



Tuscarawas County Health Department  
Mosquito Control Program

# GENERAL FIELD MANUAL

## Table of Contents

### I. PROGRAM POLICIES & PROCEDURES

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TCHD Program Personnel Policy .....	1
Public Relations .....	4
Mosquito Truck Inventory List .....	6
Map of Tuscarawas County .....	7

### II. SAFETY, FIRST AID, INCIDENT/ACCIDENT PROCEDURES

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TCHD Safety Rules .....	9
TCHD Medical Emergencies & First Aid Procedures .....	9
Procedures for Respirator Use .....	10
<i>Certificate of Automotive Liability Coverage Card (SAMPLE)</i> .....	13

### III. CONTROL MEASURES & SPECIES ECOLOGY

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TCHD Mosquito Control Program .....	14
Methods of Control .....	16
Mosquito Life Cycle .....	17
Comparison of Life History Characteristics .....	19
Mosquito-Borne Disease .....	20
Mosquito Facts .....	23
Common Mosquito Species of Tuscarawas Co. ....	24

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# I. PROGRAM POLICIES & PROCEDURES

## TCHD PROGRAM PERSONNEL POLICY

### 1. Work Schedule:

Surveillance: Noon - 4:00 p.m., Monday

8:00 a.m.- 4:00 p.m., Tuesday- Thursday

8:00 a.m. – Noon, Friday

Larviciding: 28 Hours as needed

Adulticiding: 8:30 p.m. - 1:00 a.m., Monday - Thursday nights (as scheduled)

- All employees are expected to report promptly by starting time.
- Each work week constitutes up to 29 hours of pay.
- No overtime without prior approval.

### 2. Lunch:

- 12:00 p.m. – 1:00 p.m.
- All employees will take the necessary time to eat lunch.
- Never leave truck unattended or out of sight during lunch.
- Employees must supply their own drinking water container for field use.

### 3. Holidays:

- Employees will not be compensated for the three holidays observed during the season:
  - Memorial Day
  - Fourth of July
  - Labor Day

### 4. Vacation Requests:

- Employees are permitted to request up to one week of time off for vacation if necessary.
- Vacation requests must be submitted ASAP, or at the beginning of the season.
- Employees will not be compensated for requested time off, unless earned time off is utilized.

### 5. Sick Leave:

- Notify supervisor in advance if you are unable to report for work due to an illness, doctor appointment, or other health-related issue.
- Employees are not compensated for sick time.

**6. Weather Conditions:**

- When weather conditions (such as heavy rain) interfere with field work, the employee will be paid only for the hours actually worked that day.

**7. Pay Periods:**

Biweekly on Thursday

**8. Trucks:**

- Seat belts are to be worn at all times.
- Vehicle speed is not to exceed posted speed limits at any time.
- Daytime crew members are responsible for ensuring their truck & ULV have been filled for the nighttime crew before leaving for the day.
- Vehicles must be kept clean, orderly, and free of garbage or clutter at all times. ALL employees are responsible for removing trash and cleaning up spills at the end of their shift.
- Leave keys in desk drawer at the end of the day
- Employee is responsible for inspecting truck for damage prior to each use; immediately report any damages to the supervisor.
- Employees must notify the supervisor the SAME DAY a moving traffic citation is received.
- Employees must notify the supervisor immediately of accidents causing physical injury/vehicle or damage.
- At NO time should anyone other than a county employee be in the truck.

**9. Gas Cards:**

- TCHD currently utilizes two types of fuel cards – AgLand and Speedy fleet cards. It is the preference of the administration that AgLand be used above Speedy fleet cards.
- Trucks & ULVs take unleaded fuel (the minimum octane available).
- If filling both the truck & ULV, always fill the truck FIRST.
- When filling a ULV, keep the gas nozzle in contact with the rim of the fuel tank AT ALL TIMES.
- Employees MUST obtain a receipt from all truck & ULV fuel purchases. Each receipt must include the employee's name and initials.
- Receipts are to be turned in at the end of EACH day. It is the employee's responsibility to ensure receipts are not missing or lost.
- Employees MUST sign off on the credit card use policy statement.

## 10. Clothing Requirements:

- The following items are required to be worn daily:
  - Plain colored T-Shirt (both short and long sleeve are acceptable, dependent on tasks)
  - Waterproof/Rubberized Boots (supplied by the employee)
  - Fluorescent vests for visibility in the field
  - TCHD branded apparel is allowable
  - Long Pants-jeans are best
- Also recommended: hat, sunglasses, raincoat or poncho.
- NO open-toed shoes or sandals are to be worn at any time.
- Clothing contaminated with insecticide must be changed immediately.
- An extra set of clothing must be kept in the truck AT ALL TIMES.
- Clothing must be kept clean & maintain a professional appearance at all times.

## 11. Media & Information Release Policy:

- Under no circumstances should staff initiate media contact without prior knowledge and approval of the supervisor.
- Media inquiries for information are to be referred to the supervisor.
- No information, with the exception of educational materials, is to be released without prior approval of the supervisor.

## 12. Miscellaneous:

- THE PUBLIC IS ALWAYS #1!
- Employees are expected to act in a professional manner at all times.
- Employees are expected to keep all records neat and up-to-date.
- Employees are expected to turn in books, receipts, and any completed forms (Requests for Service, Pesticide Application Records, etc.) at the end of EVERY day.
- Employees are expected to keep all work areas/trucks clean and orderly.
- All employee personal vehicles are to be parked in the designated parking area.
- Personal phone calls and texting are to be kept at a minimum during working hours.

## 13. Dismissal:

- Failure to comply with any procedure will result in a written warning which will be placed in the employee's permanent file. Depending on the severity of the infraction, the warnings may constitute grounds for dismissal, or failure to rehire in subsequent years.
- Additional Grounds for Dismissal:
  - Destruction of departmental property
  - Theft of departmental or public property
  - Alcohol or drug use during work hours
  - Any other offenses outline in TCHD policy manual

# PUBLIC RELATIONS

Public relations are the methods and actions used by individuals and organizations to increase effective communication and constructive partnerships with the public. Such a relationship requires technical competence, a professional appearance and attitude, and the ability and drive to identify and resolve problems quickly. To a mosquito control program, the cooperation of the public is essential for success.

