern Equine Encephalitis (EEE) Virus.

Coquillettidia perturbans - Cattail marshes are the primary larval habitat of this mosquito. It feeds on both birds and mammals. It is a persistent human biter and one of the most common mosquitoes in Massachusetts. This species is typically collected from June to September. *Cq perturbans* is an epizootic vector of EEE Virus.

Culex pipiens – Artificial containers are the preferred larval habitat of this mosquito. It feeds mainly on birds and occasionally on mammals. It will bite humans, typically from dusk into the evening. This species is regularly collected from May to October but can be found year round as it readily overwinters in man-made structures. *Cx pipiens* has been implicated as a vector of West Nile Virus (WNV).

Culex restuans – Natural and artificial containers are the preferred larval habitat of this mosquito. It feeds almost primarily on birds but has been known to bite humans on occasion. This species is typically collected from May to October but can be found year round as it readily overwinters in man-made structures. *Cx restuans* has been implicated as a vector of WNV.

Culex salinarius – Brackish and freshwater wetlands are the preferred habitat of this mosquito. It feeds on birds, mammals, and amphibians and is well known for biting humans. This species is typically collected from May to October but can be found year round as it readily overwinters in natural and man-made structures. *Cx salinarius* may be involved in the transmission of both WNV and EEE virus.

Culiseta melanura –White Cedar and Red Maple swamps are the preferred larval habitat of this mosquito. It feeds almost exclusively on birds. This species is typically collected from May to October. *Cs melanura* is the primary enzootic vector of EEE virus.

Ochlerotatus canadensis – Shaded woodland pools are the preferred larval habitat of this mosquito. It feeds mainly on birds and mammals but is also known to take blood meals from amphibians and reptiles. This mosquito can be a fierce human biter near it larval habitat. This species is typically collected from May to October. *Oc canadensis* is an epizootic vector of EEE virus.

Ochlerotatus japonicus – Natural and artificial containers such as tires, catch basins, and rock pools are the preferred larval habitat of this mosquito. It feeds mainly on mammals and is a fierce human biter. This species is typically collected from May to October. *Oc japonicus* may be involved in the transmission of both WNV and EEE virus.

Figure 1: Location of MDPH EEE virus Mosquito Trap Sites