# Utah County Mosquito Abatement District
# Pesticide Discharge Management Plan (PDMP)

Reviewed & Updated January 2026

**Utah County Mosquito Abatement**

476 W 3000 N
Spanish Fork, UT 84660

**Jason Bird, MSML & BSES**
District Director

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**Utah County, Utah**

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## Introduction

The Pesticide General Permit (PGP) for point source discharges to waters to the state of Utah from the application of pesticides covers any qualified "operator" that meets the eligibility requirements identified in Part 1.C.1 and Part 1.D.1, and if so required, submits a Notice of Intent (NOI) in accordance with Part 1.A.3.

As a Mosquito Abatement District (activity covered in Part 1.C.1), the Utah County Mosquito Abatement District (UCMAD) is eligible for the coverage under the PDP. Also, as an "Operator Group 2" defined in Part 1.D.1, the UCMAD has to submit an NOI regardless of the size of the area to be treated. The NOI was submitted to the Department of Environment Quality on 3 February 2012.

The PGP requires any "operator" that is required to submit an NOI and comply with the water quality based effluent limitations to also develop a written Pesticide Discharge Management Plan (PDMP) to document measures taken to meet the effluent limits.

The PDMP requires that the following to be documented:

1. Pesticide discharge management team information;
2. Pest management area description;
3. Control measure description; and
4. Schedules and procedures pertaining to control measures used to comply with the effluent limitations

The UCMAD must keep the PDMP up-to-date thereafter for the duration of coverage under the PGP. The PDMP may contain other documents to describe how we will comply with the effluent limitations of the permit. A copy of any portions of any documents that we will use must be attached to the PDMP.

You will find in the next pages the description of the different control measures implemented.

Jason Bird

Jason L. Bird, MSML & BSES
Utah County Mosquito
Abatement Director

Date: 04/23/2026

Next review date: 01 Jan, 2027

## 1. Pesticide Discharge Management Team Information

All persons may be contacted at:

Utah County Mosquito Abatement District
476 West 3000 North
Spanish Fork, Utah, USA 84660
Tel: (801) 851-7637

A. Person(s) responsible for managing pests in relation to the pest management area:

Jason L. Bird, MSML & BSES, District Director
Email: jasonbi@utahcounty.gov

B. Person(s) responsible for developing and revising the PDMP:

Jason L. Bird, MSML & BSES, District Director
Email: jasonbi@utahcounty.gov

C. Person(s) responsible for developing, revising, and implementing corrective actions and other effluent limitation requirements:

Jason L. Bird, MSML & BSES, District Director
Email: jasonbi@utahcounty.gov

D. Person(s) responsible for pesticide applications (mix, load, apply):

Jason L. Bird, MSML & BSES, District Director
Email: jasonbi@utahcounty.gov

Seasonal employees (15-18/year) currently including but not limited to the following:

E. Person(s) responsible for mixing, loading, and applying pesticide by airplane.

Vector Disease Control Inc. (VDCI) not employed by Utah County but private contractor.

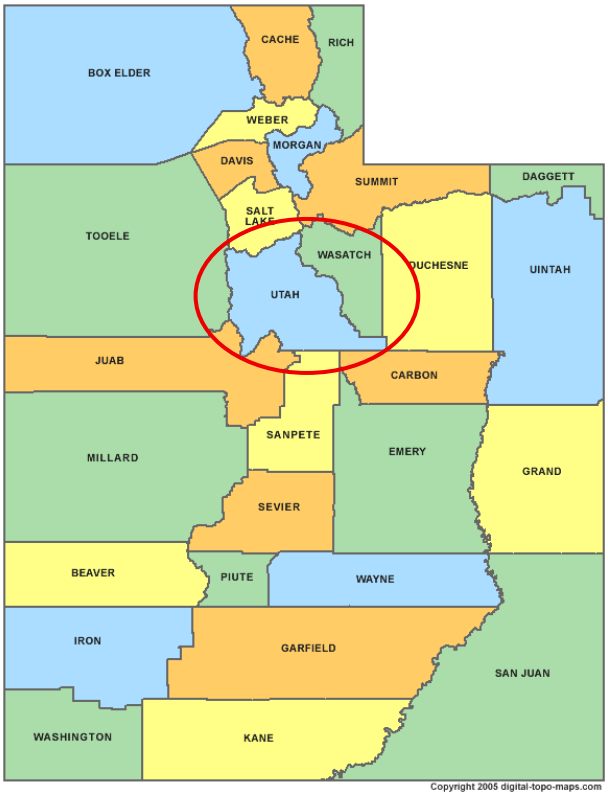
## 2. Pest Management Area Description

### General Description and Location

Utah County is located near the center of the State of Utah, encompassing just over 2,142 square miles. Distinctive geographic features include the Wasatch Mountain Range on the East and Utah Lake on the West of the valley. Utah Lake is a remnant of prehistoric Lake Bonneville that once covered much of north and central Utah over 10,000 years ago. The county continues to benefit from alluvial deposits of this ancient lake in the resources of the sand, gravel, and excellent farm lands. Ancient shorelines are still visible on the mountains. The county is bordered on the north by Salt Lake County, on the east by Wasatch County, on the south by parts of Carbon, Duchesne, Sanpete, and Juab counties, and to the west by Tooele County.

The county population has exceeded 687,000 people according to the United States Census data. Most of these residents live in communities established between the east shore of Utah Lake and the west side of the mountain range. The highest populations are centered in the Provo-Orem area and also include BYU, UVU, and Mountainland Applied Technology schools. The cities/towns of Alpine, American Fork, Cedar Fort, Cedar Hills, Draper (part), Eagle Mountain, Elk Ridge, Genola, Goshen, Highland, Lehi, Lindon, Mapleton, Orem, Payson, Pleasant Grove, Provo, Salem, Santaquin, Saratoga Springs, Spanish Fork, Springville, Vineyard, and Woodland Hills are within county boundaries.

The Wasatch Range includes several mountains over 11,000 feet in elevation, such as Mt. Nebo, Mt. Timpanogos, Twin Peaks, and Lone Peak, which provide major water sources for the valley. The lowest point in the county is in the Jordan River Flood Plain at 4,480 feet. The annual average precipitation for the county is 14.2 inches, with spring and summer rains and winter snow. The average January temperatures are 37° F maximum and 14° F minimum. The July average temperatures are 91° F maximum and 54° F minimum.




**Map 1.** State<img src="http://www.digital-topo-maps.com/county-map/utah-county-map.gif"><br>Map Courtesy of <a href="http://www.digital-topo-maps.com/county-map/utah.shtml">Digital-Topo-Maps.com</a> of Utah and Washington County in the left corner.

**Natural Environments**

- River and creek floodplains in Utah County are associated with major drainage systems from Beer Creek, Peteetneet Creek, Spanish Fork River, Hobble Creek, Provo River, and American Fork River, and the tributaries that flow into these. These floodplains are characterized by tamarisks, Russian olive, cottonwoods, willows, herbaceous sedges, salt grass, cattails, and Phragmites. Mosquito species commonly found in these environments include *Culex tarsalis, Anopheles freeborni,* and a number of floodwater species of *Ochlerotatus* genus.
- Woodland ponds, sloughs, marshes, pastures, and depressions occur throughout the county. Examples of these habitats include ponds, Benjamin Slough, and irregular topography forming depressions. Large parcels of land in the Goshen Bay, Lincoln Beach, and Provo Bay areas are designated Utah Lake Wetlands. Many of these sites that trap water from runoff and high water table serve as excellent nurseries for most species of mosquitoes found in our region.
- Other natural environments include springs, seeps, tree holes, tree cavities, and burrows made by various species of wildlife. Springs and seeps are important sources of mosquitoes in the valley and require regular monitoring and treatment. Tree holes play a major role in the biology of *Ochlerotatus varipalpus.* Salt Lake County has an extensive program to monitor treehole mosqouitoes, *Ochlerotatus varipalpus and Ochlerotatus sierrensis* vectors of the dog heartworm. However, these as a whole are generally not a pressing concern to our mosquito program. This could become a future concern in Utah County.