Miscommunication often occurs when residents misunderstand or have incomplete or inaccurate information. To help resolve this problem, all mosquito personnel need to be able to communicate effectively with residents and help increase public education.

## **GENERAL GUIDELINES FOR DEALING WITH THE PUBLIC:**

- Acquire technical competence of control & surveillance methods, equipment, rules/regulations governing control activities, IPM philosophy, & the community.
- Take the initiative to communicate with residents. Show that you care by taking the time to listen and ask questions. Immediately investigate & attempt to resolve problems if able.
- Answer questions only if you know the answer. If unsure, be honest and say so. Contact the supervisor or have them contact the supervisor (whichever is appropriate) for an answer.
- Commit to excellence in all pesticide applications and surveillance operations. Strive to make a positive impression in every interaction. See that decisions are made competently and with sensitivity to both the environment and public health safety.
- Be willing to go the extra mile to create a positive experience, but only within reason. Never promise something you are not POSITIVE you can deliver. If unsure, ask supervisor first.
- Keep detailed records. Follow up on any past issues or concerns.
- Use terminology the public can understand. Use words such as “reduced risk” or “less toxic”.
- Explain WHAT needs done and WHY (i.e. choice of larvicide, how it is used, anticipated results). Be factual; do not exaggerate expected results.
- Inform homeowners of any post-application instructions (i.e. REI, water solubility).

*Sources: “National Pesticide Applicator Certification Core Manual”, National Association of State Departments of Agriculture Research Foundation; “Public-Health Pesticide Applicator Training Manual”, University of Florida & AMCA.*

## MOSQUITO CONTROL DAILY ACTIVITY LEGEND

1. DOVER
3. UHRICHSVILLE
4. BOLIVAR
11. WAYNE
12. FRANKLIN
13. LAWRENCE
14. SANDY
15. SUGARCREEK
16. DOVER
17. FAIRFIELD
18. WARREN
19. AUBURN
20. YORK
21. GOSHEN
22. UNION
23. BUCKS
24. JEFFERSON
25. WARWICK
26. MILL
27. SALEM
28. CLAY
29. RUSH
30. OXFORD
31. WASHINGTON
32. PERRY
41. BALTIC
44. DENNISON
45. DUNDEE
46. GNADENHUTTEN
47. MIDVALE
48. MINERAL CITY
49. NEWCOMERSTOWN
50. PARRAL
51. PORT WASHINGTON
52. ROSWELL
56. STONECREEK
57. STRASBURG
58. SUGARCREEK (VILLAGE OF)
59. TUSCARAWAS (VILLAGE OF)
60. ZOAR
99. OUT OF COUNTY

# MOSQUITO TRUCK INVENTORY LIST

## 1) GLOVE COMPARTMENT:

### ⊙ First-Aid Kit:

- Band-Aids
- Sterile & Antiseptic Wipes
- Gauze Pads/Sponges
- Waterproof Tape
- Sunscreen Wipes

### ⊙ Instant Soap & Water

### ⊙ Safety Glasses

### ⊙ Dust Mask

### ⊙ Flashlight

### ⊙ Tuscarawas County Map

### ⊙ Vehicle Envelope:

- Gas Card Instructions
- Certificate of Auto Liability
- Drug Test Collection Kit
- TCHD Vehicle Policy
- Injury Reporting Instructions
- TCHD Incident Report Form
- Tuscarawas Co. Injury/Illness Report Form

## 3) MISCELLANEOUS:

### ⊙ Pen(s)

### ⊙ Red Grease Pencil

### ⊙ Gas Card

### ⊙ Dog Repellent

### ⊙ Ear Protectors

### ⊙ Latex Gloves (box)

### ⊙ No-Spray List (current)

### ⊙ Door Hangers

## 2) BEHIND SEAT:

### ⊙ Larva Sample Box:

- Sample Jars
- Baster
- Eye Wash
- Rag

### ⊙ Toolbox:

- Phillips Screwdriver
- Standard Screwdriver
- Pliers
- Trash Bags
- Safety Vest

