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Magna Mosquito Abatement District's Pesticide Discharge Management Plan (PDMP)

Finalized on January 4, 2012

Salt Lake County, Utah

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Introduction

The Pesticide General Permit (PGP) to point source discharges to waters of 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 Magna Mosquito Abatement District (MMAD) is eligible for coverage under the PGP. Also as an “Operator Group 2” defined in Part 1.D.1, the MMAD must submit an NOI regardless of the size of the area to be treated. The NOI was submitted to the Department of Environmental Quality on January 5, 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 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 MMAD 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 a description of the different control methods implemented.

_____ Date: ___1/4/2012_____

Ryan Lusty
Manager
Magna Mosquito Abatement District

1. Pesticide Discharge Management Team Information

All persons may be contacted at:
Magna Mosquito Abatement District

PO Box 40
2611 South 9080 West
Magna, Utah 84044

Phone: 801-250-7765
Fax: 801-250-4161
Email: magnamosq@yahoo.com

A. Pesticide Discharge Management Team.

   a. Manager: E. Ryan Lusty
   b. District Clerk: Judy Desmond
   c. 8-10 seasonal employees

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

   a. Manager: E. Ryan Lusty
   b. Field Technician Supervisor (Seasonal employee)

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

   a. Manager: E. Ryan Lusty

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

   a. Manager: E. Ryan Lusty

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

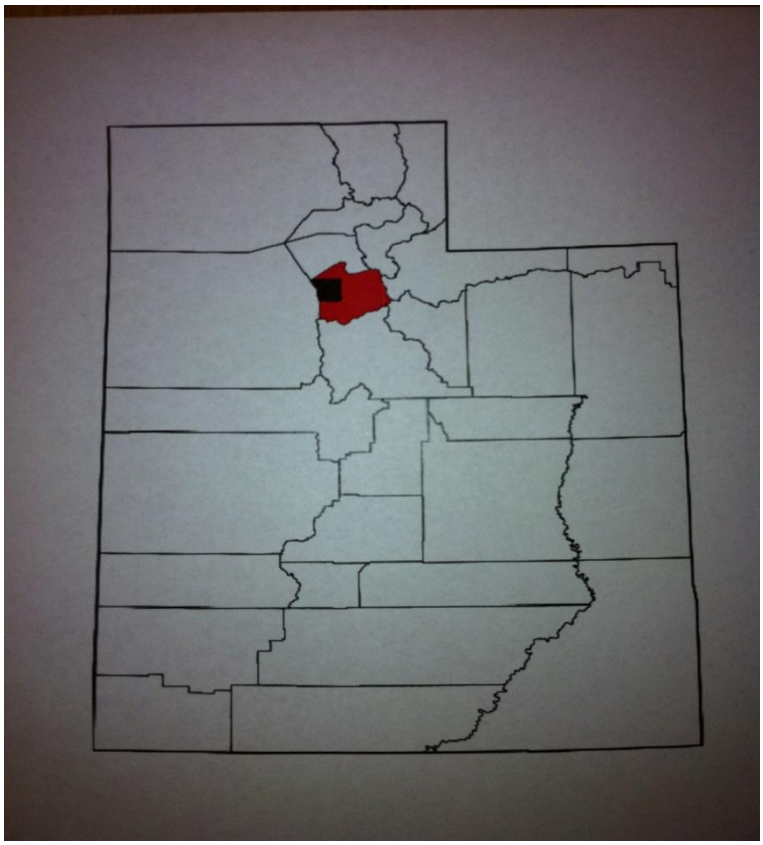
   a. Manager: E. Ryan Lusty
   b. All seasonal employees under direction of the Manager.