**Man-made Environments**

- Shallow roadside ditches and canals are frequently sources of mosquito problems. Such sites often remain dry throughout much of the year because of temperature, but in some suburbs, runoffs from flooded fields can keep them wet for a good part of the year and become very attractive sites for mosquito females to lay their eggs.
- Trenches and ruts from the heavy equipment used at construction sites can create new mosquito habitat. Irrigation sprinkler wheel lines and pivots can generate many new mosquito breeding sites.
- Flood irrigation: Overwatering farmland and pastures can add significantly to mosquito production. Livestock not only provide a reliable blood meal for female mosquitoes, but also form numerous larval habitats from their hoof prints. The presence of watering troughs on the sites also adds habitat for mosquito development.
- Storm drains and catch basins: Several thousand are found throughout Utah County, providing a suitable breeding environment for *Culex pipiens*, a known vector of WNV in Utah.
- Containers come in all sorts of shapes and sizes. These may be represented by something as small as a bottle top to something as large as a discarded or unkempt boat. Many items in people's backyards could be potential development sites for mosquitoes (toys,

bird baths, old tires, buckets, wheelbarrows, blocked rain gutters, neglected swimming pools, etc.).

- Other man-made sites include railroad borrow pits, agricultural fields, retention and detention ponds. Fields flooded on purpose by farmers to water their crops are also a major issue for the mosquito abatement program.

**Pest Problem Description**

The county is known to contain over 20 species of mosquitoes, although the Utah County Mosquito Abatement District actively surveys and conducts control efforts primarily on 9species (listed below). Three of those species (*Culex erythrothorax*, *Culex pipiens,* and *Culextarsalis*) are known to be carriers of the West Nile virus (WNV) in Utah County and commonly make up 80-90% of the mosquitoes trapped. Other mosquito species, *Aedesvexans*, *Ochlerotatus dorsalis*, *Ochlerotatus* increpitus, Ochlerotatus nigromaculis, found in the county may cause nuisance problems when populations build up after farmers flood their fields, river flooding, or rain events. The most common species are:

- ***Aedes vexans*** (Meigen, 1830)
  *Ae. vexans* is one of the most widespread pest mosquitoes in the world and is widely distributed throughout Utah, where cycles have been observed to follow the irrigation patterns of farming in the area. The number of adults increases following harvest times as fields are flooded for the next crop. Alfalfa is the most likely farm crop to support *Ae. vexans* larvae. Areas near American Fork Marina, Palymyra, and Lake Shore commonly produce this species. Females prefer the blood of mammals for protein meals. *Ae. vexans* has been implicated as a secondary vector of eastern equine encephalitis and dog heartworm. It has also been tested in laboratories to be suitable to carry West Nile Virus (WNV).
- ***Anopheles freeborni*** (Aitken, 1939)
  It is the most common Anopheles species in Utah and is widely distributed throughout the state. In Utah, its largest numbers have been collected along the drainage that is spring feed. Fewer numbers are collected in areas of higher elevation. Females are most active at dusk and will readily enter houses in search of hosts. *An. freeborni* almost exclusively uses mammals as hosts. It prefers small mammals like rabbits as hosts over large domestic animals and humans. *An. freeborni* is currently considered to be the most important vector species of malaria in the West. This species has also been found to carry the Western Equine Encephalitis (WEE) and St. Louis Encephalitis (SLE) viruses.
- ***Culex erythrothorax*** (Dyar, 1907)
  In Utah County, *Cx. erythrothorax* has been found developing in deeper water of ponds and lake margins with heavy vegetation like tules, cattails, willows, and grasses. Large populations have been identified in swampy areas from Provo Bay to Lincoln Beach. This species does not migrate far (generally less than 1 mile) from its larval habitat. *Cx.erythrothorax* will spend winter as larva and then emerge in late spring. *Cx. erythrothorax* are the last *Culex* species to be collected for the year, usually in August and

September. Huge numbers of this species may emerge. Multiple pools of *Cx. erythrothorax* have tested positive for WNV in Southwestern Utah, but it is less frequent in Utah Valley. These pools are usually from locations with *Culex tarsalis* that are also positive.

- ***Culex pipiens*** (Linnaeus, 1758)
  *Cx pipiens* are found widely distributed throughout the world and are usually considered the most common pest mosquito in urban and suburban settings. *Cx pipiens* is referred to as the "Northern House Mosquito" because it is rarely found below 39 degrees latitude and is more suited for cooler weather conditions. They often live in stagnant brown water, often containing organic matter such as lawn clippings, leaves, etc. Grated catch basins containing trapped water and neglected ornamental ponds and bird baths provide excellent habitat for this species. Adults are regularly found entering homes. Adults are generally active only during the warmer months and prefer to bite birds over mammals. This species can be considered "bridge" vectors, because they maintain the viruses within bird populations and then transmit viruses between birds and mammals. *Culex pipiens* is a vector, or carrier, of St. Louis Encephalitis (SLE), West Nile Virus (WNV), Western Equine Encephalitis (WEE), Heartworm in dogs, and bird Malaria.
- ***Culex tarsalis*** (Coquillett, 1895)
  *Cx. tarsalis* is widely distributed throughout Utah and in Utah County. The largest numbers are collected along marshy areas around Utah Lake. Types of habitat vary immensely from pasture and other flood irrigated crops to wetlands. This species of mosquito is probably the most prominent vector of arboviruses in North America. *Cx. tarsalis* is the most important transmitter of viruses in Utah. In this area, *Cx. tarsalis* has been determined to carry Western Equine Encephalitis (WEE), St. Louis Encephalitis (SLE), and West Nile Virus (WNV). This is a multiple-brood mosquito, and numbers continue to increase during the summer, usually peaking near the 24th of July weekend to the 1st week in August.
- **Culiseta inornata** (Williston, 1893)
  *Cu. inornata* have been found in almost all collection locations within Utah County. They are more common in marshy areas surrounded by taller vegetation near farms with cattle or horses. They are large, active flyers and can disperse 5-10 miles from their emergence site. *Cu. inornata* mostly feeds on large mammals, with no preference between horses or cattle. They usually comprise about 5% of our trapped mosquitoes. Females will sometimes bite humans, but are not considered to be a major pest.
- **Ochlerotatus dorsalis** (Meigen, 1830)
  This is a light colored, multiple-brood mosquito that can appear early in the spring and continue until freezing weather. The preferred habitat is alkaline waters, often with salt grass. This is one of the most abundant and annoying floodwater mosquitoes. It will bite during the day as well as at night and is known to migrate several miles from the emergence site. This species has been linked as a vector of California Encephalitis.
- **Ochlerotatus increpitus** (Dyar, 1916)

This is a single-brood species that occurs commonly in Utah Valley near the lake edge between Lindon Marina and Provo Marina in June. As the hot days of summer arrive, this species is mostly gone. This nuisance species impacts participants of sports parks in West Provo, Orem, and Vineyard, often moving up into neighborhoods near Utah Valley University.

- ***Ochlerotatus nigromaculis*** (Ludlow, 1907)
  In Utah County, Oc. *nigromaculis* has been collected mostly in the West Spanish Fork, Lakeshore/Palmyra areas. These aggressive mosquitoes are associated with agricultural crops like alfalfa and feed corn. *Oc. nigromaculis* competes directly with *Ae. vexans* for habitat space. It is a strong flyer, and females are capable of flights up to 20 miles when seeking a blood meal. Residential areas surrounding these fields are inundated with aggressive females, usually shortly after rainstorms and heavy flooding of fields. Pasture mosquitoes are considered pests and can interfere with agricultural operations as well as the use of recreational areas. This species is not known to be a natural carrier of disease.

## Action Threshold

To better guide UCMAD treatments for adult mosquitoes, thresholds were established according to different criteria. These criteria have been established based on the fact that UCMAD was created to treat either for nuisance and/or for public health protection (potential transmission of diseases by the mosquitoes). The WNV plan includes three levels of responses based on surveillance thresholds.

**Level 0 (None)**

- No adult mosquito biting activity
- Action:
  - Develop and review WNV response plan.
  - Review mosquito control program.
  - Maintain source reduction projects.
  - Secure surveillance and control resources necessary to enable emergency response.
  - Review and update community outreach and public education programs.
  - Establish communication with other public health professionals, such as the Department of Agriculture, veterinarians, etc.