### ⊙ Kitty Litter

### ⊙ Broom & Dustpan

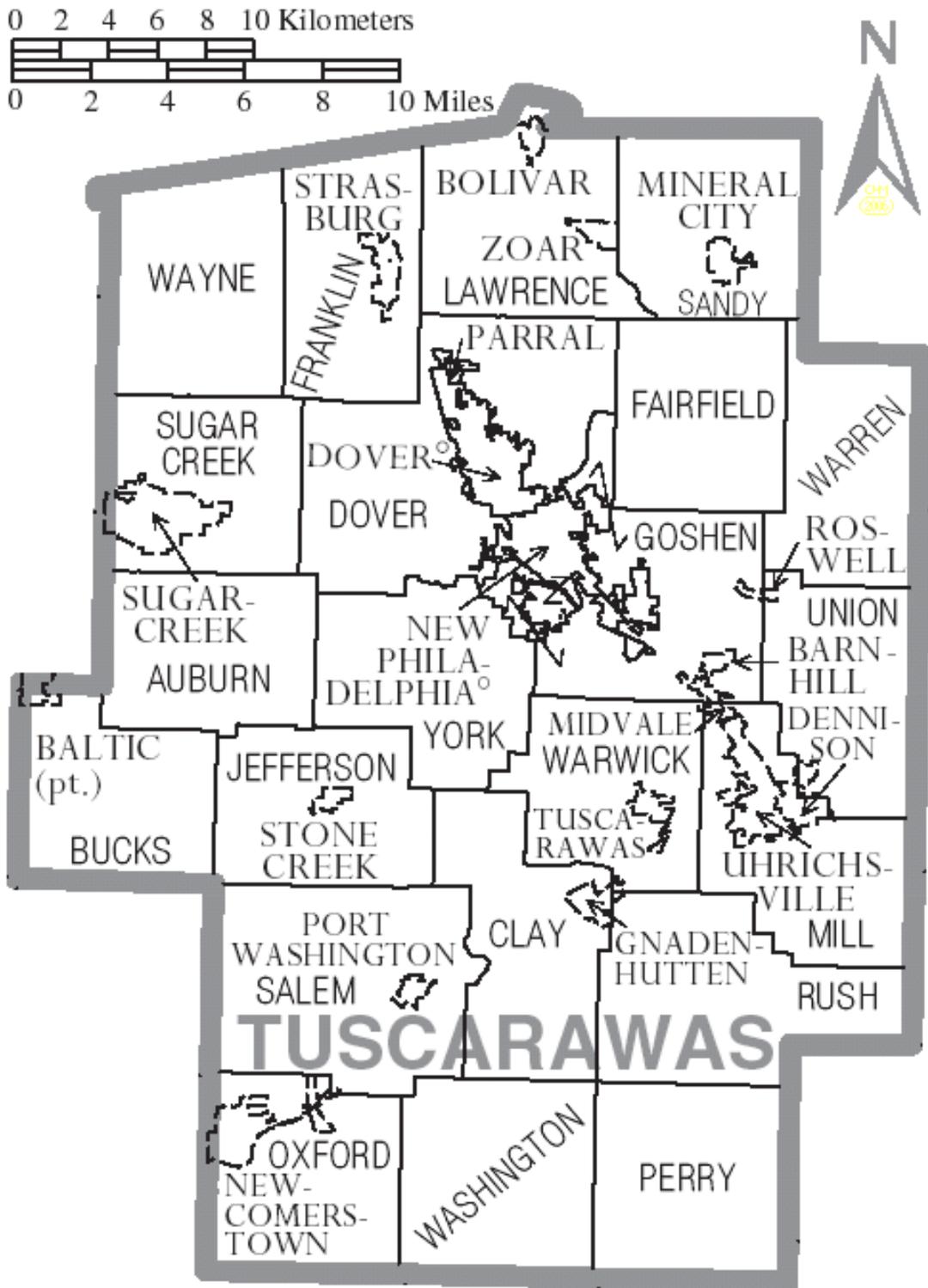
### ⊙ Fire Extinguisher

### ⊙ Summit County Map Book

### ⊙ MSDS Folder (current)

**\* PLEASE CONTACT SUPERVISOR WITH QUESTIONS OR IF ANY OF THESE ITEMS ARE MISSING.**

# MAP OF TUSCARAWAS COUNTY



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## II. SAFETY, FIRST AID, INCIDENT/ACCIDENT PROCEDURES

### TCHD SAFETY RULES

#### Field Safety:

- Wear rubber gloves, goggles, and dust masks when needed to prevent contact with spray or dust.
- Check sprayers daily to make certain that hose connections are tight and valves do not leak. Report any leaks to maintenance and the supervisor.
- Caution should be used in the application of pesticides which are hazardous to honeybees or other pollinating insects.
- Use caution to avoid directly spraying any field containing a crop (including homeowner gardens), plants in flower, or water which contains non-target aquatic life.
- Report any suspected overspray to people, pets, or property resulting from applications to the supervisor as soon as possible.
- Report the loss or disappearance of any insecticides or equipment to the supervisor.
- Take your time when driving to new locations or when on unfamiliar roads.
- Do not park truck along roadway whenever possible.
- Turn truck beacon light on when driving slowly (as when ditching), when truck is parked at an application site, or any time when added visibility is needed.

#### Mixing & Spraying Pesticides:

- Read labels and MSDS before working with any chemical.
- Protective glasses/goggles, gloves, and dust masks must be worn when handling concentrated chemicals.
- Avoid eye contact, skin contact, or inhalation of any insecticide spray or dust.
- Wash hands (especially the back of hands) after handling concentrates.
- Wash skin immediately if it becomes contaminated.
- Remove clothing immediately if it becomes contaminated.

- Always work in a well-ventilated area to avoid inhalation of fumes.
- Pesticide containers must be properly labeled at all times.
- Empty pesticide containers must be disposed of per label requirements. Check with the coordinator/supervisor before disposing of any pesticide containers.

## **TCHD MEDICAL EMERGENCIES & FIRST AID PROCEDURES**

**Purpose:** To provide appropriate guidelines for safety incidents and to comply with the Occupational Health and Safety Act Standards.

**Policy:**

- Staff will respond appropriately to medical emergencies and injuries.
- It is expected that staff will use first aid measures appropriate to their level of training, and that they will prioritize interventions according to their assessment of immediate situational needs.

**Procedure:**

***MEDICAL EMERGENCY:***

1. Call 9-1-1 immediately.
2. If further harm is imminent, move the victim to a safer location. Keep the victim comfortable and calm until emergency services arrive. If necessary, administer CPR, apply pressure to severe cuts, etc. The Medical Director may be contacted for assistance.

a. **Incidents Involving an Employee:**

- i. Employee's immediate supervisor must notify the emergency contact person designated in personnel record, as well as the TCHD Health Commissioner (The Health Commissioner is accessible by cell phone, which is listed on the 27/7 Call Down List.)
- ii. An incident/accident report should be completed as soon as possible while details are fresh and accurate. The report is given to the employee's supervisor for review.
- iii. A Tuscarawas County Health Department Accident Report should be completed within 24 hours in cases of physical injury. A Bureau of Workers' Compensation Report should also be completed within 24 hours, if appropriate. The Health Commissioner may be contacted for assistance.

b. **Incidents Involving a Visitor/Client:**

- i. Ask visitor/client if they wish a family member/friend to be notified the emergency.

- ii. An incident/accident report should be completed as soon as possible while details are fresh and accurate. The Health Commissioner must be notified as soon as possible.

***FIRST AID:***

1. Retrieve first aid kit from one of the following areas:
  - ⊙ Mosquito Control Building
  - ⊙ Mosquito Truck
2. If necessary, request assistance from nursing supervisor/personnel.
3. Administer first aid treatment appropriate to level of training.
4. An incident/accident report should be completed as soon as possible while details are fresh and accurate. The report is given to the employee's supervisor for review. The Health Commissioner must be notified as soon as possible.
5. A Tuscarawas County Health Department accident report should be completed within 24 hours in cases of physical injury. A Bureau of Workers' Compensation Report should also be completed within 24 hours, if appropriate. The Health Commissioner may be contacted for assistance.
6. Be sure to note the supplies removed from the first aid kit so it can be properly restocked. Return first aid kit to its original location.

## **PROCEDURES FOR RESPIRATOR USE**

**Purpose:** To establish and define the procedure for an effective respiratory program to protect employees from respiratory exposure to pesticides.