**Level 1 (Low)**

- Biting adult mosquitoes are active.
- **Surveillance:** Field sampling of known *Culex* species habitats, determined from the database, to monitor the development of mosquito populations. (Beginning mid-April)
- **Surveillance:** Limited CDC traps will be used to detect adult mosquito vector emergence. Early trapping will begin in May, dependent on weather conditions, and regular weekly trapping will be conducted from June to September.

    - Selected traps in Goshen Elementary, Genola, Wild Wings, Camelot, Provo Bay, and Inlet Park will serve as early sentinel traps for WNV. These areas have historically caught mosquitoes infected with WNV.
- **Surveillance:** Conduct a resistance study using CDC bottle Bio Asay or caged field trails to assess the level of resistance found in the mosquito populations for the adulticides we use.
- **Action:** Response as in level 0, plus
- **Action:** Mosquito pools of *Culex* species will be tested weekly for WNV, SLE, and WEE in our lab by qPCR testing. **Positive tests** for WNV raise the health threat and urgency for added control to level 3 response.
- **Action**: Vector Control employees will assess mosquito numbers and metamorphic development to determine if chemical larviciding is needed. They will access aquatic life, organic matter, water quantity, temperature, and mosquito species to determine which product will be most effective and environmentally friendly.
    - Target mosquitoes reaching a **threshold of >3-5/dip** may be treated with a larvicide product.
- **Action:** Evening (9-12 PM) adulticiding with ULV foggers will be used as needed to control mosquitoes based on trapping data.
    - A **threshold of > 50 adult mosquitoes** that are potential vectors of West Nile virus, i.e., Culex tarsalis, Culex pipiens, or *Culex erythrothorax* from selected traps in Goshen Elementary, Genola, Wild Wings, Camelot, Provo Bay, and Inlet Park will serve as early sentinel traps for WNV. These areas have historically produced disease vector mosquitoes.
- **Action:** Evening (9-12 PM) adulticiding with ULV foggers will be used as needed to control mosquitoes based on trapping data.
    - **A threshold of > 50 nuisance mosquitoes**, i.e., Aedes vexans, Ochlerotatus dorsalis, Ochlerotatus increpitus, Ochlerotatus nigromaculis, *or Culiseta inornata* from any trap site in the county will trigger a habitat inspection and potential ULV fogging as needed.
- **Action:** If resistance is discovered, take appropriate measures to combat the problem.

**Level 2 (Moderate)**

- Increase in biting adult mosquito activity
- **Surveillance:** Continue regular field work to monitor upcoming mosquito hatches, indicating an increase in Culex species.
- **Surveillance:** Continue regular CDC trapping county-wide, June through September.
- **Surveillance:** Monitor those traps located near the east side of Utah Lake to monitor potential need for air spraying in areas inaccessible to ULV fogging.
- **Surveillance:** Monitor veterinarian clinics and EDCO website for the presence of WNV in the horse population. If WNV is detected, will move to level 3 response.
- **Action:** Response as in level 1, plus

- **Action:** When trap counts reach a **threshold of 1000 *Culex*** species**,** this indicates a rapid increase in WNV vector mosquitoes. This is the threshold to begin initial air spray, usually occurring in late June-early July.
- **Action:** Mosquito pools of *Culex* species will be tested weekly for WNV, SLE, and WEE in our lab by qPCR testing. **Positive tests** for WNV raise the health threat and urgency for added control to level 3 response.
- **Action:** Increase evening fogging (4-9 trucks), targeting areas of concern to create a buffer zone between the source and major county populations. Weekly spray routes are conducted targeting areas with high trap count numbers.
- **Action:** Contact Vector Disease Control Inc. (VDCI) of need and provide shape files of the area posing a health threat targeted for aerial control. Initiate 1st spray for control of *Cx.* species to continue weekly up to 8 sprays or until numbers drop below 1000.
- **Action:** Post-trapping will monitor the effectiveness of air spraying. The goal is the reduction of 50-80% of adult mosquitoes.

**Level 3 (High)**

- Detection of arborviruses in mosquito, horse, or human populations.
- **Surveillance:** Continue regular field work to monitor upcoming mosquito hatches, indicating an increase in *Culex*. species.
- **Surveillance:** Continue regular CDC trapping county-wide, June through September.
- **Surveillance:** Monitor those traps located near the east side of Utah Lake to monitor potential need for air spraying in areas inaccessible to ULV fogging.
- **Surveillance:** Monitor veterinarian clinics and EDCO website for the presence of WNV in the horse population. If WNV is detected, will move to level 3 response.
- **Action:** Response as in level 2, plus
- **Action:** Alert and coordinate with Eric Edwards (Health Department Director) and PIO (Ailsynn Tolman-Hill) of impending threat and intended control actions. PIO will make a statement to the media.
- **Action:** Increase evening fogging (4-9 trucks) targeting where positive test results are found or where horse or human cases have been reported.

Additional criteria for spraying/larviciding will be:

- Complaint calls from residents.
    - If this is a zone where a threshold is already reached (nuisance or vectors), spraying is already scheduled and performed for that zone.
    - If this is a zone where a threshold has not been reached, Vector control personnel may inspect the area/ talk with the resident to determine the need. If needed (see thresholds), spraying will be performed.
    - Multiple spray requests from a neighborhood may warrant immediate response.
- Field supervisors reporting a larvicide failure at any breeding site located near populated areas.

- Based on a service request, limited area treatments may be conducted prior to special events or community functions.
- A limited number of known, historic breeding sites may be pre-treated after a major rain or flooding event if there is insufficient time to inspect and treat all larval sites within the county.

**General Location**

Map 2, page 13, represents a general location map of major drainages and mosquito breeding sites within Utah County, UT.

- Larviciding or Pupaciding
  Purple shading indicates areas treated with larvicides. There are several thousand areas noted on more detailed maps where mosquitoes have been collected.

  Control of mosquitoes at the larval stage is a major part of mosquito control. Trained Vector Control personnel survey potential larval habitats and use larvicides when larvae are found. Larvicides are pesticides that are added to the water in order to kill the mosquito larvae before they emerge as adults. Mosquito Kontrol Oil or pupicide oils may also be applied to control non-feeding pupa, preventing them from emerging. Many of the products are applied by hand or with a power backpack. This is done on foot, from all-terrain vehicles (ATVs), or from trucks.

  Additionally, we have bikers who check thousands of catch basins throughout the county and treat any that have stagnant water for mosquitoes. They alternate pesticides to reduce the development of chemical resistance by mosquitoes. (See map 3, page 14)

  Some of the pesticides used for larviciding, both in granular and liquid formulations, would include:
    - Bacterial products, surface agents, and growth regulators.

- Adulticiding
  Adult mosquito control is used to rapidly knock down biting adult mosquitoes. This can become necessary when larval control measures are insufficient or not feasible.

  Adulticiding is used mostly when there is a large possibility of disease transmission in an area, such as the West Nile Virus (WNV), Saint Louis Encephalitis (SLE), Western Equine Encephalitis (WEE), and where adult mosquitoes are considered a nuisance for the public.

  The most common method of adult mosquito control is ultra-low volume (ULV) spraying. ULV spraying is the process of putting very small amounts of liquid into the air as a fine mist of droplets. These droplets float on the air currents and quickly kill mosquitoes that come into contact with them. ULV adulticides are applied in the evening when mosquitoes

are most active (different peaks of activity depending on the species). Typically, between 9:00 PM and 1:00 AM. ULV applications are only done during environmental conditions that ensure desirable product movement.

Utah County is divided into several ULV spray areas to facilitate multiple personnel who may be involved and to track the pesticide delivered. See map 4, page 15. Some of these areas may be sprayed weekly, and some are seldom sprayed depending on the mosquito threat.