**General:**

The OSHA General Industry Standard for respiratory protection 29 CFR 1910.134 requires that a respiratory protection program be established by an employer. The following procedures are based on the 11 Commandments as established by the Occupational Health and Safety Administration.

**Guidelines:**

- The guidelines in this program are designed to help reduce employee exposures to occupational dusts, mists, gases, and vapors.
- The primary objective is to prevent excessive exposure to such contaminants.

- Where feasible, exposure to contaminants will be eliminated by engineering controls (i.e. general/local ventilation, enclosure/isolation, substitution of a less hazardous process/material).
- When effective engineering controls are not feasible, use of personal respiratory protection equipment may be required to achieve this goal.

### **Responsibilities:**

It is the Program Coordinator's responsibility to determine what specific applications require use of respiratory equipment. Management must also provide proper respiratory equipment to meet the needs of each specific application. Employees must be provided with adequate training and instructions for all equipment.

The Program Coordinator is responsible for insuring that all personnel under their control are completely knowledgeable of the respiratory protection requirements for the duties which they perform and areas in which they work. The Coordinator is also responsible for insuring that the subordinates comply with all aspects of the respiratory program.

It is the employee's responsibility to have an awareness of the respiratory protection program requirements, as explained by management. Employees are also responsible for wearing the appropriate respiratory equipment according to proper instructions and for maintaining the equipment in a clean and operable condition.

### **Administration:**

The Program Coordinator is responsible for overall program administration. This includes selection, issuance, training, and fit testing of all respirators used. This includes maintenance of all the necessary documentation for verification and recordkeeping purposes.

The Medical Director is responsible for determining that employees are physically capable of using the respirators.

### **Respirators:**

The Program Coordinator shall assign the appropriate respirators to authorized personnel prior to the work assignment. Approved respirators shall be worn during pesticide applications whenever the product label recommends doing so. Each employee is responsible for knowing and understanding the product labeling prior to the use of any pesticide.

### **Employee Training:**

Each employee authorized to carry out tasks that may warrant the use of a respirator shall participate in a respirator training program during the first week of employment. The training will include:

1. Purpose of respiratory protection

2. Types of protection available and the limitations of each
3. How to properly put on the equipment and check the fit
4. How to properly clean, inspect, and store the equipment
5. Discussion of Tuscarawas County Health District's respiratory protection plan

### **Employee Fit Testing:**

Employees required to wear a respirator must be fitted properly and tested for a face seal prior to use of the respirator. Those with facial hair stubble, mustaches, sideburns, beards, low hairlines, or bangs which pass between the face and the sealing surface of the face piece of the respirator will not be fit tested. Manufacturers provide fitting instructions and limitations of use on the product packaging.

### **Medical Evaluation:**

Employees will be interviewed to evaluate their medical status as it relates to respiratory protection, and to ensure that they are physically able to perform the work while wearing a respirator. Based on their responses in the interview and the SCHD Health History Questionnaire a physical examination may be required prior to being granted approval to use a respirator and being assigned tasks which would necessitate the use of a respirator.

The medical status of all employees who use respiratory protection will be reviewed on an annual basis in the beginning of the season.

### **Respirator Inspection & Maintenance:**

The following points should be considered for respirator inspection and maintenance:

1. The wearer of a respirator will inspect it daily whenever it is in use.
2. The Coordinator will periodically spot-check respirators for usage and condition.
3. Respirators not discarded after one-shift use will be cleaned on a daily basis by the assigned employee whenever in use, in accordance with the manufacturer's instructions.
4. Respirators not discarded after one-shift use will be stored in a suitable container away from areas of potential contamination.
5. Whenever feasible, respirators not discarded after one-shift use will be marked or stored in such a manner as to ensure that they are worn only by the assigned employee.
6. If use by more than one employee is required, the respirator will be cleaned between uses.



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### III. CONTROL MEASURES & SPECIES ECOLOGY

#### TCHD MOSQUITO CONTROL PROGRAM

##### PROGRAM GOALS:

- Reduce the number of disease-carrying and pest mosquitoes in a cost-effective, environmentally-responsible manner.
- Educate the public on practices which will reduce the number of breeding sites and methods of reducing mosquito feeding activity.
- Monitor mosquito populations in Tuscarawas County for mosquito-borne diseases and to determine population levels of pest species.

##### PROGRAM PHILOSOPHY:

TCHD's Mosquito Control Program is based on a philosophy known as integrated pest management (IPM), which emphasizes the balanced use of cultural, biological, and chemical practices which are environmentally compatible and economically feasible in reducing pest and/or disease-carrying mosquito populations.

The program uses a combination of control strategies, including surveillance, source reduction, larviciding, adulticiding (when necessary), biological control, and education. Surveillance forms the foundation for all subsequent control activities.

##### METHODS OF CONTROL:

- **Physical Control** - involves practices which prevent water from standing long enough to produce larvae (more than 4 days). Source reduction (the elimination, removal, or reduction of larval mosquito habitats), is typically the most economical and effective of control methods.
- **Biological Control** - utilizing natural predators of mosquito immatures or adults such as certain species of fish, bats, birds, or dragonflies. This type of control is usually resource-intensive and not practical for many programs.
- **Chemical Control** - applying larvicides and/or adulticides to reduce immature or adult population levels. These chemicals are targeted to control mosquitoes in various stages of development. Of these, larviciding is the most effective method; adulticiding is the

least effective and is used only when nuisance threshold values have been exceeded or when mosquito-borne disease is found.

## **PROGRAM COMPONENTS:**

1. Education & Information
2. Surveillance Program
3. Larviciding Program
4. Adulticiding Program

### **1. Mosquito Education & Information:**

Provide information to the public in regards to mosquito ecology, vector-borne diseases, methods to reduce breeding sites, and control methods utilized by TCHD.

### **2. Surveillance:**

- Trap adult mosquitoes using gravid, and BG Sentinel traps designed to attract specific species at specific life stages.
- Collect and ship adult specimens to the Ohio Department of Health (ODH) Laboratory for mosquito-borne encephalitis testing.
- Identify locations where mosquito populations are building, so targeted control measures can be implemented before a problem exists.
- Provide information on location, population levels, and identification of disease-carrying and pest species.
- Monitor larvae population levels and locations through breeding site sampling.