Labels and Material Safety Data Sheets (MSDS) of all larvicides and adulticides used in our operation are posted on the Utah County Mosquito Abatement under the link Chemicals We Use. (https://health.utahcounty.gov/chemical-we-use/)

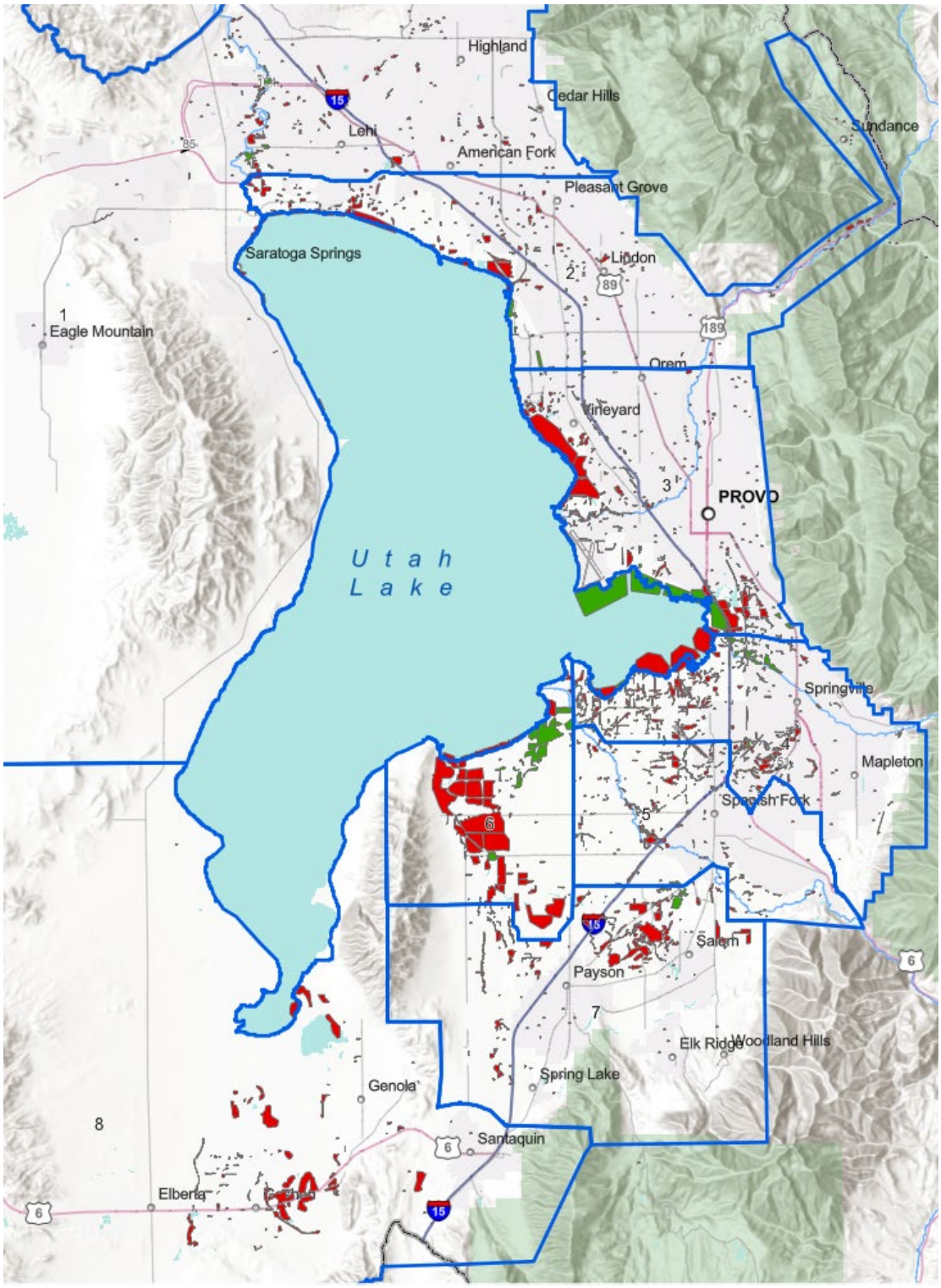
The Mosquito Abatement Website is located at (https://health.utahcounty.gov/mosquito-abatement/). and available for the public. The modes of action of those different families of products are also described on the website.

When the previously listed thresholds are exceeded for adult mosquitoes, air spray may be required. Services are contracted out by Utah County to treat areas bordering the lake that are non-accessible to ULV fogging trucks. Map 5 outlines in purple potential spray areas. Treatment occurs at night when mosquitoes are most active. Maps and post-application reports are provided the next day, indicating chemicals, application rate, pattern flown, and meteorological conditions. See map and post-application data.

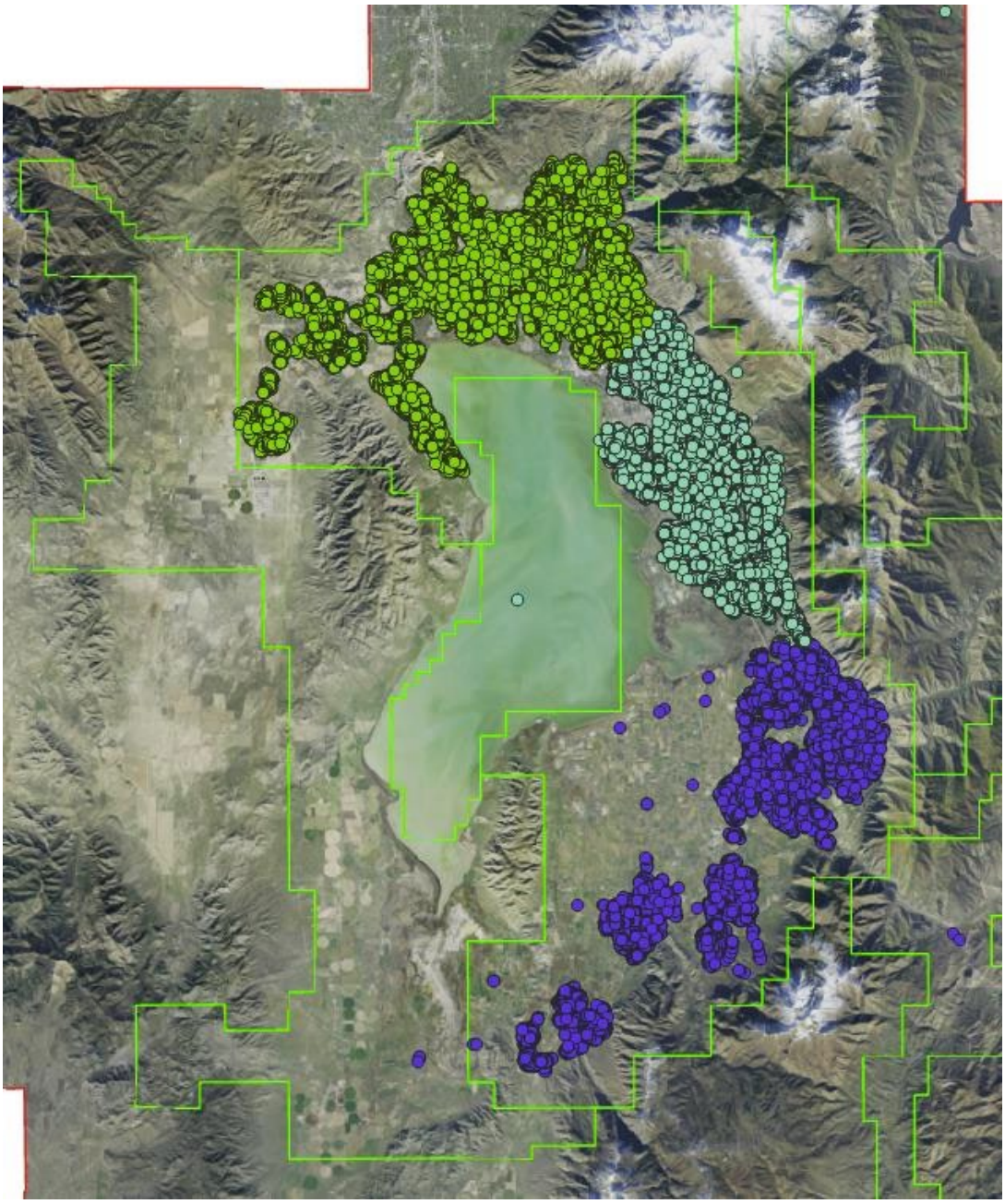
The United States Environmental Protection Agency (USEPA) approves the use of pesticides nationally. Before pesticides are registered by USEPA, they must undergo laboratory testing for acute and chronic health effects. In these tests, laboratory animals are purposely fed a pesticide at high doses for an extended period of time specially to see if toxic effects occur. These tests help scientists judge how these chemicals might affect humans, domestic animals, and wildlife in the case of exposure.