### **3. Larviciding:**

- Treat breeding sites as necessary using a variety of biological and/or chemical insecticides.
- Reduce mosquito breeding sites using source reduction practices whenever possible.
- Identify new larviciding sites, sites no longer needed, and potential adult surveillance sites.
- Respond to resident questions and requests for service.

#### **4. Adulticiding:**

- Perform evening treatments of residential areas using truck-mounted ultra-low-volume (ULV) mist sprayers.
- Apply residual barrier treatments to targeted areas of vegetation.

#### **FACTORS USED IN DETERMINING ADULTICIDING TREATMENTS:**

- High or sudden jumps in trap numbers in an area
- Positive disease pool
- Numerous resident complaints in an area
- Presence of ideal environmental breeding conditions (i.e. flooding)

#### **METHODS OF CONTROL**

There have been a number of natural and man-made mosquito repellents, attractants, and predators touted as effective against mosquitoes. In truth, they are inefficient and cannot be used to effectively control mosquitoes. Examples of methods with little value include citronella products, natural predators such as bats and purple martins, and ultraviolet or sonic devices.

#### **Prevention:**

Since most species which transmit encephalitis have limited flight ranges, the risk of contracting encephalitis can be minimized by controlling the breeding sites which are in close proximity to a home. Water management, to prevent mosquito breeding, is essential for control; eggs cannot hatch unless they are in water. Routinely emptying or removing old tires, buckets, tires, glass jars, broken toys, or other containers that hold water is the easiest and single most effective method for reducing breeding sites.

#### **Repellents:**

When applied to skin and clothing, repellents will prevent mosquito bites for 1-5 hours, depending on the person, mosquito numbers and identity, and the type and percentage of active ingredient in the repellent. Repellents are available as aerosol sprays, pump sprays, cream sticks, lotions, and foams.

Deet (N, N-Diethyl-m-toluamide) is a very effective and widely used repellent; however, it should not be used indiscriminately as severe allergies can develop. Formulations containing high concentrations of Deet (50% or more) should not be used on children. Formulations containing 5-10% Deet are as equally effective as those containing 90% or more but will not last as long.

#### **Outdoor Control (Adulticides):**

Space sprays or aerosol foggers which contain pyrethrins will give rapid knockdown of adult mosquitoes; however, these are only temporary treatments with little residual

effect. Residual sprays (or barrier treatments) applied to tall grasses, weeds, shrubs, or trees 1-2 days before use of an area, is more effective. Water solutions or emulsions should be used instead of oil-based formulations to prevent injury to plants. Some insecticides registered for residual mosquito control include carbaryl (Sevin), chlorpyrifos (Dursban), and malathion. A number of different formulations are available; specific label directions should be followed when applying.

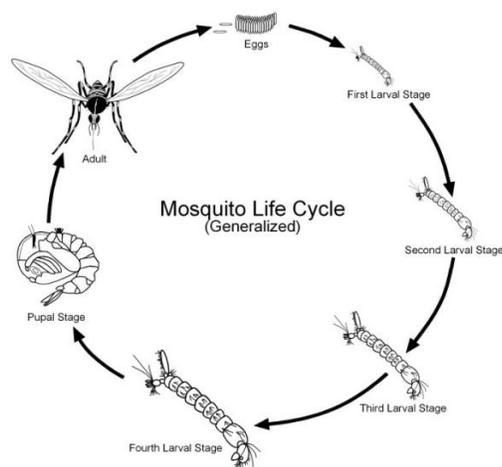
**NOTE:** Malathion and carbaryl are **extremely toxic to honey bees**, and should never be applied to plants in bloom. Bee losses are minimized by spraying late in the afternoon after bees have returned to the hive or when temperatures are below 45°F. Malathion is highly toxic to fish.

### **Outdoor Control (Larvicides):**

Homeowners may apply Mosquito Dunks, widely available in many home improvement stores, to kill mosquito larvae in the water. These dunks utilize *Bacillus thuringiensis* subspecies *israelensis* (Bti), a naturally-occurring bacteria, which is biodegradable and harmless to other living things.

Methoprene (Altosid) is another safe material for control of mosquito larvae. Methoprene is an insect hormone which retards the development of larvae by disrupting the molting process, preventing them from developing into adults.

## **MOSQUITO LIFE CYCLE**



### **ADULTS:**

- Have one pair of wings (with tiny scales attached to wing veins); three pairs of long, slender legs.
- Have elongated piercing “beak” known as a proboscis.
- Length varies between 3/16 - 1/2 inch.
- Capable of flying up to 10 miles to feed (depending on the species).
- Females ready to bite 1-2 days after emergence from pupal stage.
- Both sexes feed on nectar or plant juices, however only females bite.

- Produce one to four generations per year (depending on the species and weather conditions).
- Duration of Adult Stage = several months (depending on the species)

### **EGGS:**

- Elongated; brown or black in color.
- Usually about 1/40 inch long.
- May be laid directly on the water surface or above the waterline (depending on the species).
- May be laid singly or in rafts containing up to 400 eggs (depending on the species).
- Some eggs are resistant to desiccation and can remain viable for several years.
- Duration of Egg Stage = 1-4 days (depending on environmental and genetic factors)