### Water Quality Standards

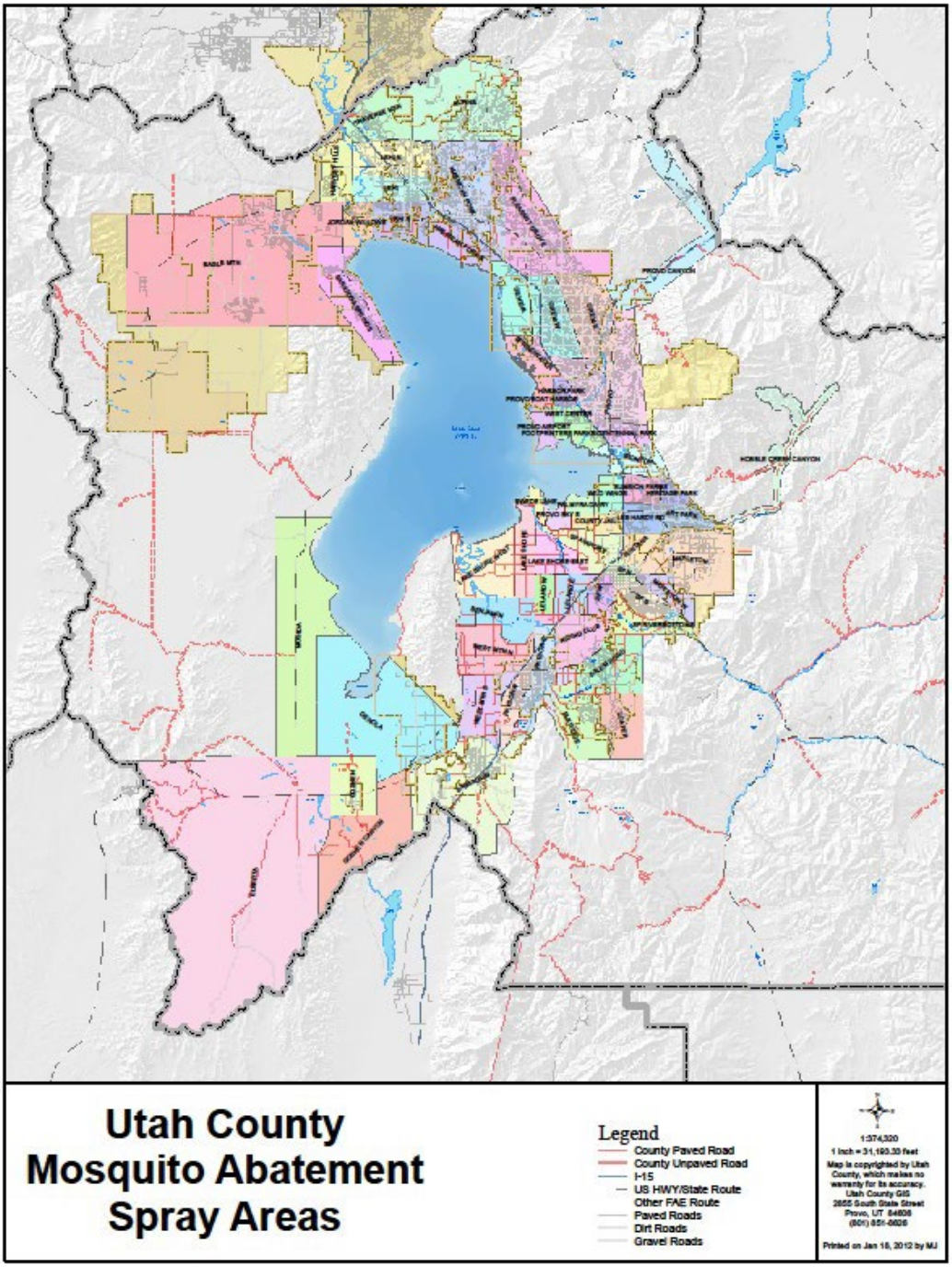
Waterways in Utah County are not impaired by any pesticides used by the UCMAD.



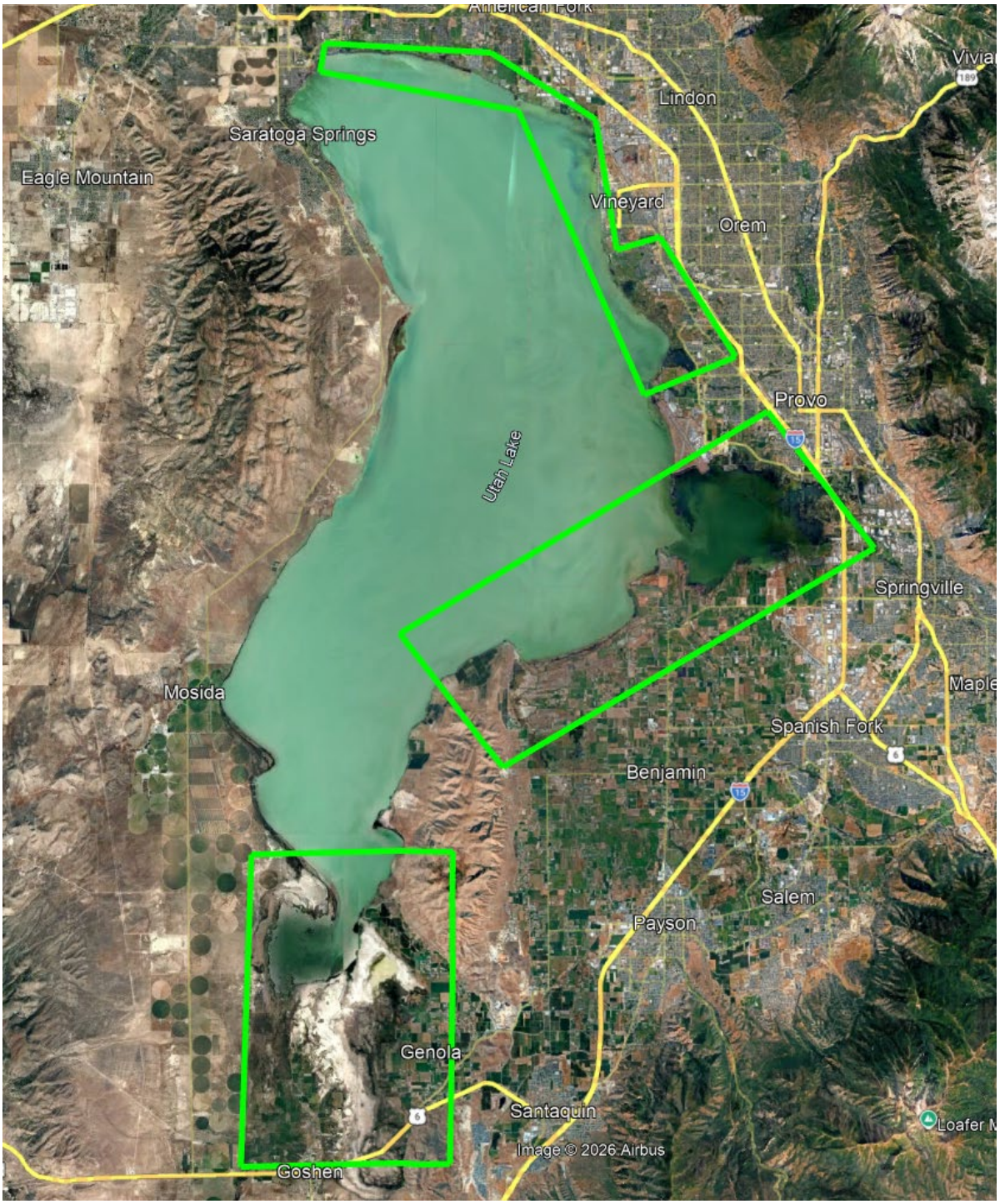

Map 2. Major drainages into Utah Lake and larval sources.