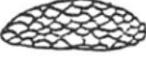
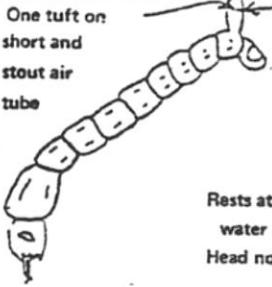
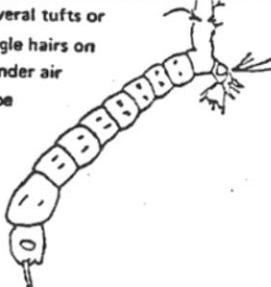
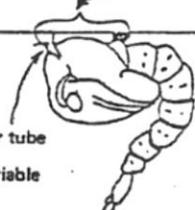
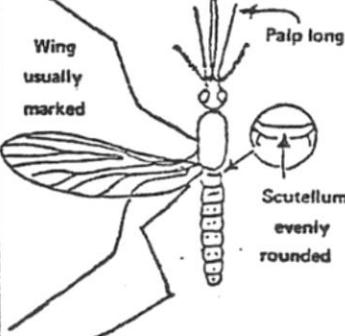
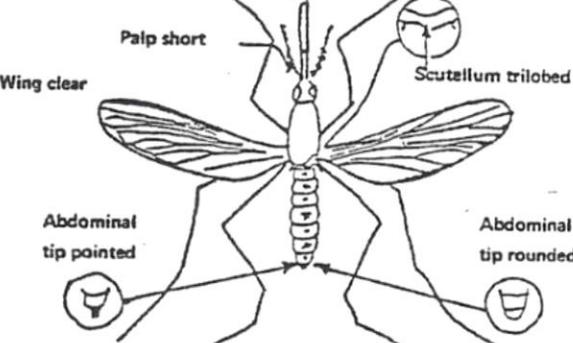
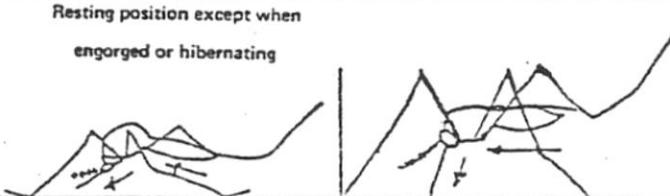
### **LARVAE:**

- “Wrigglers”
- Move through the water in an S-shaped motion.
- Require shallow, quiet water with little to no current.
- Most breathe using siphon tubes while hanging upside down from the water surface.
- Filter feed organic particles out of the water using mouth brushes.
- Undergo four growth stages called instars before molting into pupae.
- Duration of Larval Stage = 1 week

### **PUPAE:**

- “Tumblers”
- Comma-shaped; move with a tumbling motion when disturbed.
- Breathe through two respiratory structures called trumpets.
- Non-feeding
- Duration of Pupal Stage = 2-3 days

# COMPARISON OF LIFE HISTORY CHARACTERISTICS

	ANOPHELES	AEDES	CULEX
Eggs	 <p>With floats</p>  <p>Laid singly on water</p>	 <p>No floats</p>  <p>Laid singly on dry surface</p>	 <p>No floats</p>  <p>Laid in rafts, on water</p>
Larvae	 <p>Palmate hair</p> <p>No air tube</p> <p>Rests parallel to water surface</p> <p>Head rotated 180° when feeding</p>	 <p>One tuft on short and stout air tube</p> <p>Rests at angle to water surface</p> <p>Head not rotated</p>	 <p>Several tufts or single hairs on slender air tube</p> <p>Rests at angle to water surface</p> <p>Head not rotated</p>
Pupae	<p>Greater proportion of body contacting water surface</p>  <p>Air tube short and flared</p> <p>Small spines on side of abdomen</p> <p>Basal segments of abdomen closely appressed to head and thorax</p>	<p>Smaller proportion of body contacting water surface</p>  <p>Air tube variable</p> <p>Basal segments of abdomen not closely appressed to head and thorax</p>	 <p>Air tube long and slender</p> <p>Basal segments of abdomen not closely appressed to head and thorax</p>
Females	 <p>Wing usually marked</p> <p>Palp long</p> <p>Scutellum evenly rounded</p>	 <p>Wing clear</p> <p>Palp short</p> <p>Scutellum trilobed</p> <p>Abdominal tip pointed</p> <p>Abdominal tip rounded</p>	<p>Abdominal tip rounded</p>
Adults		<p>Resting position except when engorged or hibernating</p> 	

# MOSQUITO-BORNE DISEASE

There are over 60 different species of mosquitoes in Ohio. Several of them are capable of transmitting diseases such as dengue, malaria, and West Nile virus to humans. Many mosquito species can also transmit filariasis (heartworm) to animals. Dog heartworm is the most common of these, however in some areas, veterinarians are beginning to see an increase of heartworm in cats as well.

Mosquito-borne encephalitis is a viral inflammation of the brain. Encephalitis can infect humans, horses, and a variety of other mammals and birds. There are four types of encephalitis currently found in Ohio – West Nile Virus encephalitis (WNV), St. Louis encephalitis (SLE), LaCrosse encephalitis (LAC), and Eastern Equine encephalitis (EEE).

## **West Nile Virus (WNV):**

- Principle Vector: *Culex pipiens*
- Reservoir Host: Birds
- Dead-End Host: Humans
- Mode of Transmission: Cycles between mosquitoes & birds; spreads due to bird migration, varying mosquito species amplifying the virus in birds, & bridge vectors.
- Incubation Period: 3 – 15 days
- Symptoms: Fever, headache, eye pain, muscle aches, joint pain, rash, swollen lymph nodes.
- Risk Factors: Approximately 80% of people infected do not become ill.
- Occurrence: First appeared in western hemisphere in 1999, in New York, NY; now nationwide.
- Presence in Ohio: Outbreak in 2002 (441 cases, 31 fatalities).

## **St. Louis Encephalitis (SLE):**

- Main Vector: *Culex pipiens*
- Reservoir Host: Birds
- Dead-End Host: Humans
- Mode of Transmission: Not passed from female mosquito to offspring through eggs.
- Incubation Period: 5 – 15 days
- Symptoms: Fever, headache, neck stiffness, disorientation, coma, tremors, seizures, paralysis.
- Risk Factors: Affects all ages, most severe in the elderly. Mortality Rate: 5 – 20%.
- Occurrence: Known only in the western hemisphere; primarily in Midwestern & southern U.S.
- Presence in Ohio: Epidemic in 1975 (over 1100 suspect cases).

### **LaCrosse Encephalitis (LAC):**

- Main Vector: *Aedes triseriatus*
- Reservoir Hosts: Chipmunks, squirrels
- Dead-End Host: Humans
- Mode of Transmission: Passed from female mosquito to egg; overwinters in egg.
- Incubation Period: 5 – 15 days
- Symptoms: Fever, headache, nausea, vomiting, fatigue, seizures, coma, paralysis.
- Risk Factors: Average case age is 7 – 8 years old. Mortality Rate: <1%.
- Occurrence: Most cases reported between July & October in northern central states.  
Least severe of the mosquito-borne encephalitis infections.  
Also known as California Encephalitis.
- Presence in Ohio: Considered endemic to Ohio (occurs year after year at low levels).  
More recorded cases in Ohio than any other state.

### **Eastern Equine Encephalitis (EEE):**

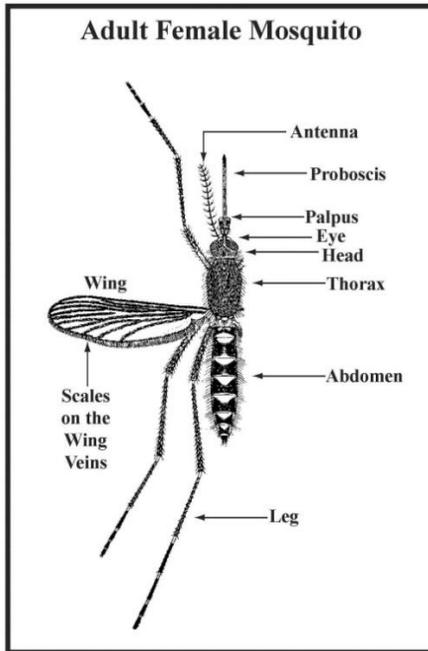
- Main Vector: *Coquillettidia perturbans*
- Reservoir Host: Birds
- Dead-End Hosts: Humans, horses
- Mode of Transmission: Vector transmits to bird; other mosquito species bite infected bird, then  
transmit to humans or horses.
- Incubation Period: 7 – 10 days
- Symptoms: Usually none; those who do get sick typically experience mild flu-like symptoms.
- Risk Factors: Mortality Rate: 30%.
- Occurrence: Rarest of the mosquito-borne infections. Less than 10 human cases each year in U.S.
- Presence in Ohio: No records of human cases in Ohio. First outbreak in horses occurred in 1991.

### **Malaria:**

- Main Vector: *Anopheles* species
- Dead-End Hosts: Humans
- Mode of Transmission: Direct bite from infected mosquito; also through blood transfusions.
- Incubation Period: 12 – 30 days (depending on species of *Plasmodium*)
- Symptoms: Fever, chills/sweats, muscle aches, fatigue, headache, shock, kidney/liver failure.

- Risk Factors: Travel to endemic areas, lack of preventative measures.
- Occurrence: Endemic malaria no longer occurs in U.S.; only cases are now imported.  
Worldwide, 300-500 million cases each year (1 million fatalities).
- Presence in Ohio: Historically indigenous, disease now eliminated from Ohio.  
Continuing risk of transmission due to presence of native *Anopheles* species.

# MOSQUITO FACTS



## How Far Do Mosquitoes Fly?

Most mosquitoes fly only short distances from where they hatch. Some species can fly many miles from where they hatch.

Riding on an airplane, a mosquito can fly many thousands of miles. Airlines spray to kill any hijacking mosquitoes, preventing species from invading other countries.

## Why Do Mosquito Bites Itch?

When a mosquito bites, it injects chemicals to prevent the blood from clotting and reduce pain. These chemicals cause irritation.

## How Do Mosquitoes Choose Who to Bite?

Mosquitoes are attracted by CO<sub>2</sub> (Carbon dioxide) in our breath. They can detect this from great distances.

When the female mosquito gets close, she makes a final choice using skin temperature, odor and other chemical or visual factors.

If two people are outside together, one will almost always get most of the mosquito bites.

## Do All Mosquitoes Suck Our Blood?

Only the female mosquitoes feed on blood, male mosquitoes feed on plant nectar and juices.

Some species only feed on the blood of amphibians (frogs). Mosquitoes have been observed feeding on other insects, even other mosquitoes.

Male and female mosquitoes in the genus *Toxorhynchites* feed on plant nectar.

The minute mosquitoes in the genus *Malaya* wait for ants then thrust their proboscis between the mandibles (jaws) of the ant. The ant then feeds the mosquito.

## What Do Mosquito Larvae and Pupae Eat?

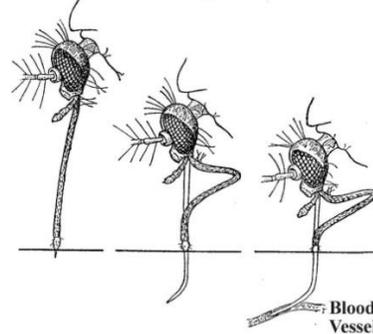
Mosquito larvae eat organic material, bacteria and microscopic plants and animals found in water. Pupae do not feed.

## How to Determine the Sex of Adult Mosquitoes



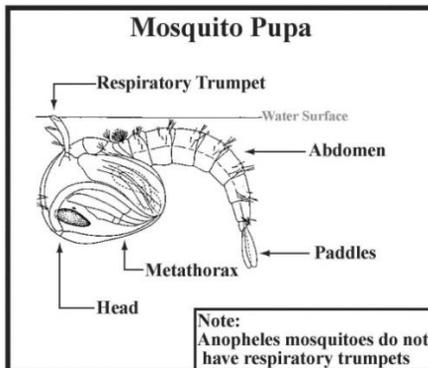
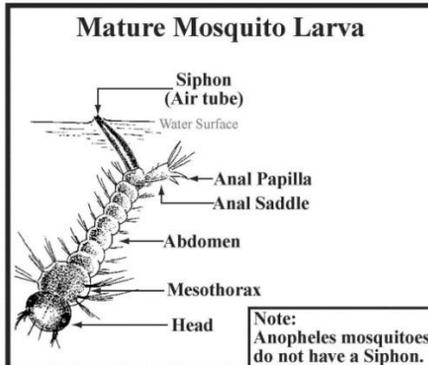
The Male mosquito may be distinguished from the female by the feather-like or plumose appearance of the antenna and palpus.

## How a Mosquito Bites

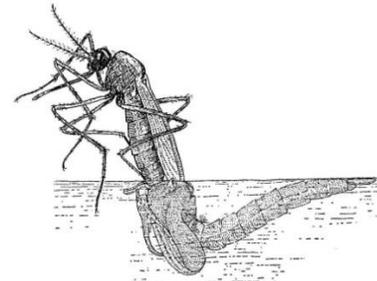


The female mosquito probes the skin for an easy entry for her proboscis, then inserts the feeding stylets and searches for a capillary blood vessel. Once the stylets are in a capillary, the female will pump blood into her abdomen.

Blood is needed to provide protein for egg formation. Some species of mosquitoes can lay the first batch of eggs without a blood meal.