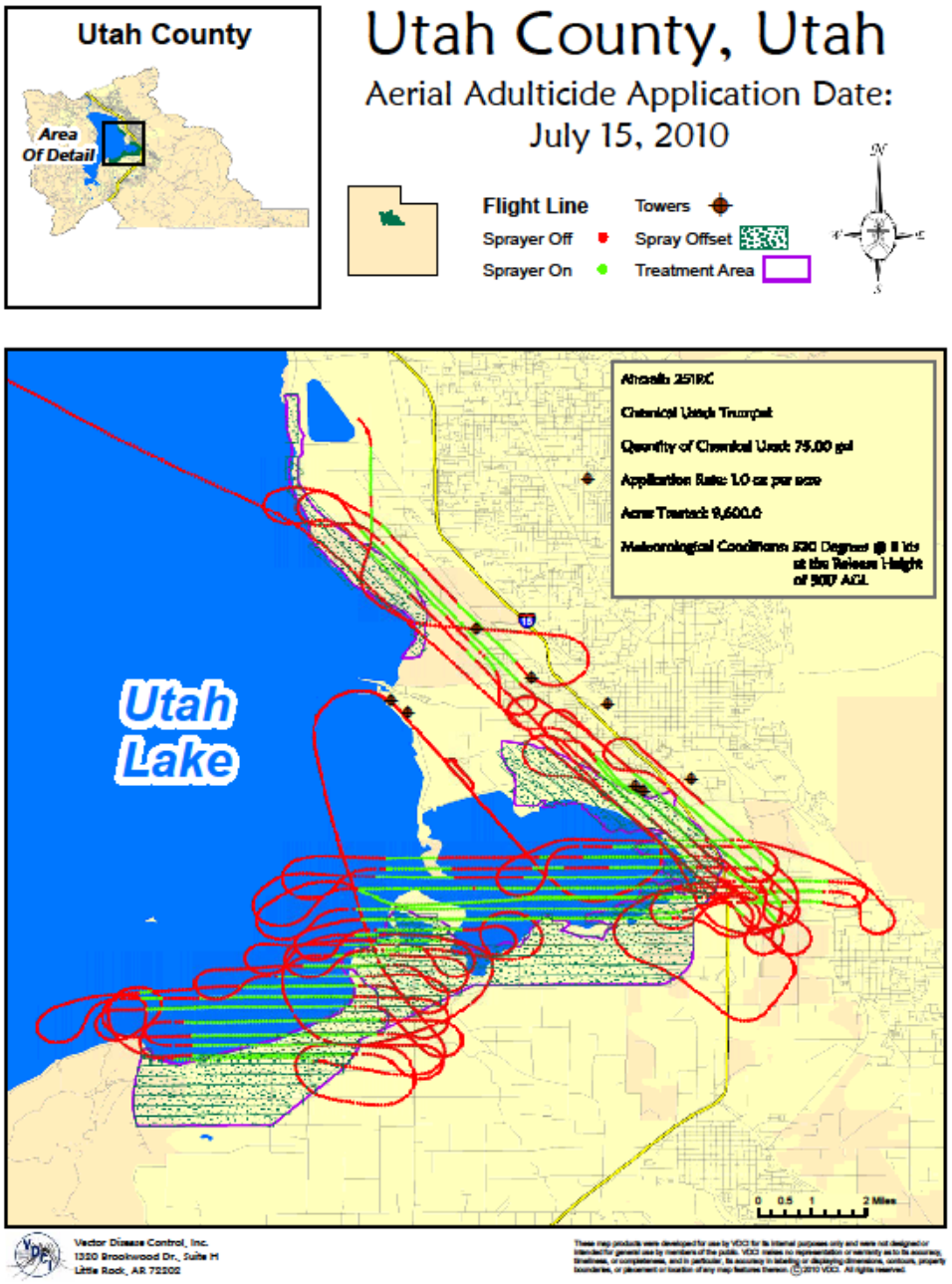
Map 3, Catch basins treated in Utah County.


Utah County
Mosquito Abatement
Spray Areas
Legend
County Paved Road
County Unpaved Road
I-15
US HWY/State Route
Other FAE Route
Paved Roads
Dirt Roads
Gravel Roads
1:374,320
1 Inch = 31,193.33 feet
Map is copyrighted by Utah County, which makes no warranty for its accuracy.
Utah County GIS
2855 South State Street
Provo, UT 84606
(801) 851-8626
Printed on Jan 18, 2012 by MJ

Map 4




Utah County Air Spray Zone (Plane Fixed Wing)


Utah County
Area Of Detail
Utah County, Utah
Aerial Adulticide Application Date:
July 15, 2010
Flight Line
Sprayer Off
Sprayer On
Towers
Spray Offset
Treatment Area
Aircraft: 251RC
Chemical: Unisect Trumpet
Quantity of Chemical Used: 75.00 gal
Application Rate: 1.0 oz per acre
Acres Treated: 9,600.0
Meteorological Conditions: 330 Degrees @ 8 kts at the Release Height of 900' AGL
Utah Lake
0 0.5 1 2 Miles
Vector Disease Control, Inc.
1320 Brookwood Dr., Suite H
Little Rock, AR 72202

Map 6

| Spray Information Type | Utah County Information |
|---|---|
| **Customer** | Utah County, UT |
| **Date** | 7/15/2010 |
| **Type of Aircraft** | Cessna 402 |
| **Registration # of Aircraft** | 251RC |
| **Type of Application** | Adulticide |
| **Spray Swath Width** | 1000 |
| **Pilot** | VDCI |
| **Co-pilot** | Joe |
| **Spray Zone treated** | Vineyard, Lincoln Beach, & Provo Bay |
| **Chemical Used** | Trumpet |
| **Quantity (gallons)** | 75.00 |
| **Oz/Ac** | 1.00 |
| **Acres treated** | 9,600 |
| **Time of Application Start** | 21:20 |
| **Time of Application End** | 22:45 |
| **Aircraft Indicated Speed** | 165 kts |
| **Release Altitude** | 300' |
| **Wind speed** | 8 kts |
| **Wind direction** | 320 |
| **Temperature/Dew Pt** | 82F/65F |
| **Sunset** | 20:55 |
| **Sunrise** | 6:10 |
| **Sky Condition** | Clear |
| **Visibility** | |

## 3. Control Measure Description

A brief explanation of the control measures to demonstrate how to meet the applicable technology-based or water quality-based effluent limitations. These control measures used at the site to reduce pesticide discharge include evaluation and implementation of management tools:

- **No action** or at least delayed action may be taken by the UCMAD at times when a major portion of the county has been inundated with water. When a county-wide flooding event takes place, it is generally more economical and environmentally friendly to allow mosquito larvae to emerge and treat for adults at a later time if necessary. This is because not all larval habitats can be treated in a timely manner to prevent adult emergence, and adult mosquitoes will migrate into our service area from the surrounding regions that have no or reduced mosquito control resources. Conversely, no action may also be taken when sites containing larvae are shallow, and extended weather forecasts indicate dry conditions. Such situations allow larval habitat to dry before mosquitoes can complete their aquatic life stages, and no adults result.
- **Prevention, mechanical/physical methods, and cultural methods** are by definition very similar in nature and share many characteristics. These methods can be as basic as simply emptying water from containers or as complex as repairing broken water lines, which often require the involvement of other county departments, such as Public Works. Mechanical/physical and cultural methods manipulate larval habitat to prevent favorable conditions for mosquitoes to complete their aquatic development. Physical manipulation of environments, such as removing blockages in ditches that serve as barriers to natural predators of mosquitoes, is sometimes a quick and effective means to resolve problems on a localized level.
- **Educational program and area events** allow the opportunity to suggest ways that residents can assist in the prevention of mosquito problems by removing containers and articles from their yards that provide larval habitat, and to be mindful that birdbaths and pet water bowls could serve as mosquito sanctuaries when not properly maintained. Training is offered to all employees at the Utah Mosquito Abatement Association (UMAA) Spring workshop, and each is required to study and obtain a Pesticide Applicator License to be employed by UCMAD.
- **Biological control products*** can be used for the control of larval stages of mosquitoes. Formulations containing *Bacillus sphaericus* and/or *Bacillus thuringiensis israelensis* are used to treat flood water and other larval sites.
- **Chemical pesticides*** often are any abatement agency's last choice of control measures. These products are applied as directed by their respective label, and all equipment used in this process is closely monitored and calibrated by staff.

Operators must consider the impact on non-target organisms, the impact on water quality, pest resistance, feasibility, and cost effectiveness when evaluating and selecting the most efficient and

effective means of pest management to minimize pesticide discharge to waters of the U.S. Control measures are evaluated separately on the basis of mosquito life stage as follows:

- **Adult Control efficacy** is determined from pre- and post-treatment trap counts when a trap site is located within the spray block. In addition, landing rates taken by staff are used to supplement this data when trap sites are not located near a treatment area.
- **Larval control efficacy** is mostly verified in post-treatment surveys when using larvicide oils and films, or biological control products, such as *B.sphaericus* or *Bti* products. When using growth hormones, control is more difficult to access since it does not cause mortality until the later stages of the larvae's development. A failure is not realized until "healthy"adults are found emerging after their pupa stage. Re-inspection of treated sites occurs within a week of application of the product.

  **A list of all insecticides (labels and MSDS) in use is provided on the UCMAD website (https://health.utahcounty.gov/chemical-we-use/). You can also find on the website the mode of action of the different families of products (organophosphates, growth regulators, etc.). Both documents are also posted at the end of this document*

## 4. Schedules and Procedures Pertaining to Control Measures Used to Comply with the Effluent Limitations

Pertaining to control measures used to comply with the effluent limitations

### Application Rate and Frequency Procedures

- Application Rate Determination
  - Determine species and age of target mosquito(es)
  - Evaluate environmental conditions
  - Consider target area flora and fauna
  - Determine appropriate application rate based on product label recommendations, previous experience, and efficacy tests
- Frequency Determination
  - Determine target site treatment history with selected pesticide
  - Evaluate the effect of selected pesticide use on frequency and quantity thresholds for the active ingredient
  - Consider alternate treatment options
- Resistance Considerations
  - Consider documented resistance of target species to selected pesticide and/or any other compounds that are in the same class or exhibit similar modes of action. Also consider the possibility of cross-resistance.
- Consider the use of alternate control options.

**Spill Prevention Procedures**

- Perform weekly inspections of chemical storage rooms and parking areas.
- Keep OSHA requirements log (spill response supplies, PPE locations, chemical list) up to date
- Spill kits are kept in each truck, and employees are trained each season in spill prevention and cleanup

**Pesticide Application Equipment Procedures**

- Ground Adulticiding
    - Operations:
        - Application equipment must be calibrated annually to confirm the Volume Median Diameter is according to the label of the pesticide being used.
        - A visual inspection of spray equipment for leaks or wear in the lines, tanks, and nozzle is done prior to the start-up of spray equipment.
        - Routine cleaning and maintenance of the spray system must be performed to ensure the system is operating properly. (filters)
        - Washing of trucks and ULV sprayers will be completed every 1-2 weeks, depending on use and need, and will be documented on the daily field report.
    - Maintenance:
        - Daily Checks - Visually check the fog generator each day before use and make any necessary adjustments and /or repairs. Before making any repairs, ensure that the required PPE is worn.
            - Check all gasoline hoses, insecticide lines, and fittings for cracks, leaks, or wear. Replace if needed.
            - Check all bolts and fasteners and tighten as necessary.
            - Ensure that pesticide tanks have sufficient chemicals for the assigned spray mission.
            - Check all nozzle parts for wear or physical damage. Replace damaged parts.
            - Inspect blower air filter for cleanliness and serviceability.
            - Check engine oil. Add oil as needed.
            - Check fuel level.
            - Start engine, listen for any unusual noises, and watch for excessive smoke or any engine oil leaks.
        - Repairs and services – Needed repairs and services on ULV equipment will be performed by Public Works appointed mechanics.
- Ground Larviciding
    - Ground larviciding is conducted by the UCMAD staff daily using various products throughout the season

- Hand treatments are conducted within Utah County by licensed personnel using their best professional judgment. These treatments take place on a daily basis. Listed sites are visited weekly and surveyed for the presence of larvae. Some sites may be pretreated where historic data justifies such actions. Equipment used during hand treatment work includes small 1-gallon or 1-quart-sized hand sprayers, hand-held seeders for dispensing granular pesticide, Maruyama Backpack Duster, backpack pump sprayers, 6-wheeler with pressurized tank and wand sprayers, also with Herd seeders, and pressurized 15-gallon truck-mounted sprayers that are calibrated prior to each season. Drones are also used to treat larger areas or areas that are difficult to access.

**Pest Surveillance Procedures**

- Adult Surveillance
    - Service request inspections are taken from telephone, from telephone messages, and from emails (on our website). Many of these are simple requests for treatments, although occasionally such calls lead to finding problems needing attention. Technicians generally will check for mosquito larvae and determine if adult populations warrant treatment during these inspections based on observed densities.
    - CDC light trap collections are used for both nuisance mosquito census and WNV surveillance. Currently, 15 CDC light traps are deployed on Monday evenings to monitor mosquitoes throughout the valley. Tuesday evening, 6 traps are set to monitor mosquitoes near the lake to determine the need for air spray. On Wednesday, 1 trap is set. Additionally, 3 locations are monitored using a rotator bottle trap to study the behavior (peak of activity) of different mosquito species in Utah County.
    - Four New Jersey traps are used to monitor residential areas in Orem, Provo, Spanish Fork, and Springville. These are plugged into a power supply and run continuously throughout the summer. They are emptied weekly.
- Larval Surveillance
    - Service request inspections performed by Vector Control personnel will check for mosquito larvae and determine if adult populations warrant treatment during these inspections
    - Breeding site inspections are conducted by Vector Control personnel following flooding events caused by rain, snow melts, or farmers. Larval surveillance entails locating the larval source (if not already known), sampling for larvae and estimating larval density, determining larval developmental stage(s), and collecting larvae for identification purposes. Other factors considered during larval inspections include the type of environment (pond, ditch, etc.), the presence of aquatic vegetation, and whether any natural predators (like fish) are present.
- Disease Surveillance
    - Mosquito pool analysis is the most useful indicator of the presence of WNV, SLE, or WEE in our service area. Up to 100 adult mosquitoes using qPCR technology are

tested for WNV, SLE, and WEE. We test all pools of *Cx. tarsalis*, *Cx.pipiens* and *Cx.erythrothoric* (the most important human vector of WNV, SLE, and WEE) during the summer.

**Assessing Environmental Conditions Procedures**

- General Considerations
  Climatic conditions are always checked prior to any ground applications. Wind speed, wind direction, and the possibility of impending rain must be taken into consideration whether applying liquid or solid products because of drift, dilution, or chemical breakdown, depending on the product being used. Temperature also plays a role in our application methods, especially the timing of application and the choice of products used.
- Adult mosquito treatments.
  Treatments for adult mosquitoes occur in both urban and rural areas of the county. Applicators are always aware of nearby crops, blooming crops, and beehive locations, and turn spray equipment off when necessary to avoid drift into such areas. Similarly, equipment is also turned off when approaching large bodies of water, such as lakes and ponds, to comply with label specifications.
- Ground Adulticiding Procedures
  - Apply when insects are most active and meteorological conditions are conducive to keeping the spray cloud in the air column close to the ground. Rotator bottle trapping data has indicated this is between dusk and 1:00 AM under normal meteorological conditions.
  - Apply during the cooler hours of the night when thermal activity is low. Do not apply when the ambient temperature is less than 50 F.
  - Apply when ground wind speeds are equal to or greater than 1 mph but less than 10mph.
  - Do not apply over bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes, or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body.
  - Pesticides can be highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply product or allow drift when bees are actively visiting the treatment area, except when applications are made to prevent or control a threat to public and/or animal health determined by a state, tribal or local health or vector control agency on the basis of documented evidence of disease causing agents in vector mosquitoes, or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.
  - To minimize hazard to bees, it is recommended that the product is not applied until dusk or later, when bees are not foraging and are in their hives.