## Emergence of an Adult Mosquito



When a pupa is ready to become an adult mosquito, the pupa case splits open and an adult mosquito emerges from the pupa case. The adult mosquito then balances on the pupa case and the surface of the water until its wings are dry and hard. It can then fly away. During this transition, the mosquito is very vulnerable to wing, predators (such as water striders).

## Some Interesting Mosquito Facts

With as many species of mosquitoes as there are in the world there are many different variations from the "normal" mosquito biology. Mosquito larvae and pupae in the genus *Coquillettida* do not breathe at the surface of the water, their siphon tubes are formed to puncture the hollow stems of aquatic plants for air. Some African *Anopheles* mosquito larvae pull themselves out of the water onto plant stems to avoid predators. Mosquito larvae in the genus *Toxorhynchites* eat other mosquito larvae and the adults of this genus have a curved proboscis to feed on nectar. Many mosquito species are adapted to use very specialized water sources such as the inside of pitcher plants, leaf axils, abandoned snail shells, holes dug by crabs, cut bamboo or rot cavities of plants. There is plenty more to be studied and discovered.

Source: Alameda County Mosquito Abatement District [<http://www.mosquitoes.org/downloads/MosqFacts.pdf>]

# COMMON MOSQUITO SPECIES OF TUSCARAWAS COUNTY

SPECIES		Common Name	Diseases Vectored	Habitat	Flight Range	Peak Daily Activity	Seasonal Pop. Peak	Typical Hosts	Eggs	Broods/Year	Winter Stage	NOTES
Scientific Name												
<i>Aedes canadensis</i>		Woodland Pool Mosquito	LAC WNV EEE DHW Pest	TEMPORARY WP, RD/DD (w/leaves)	½ mi.	Evening	Late May - Early June	Mammals Birds Other	Single (on ground)	One or more	Egg	- One of the most abundant species in early spring
<i>Aedes japonicus</i>		Asian Rock Pool Mosquito	WNV LAC?	AC TH	1 mi.	Daytime, Dusk, Dark	All Season (May - Nov.)	Mammals	Single (above water in AC)	Several	Egg	- Collected using ova traps & CDC traps
<i>Aedes triseriatus</i>		Eastern Treehole Mosquito	LAC DHW	AC, TH (w/leaves)	½ - ½ mi.	Daytime	All Season (May - Oct.)	Mammals	Single (above water in AC)	Several	Egg	- Painful biters; not aggressive - Not attracted to light - Collected using ova traps
<i>Aedes trivittatus</i>		Plains Floodwater Mosquito	WNV EEE DHW	TEMPORARY WP, FWP	½ mi.	Dusk	All Season (May - Nov.)	Mammals	Single (on ground)	Several	Eggs	- Rest in shaded vegetation during the day - Highly attracted to light
<i>Aedes vexans</i>		Inland Floodwater Mosquito	EEE DHW Pest	TEMPORARY Clean, clear pools	5 - 20 mi.	Dusk	Early June - Early July	Mammals	Single (on ground)	Several	Egg	- Vicious biters - Collected using CDC traps
<i>Anopheles punctipennis</i>		Woodland Malaria Mosquito	Malaria DHW	PERMANENT PP, Creeks, AC (clear/shaded)	1 - 2 mi.	Daytime, Dusk	Late August	Mammals	Single (on water)	Several	Adult Female (gravid)	- Feed primarily on mammals - Prefers cool, dark areas with high humidity
<i>Anopheles quadrimaculatus</i>		Malaria Mosquito	Malaria DHW	PERMANENT Pools w/ vegetation	1 - 2 mi.	Night	Late July - Mid August	Mammals	Single (on water)	Several	Adult Female (gravid)	- Bites not painful - Rest in houses during day
<i>Coquillettidia perturbans</i>		Cattail Mosquito	WNV EEE Pest	PERMANENT Pools w/ vegetation	1 - 5 mi.	Dusk, Dawn	May - June	Mammals	Single (on water)	One	Larvae	- Immatures attach to cattail roots - Aggressive biters - Collected using CDC traps
<i>Culex pipiens</i>		Northern House Mosquito	WNV SLE EEE DHW	PERMANENT PP, AC (polluted/septic)	1 mi.	Night	Late June - Early July	Birds Mammals	Rafts (on water)	Several	Adult Female (gravid)	- Rest in houses during day - Collected using gravid traps
<i>Culex restuans</i>		White Dotted Mosquito	WNV SLE EEE DHW	PERMANENT WP, RD/DD, AC	1 mi.	Night	Late May - Early June	Birds Mammals	Rafts (on water)	Several	Adult Female (gravid)	- Larvae less tolerant of pollution than <i>Culex pipiens</i> - Feed primarily on birds
<i>Culex tarsalis</i>		Encephalitis Mosquito	WNV SLE EEE	PERMANENT PP, AC (clean/clear)	2 - 10 mi.	Night	Late May - Mid June	Birds Mammals	Rafts (on water)	Several	Adult Female (gravid)	- Breeding spreads to TP & AC towards end of summer - Attracted to CDC traps
<i>Psorophora ciliata</i>		Gallinipper	Pest	FWP (unshaded)	1 - 2 mi.	Anytime	June - September	Mammals	Single (on ground)	Several	Egg	- LARGE adults - Vicious biters
<i>Psorophora ferox</i>		White-Footed Woods Mosquito	WNV EEE	WP, FWP (shaded)	1 - 2 mi.	Anytime	June - October	Mammals	Single (on ground)	Several	Egg	- Painful biters; very aggressive - Larvae most often found in rain-filled temporary pools

**DISEASE ABBREVIATIONS:**  
WNV = West Nile Virus  
SLE = St. Louis Encephalitis  
LAC = LaCrosse Encephalitis

**HABITAT ABBREVIATIONS:**  
RD/DD = Road/Drainage Ditches  
AC = Artificial Containers  
TH = Tree Holes

**WP = Woodland Pools**  
**PP = Permanent Pools**  
**FWP = Floodwater Pools**

**Revision Page**

<b>Date</b>	<b>Revision</b>	<b>Responsible Party</b>
4/26/2017	Created	Director of Environmental
4/26/2017	Edited and Formatted	Health Commissioner
5/10/2017	Approved	Board of Health