    - UCMAD Vector Control personnel will attempt to locate hives in the spring prior to spraying. Apiarists are encouraged to contact UCMAD as to the locations of hives. They are required by Utah Rule R68 to have their hives registered and licensed with the Utah Department of Agriculture and Food. The application of spray for mosquito control in the evening hours, according to the label, should avoid any bee damage by UCMAD. Beekeepers should be aware that agricultural applications of pesticides often have the same active ingredients as those used by Mosquito Control Agencies, but are typically applied during the day when bees are active.
- Air Adulticiding Procedures
    - Air spraying mosquitoes is contracted with an independent contractor. They are required to have their own liability insurance and containment. UCMAD will provide the chemicals via vendor to their storage facility. They load and apply chemicals according to the prescribed label requirements of the product used.
- Larval mosquito treatments
    - Two major environmental considerations are the tree canopy and the amount of aquatic vegetation present within the treatment site. Tree canopy may deflect or otherwise prevent the penetration of pesticide from reaching the target area. Heavy vegetation within a wetland can interfere with the migration of the larviciding agent through the water column.

## Pertaining to Other Actions Necessary to Minimize Discharges

### Spill Response Procedures

- The suggested guidelines in the event of a chemical spill are known as the three Cs: Control the spill, Contain it, and Clean it up. This procedure is described in the National Pesticide Applicator Certification core manual and required by the State of Utah Department of Agriculture and Food for certification (see addendum at the end of this document). Personnel all have a binder with labels and MSDS sheets for all chemicals used by UCMAD. Regular training occurs during staff meetings. PPE and spill kits are provided in each vehicle.

### Adverse Incident Response Procedures

- To help avoid or at least minimize adverse incidents, the UCMAD applicators turn off spray equipment when approaching areas with high human activity, such as outdoor sport practices, games, or other events.
- We maintain a list of individuals who have informed us of any sensitivity to the products we use. These homes are avoided if possible or informed about spray schedules in case of a health threat, enabling these individuals to avoid contact with these products altogether.
- In addition, our 'no spray" list extends to certified backyard organic gardeners and registered, licensed beekeepers to ensure the integrity of their crop and the safety of their apiary, respectively. A distance of 300' on each side of the identified property will be used as a buffer zone. In case of a disease event/threat, this buffer zone may shrink.

### Pesticide Monitoring Schedules and Procedures

- For application by, or under the supervision of, personnel certified/trained in public health pest control or mosquito control. For each application, a record must be kept of:
    - Date, time, and areas where the application occurred
    - Dilution (if applied) and application rate
    - Speed of the application vehicle
    - A description of the insecticide delivery system used for the specific application
    - Climate factors (e.g., ambient temperature, wind speed/direction) as determined using a reliable means
    - Employees involved in mixing, loading, and applying the pesticides
    - These records must be kept by the responsible public agency or their designee for a minimum of two years using storage methods that will allow the records to be easily retrieved

### Insecticides – Modes of Action

Most people know that insecticides kill insects. However, the way in which these chemicals work is less understood. How an insecticide works is called its mode of action. A complete understanding of the mode of action of an insecticide requires knowledge of how it affects a specific target site within an organism. The target site is usually a critical protein or enzyme in the insect, but some insecticides affect broader targets. Although most insecticides have multiple biological effects, toxicity is usually attributed to a single major effect.

#### Larvicides and Adulticides – Organophosphates

Organophosphate insecticides affect the nervous system. These insecticides are synaptic poisons. The synapse is a junction between two nerves or a nerve connection point (hence the name synaptic poison). Specifically, organophosphate insecticides bind to an enzyme found in the synapse called acetylcholinesterase. This enzyme is designed to stop a nerve impulse after it has crossed the synapse. Organophosphates insecticides bind to and prevent the enzyme from working. Therefore, poisoned synapses cannot stop the nerve impulse. Consequently, continued stimulation of the nerve occurs as observed with pyrethroids. Poisoned insects exhibit tremors and uncoordinated movement.

#### Larvicides - Growth Regulators

These chemicals are typically referred to as insect growth regulators or IGRs. IGRs act on the endocrine or hormone system of insects. These insecticides are specific for insects, have very low mammalian toxicity, are non-persistent in the environment, and cause death slowly. Most of the currently registered IGRs mimic the juvenile hormone produced in the insect brain. Juvenile hormone tells the insect to remain in the immature state. When sufficient growth has occurred, the juvenile hormone production ceases, triggering the molt to the adult stage. IGR chemicals, such as methoprene, mimic the action of juvenile hormone and keep the insect in the immature

state. Insects treated with these chemicals are unable to molt successfully to the adult stage and cannot reproduce normally.

**Larvicides – Bacteria**

Bacillus thuringiensis var. israelensis (Bti) is a naturally occurring bacterium that produces a crystalline protein toxin (crystal) and a spore. The larval activity of Bti formulations is due to the presence of the protein toxin. The spore has no larvicidal activity. For mosquito larvae, many factors are necessary to produce the toxic effects of Bti crystals. If the crystals are available in sufficient quantity, to suffer toxicity and die, a larva must: 1) Capture and ingest the crystals, 2) Possess a digestive tract with a highly alkaline pH, 3) Possess the enzymes capable of liberating the toxic proteins, and 4) Possess the gut membrane receptors, compatible with the soluble toxins. Bti-based products are not insecticides of contact. The active ingredient (crystals) must be ingested to show a toxic activity. This very specific mode of action makes it very safe for non-target organisms present in the same environment.

Bacillus sphaericus (Bs) is also a naturally occurring, spore-forming bacterium found throughout the world. At the time of sporulation, Bs produces crystallin proteins (as in Bti but different), toxic for many species of mosquito larvae upon ingestion.

**Larvicides/Pupicides**

Very refined oil or surfactants can be used as larvicides/pupicides. These products have the ability to kill both larvae and pupae. Using conventional spraying methods, the oil is sprayed on the water surface. The film reduces the surface tension of the water, making it difficult for the mosquito larvae and pupae to attach to the surface, which causes them to drown. Emerging mosquitoes are unable to fully emerge and will drown. Mosquito larvicide and pupicide are effective on all species of mosquitoes that breed in standing water and require the air/water interface in their lifecycle.

**ULV Adulticides – Pyrethroids**

Pyrethroids are synthetic chemicals whose structures mimic the natural insecticide pyrethrin. Pyrethrins are found in the flower heads of plants belonging to the family Compositae (e.g., chrysanthemums). These insecticides have a unique ability to knock down insects quickly. Synthetic pyrethrins (also known as pyrethroids) have been chemically altered to make them more stable. Pyrethroids are axonic poisons (they poison the nerve fiber). They bind to a protein in nerves called the voltage-gated sodium channel. Normally, this protein opens, causing stimulation of the nerve, and closes to terminate the nerve signal. Pyrethroids bind to this gate and prevent it from closing normally, which results in continuous nerve stimulation. This explains the tremors exhibited by poisoned insects. They lose control of their nervous system and are unable to produce coordinated movement.

Pyrethroids are used most of the time with piperonyl butoxide (PBO), which is a synergist that is usually incorporated within the final products. PBO enhances the effect of pyrethroids by inhibiting an enzyme (cytochrome P450) produced by the insect to break down the pesticides. The PBO

allows the insecticides to be effective with less active ingredient than would otherwise be required.

References: Insecticides Used in the Urban Environment: Mode of Action. S. M. Valles and P.G. Koeler, http://edis.ifas.ufl.edu/IN077. Cognis.
http://www.mosquitommf.com/AgniqueBrochureWeb.pdf

All pesticides used by UCMAD are registered with the State of Utah and the EPA.

**Pesticides: List of Pesticides (Labels & MSDS)**

The following pesticides are currently used by UCMAD to control mosquito larvae (larvicides) or adult mosquitoes (adulticides).

**Larvicides - Growth Regulators**

- Altosid WSP (Label / SDS)
- Sumilarv 0.5G WSP (Label / SDS)
- METALARV (Label/SDS

**Larvicides - Bacteria**

- VectoLex WSP (Label / SDS)
- VectoMax FG (Label / SDS)·
- Vecto Max WSP (Label / SDS)
- Vecto Prime FG (Label / SDS)

**Larvicides/Pupicides**

- Kontrol Mosquito Larvicide (Label / SDS)
- BVA 2 Mosquito Larvicide Oil (Label / SDS)

**ULV Adulticides — Pyrethroids**

- ZENIVEX E4 (Label/MSDS)
- DUET (Label/MSDS
- REMOA- TRI (Label/MSDS

**ULV/Airspray Adulticide-Organophosphate**

- Dibrom (Label/MSDS)