F. Each of the preceding items, are under oversight supervision by Magna Mosquito Abatement District Board of Directors

2. Pest Management Area Description

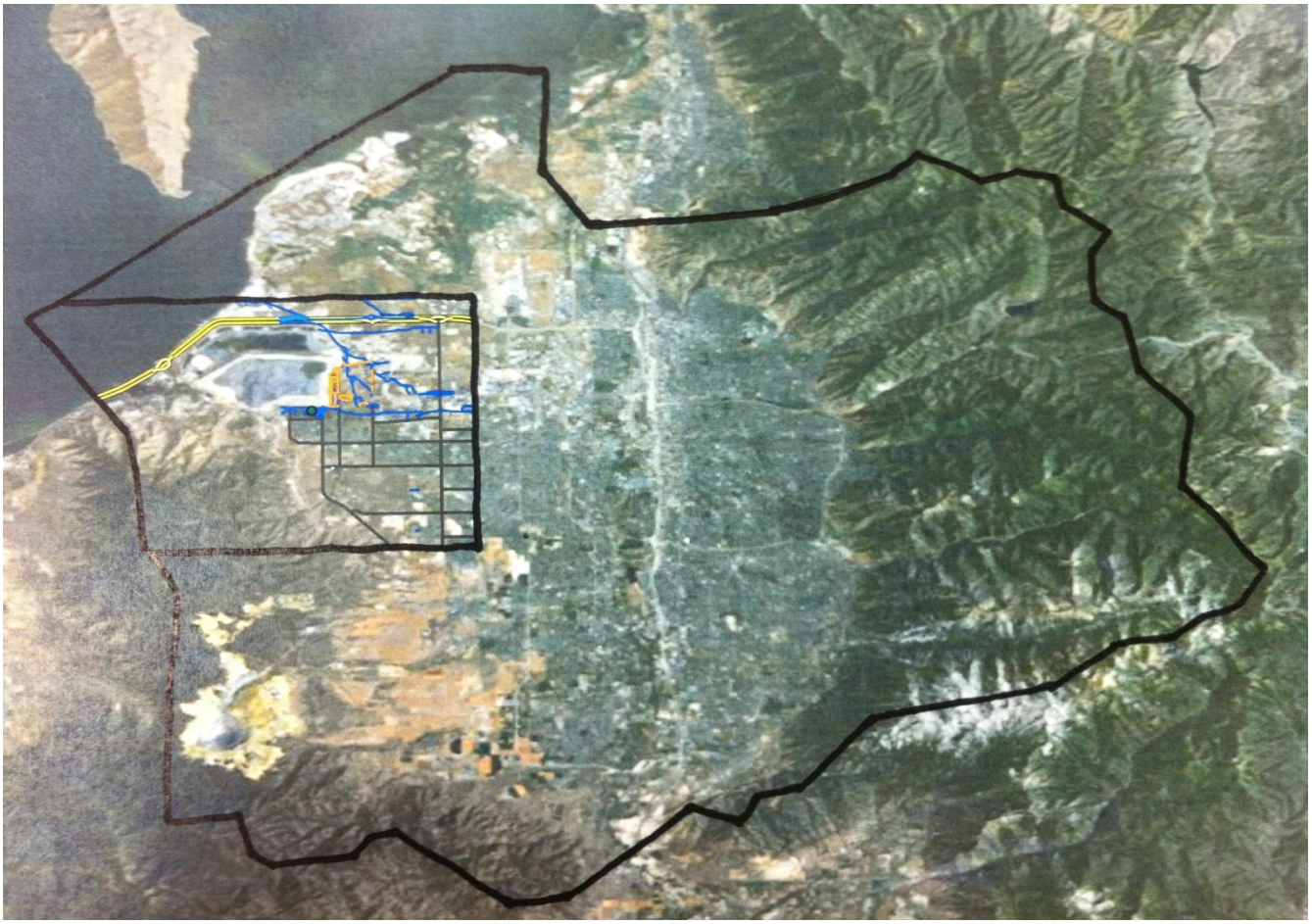
A. Pest Problem Area Description:

1. Salt Lake County is located in the north and center of Utah within the Salt Lake Valley. The Magna District is located in the western portion of the county. The Districts northern border is 700 North, the south border is 6600 south, the west border is the Tooele County line and the east border is 4800 west. The District includes portions of West Valley City, Salt Lake City, and the township of Kearns. The District also includes the entire township of Magna. Total area within the district is 154.25 square miles or 99,190 acres. (See Arc GIS map below) Pest problem areas are separated into 2 broad areas within our service district that can be further divided into more specific groups based on habitat type.



(Fig. 1, The State of Utah with Salt Lake County in red and Magna MAD in black.)

2. The first area is referred to as the A district. Everything South of the 201 highway/freeway is referred to as the A district. Most of this area is urbanized with a few fields and acreage closer to the freeway. The majority of control efforts in the A district are done by bicycle. A crew is tasked with going through neighborhoods to treat gutters and backyard ponds.



(Fig. 2 Salt Lake County with the Magna MAD blocked out on the west side)

2. The second area is referred to as the B district. Everything North of the 201 highway/freeway is referred to as the B district. Most of this area is owned by Rio Tinto or the Salt Lake County Landfill. Most of the mosquito producing area within the B district is salt marshes. Vegetation in this area is salt grass, phragmites, moss and lichen. Treating these areas is done by hand, ATV (4-wheeler) or track vehicle.

B. Natural Environments

1. River and creek floodplains in Salt Lake County are associated with The Great Salt Lake tied to Utah Lake by the Jordan River which runs between them. There is no part of the Jordan River inside the Magna District. The District is concerned with Kersey Creek and Brighton Drain on the west side of the Salt Lake Valley. From March until late July the District monitors spring ponds from winter storms and runoff. Each creates a distinct issue to deal with from phragmites near the drains, Russian olive trees growing near ponds and salt marshes around the Great Salt Lake. Mosquito species commonly found in these environments include *Culex tarsalis, Culiseta inornata, Anopheles freeborni,* and a number of floodwater species of *Ochlerotatus* genus.

2. Salt marsh ponds, pools and depressions are wetlands occurring throughout the district from winter storms and mountain runoff. Examples of these habitats include salt grass ponds, wire grass ponds, phragmites ponds and algae ponds. These usually occur in the wet seasons and slowly dry up throughout the summer depending on spring and summer storms. *Ochlerotatus dorsalis, Aedes vexans,* and *Aedes campestris* usually occur in early spring while *Culex tarsalis*, and *Culex erythrothorax* occur toward middle and late summer.

3. Wells, springs, ditches and sloughs are dispersed throughout the district. These areas are affected by the water table, runoff and storms. Wells and springs are habitat that produces *Anopheles freeborni*, the malaria mosquito, in abundance.

4. Other natural environments include, seeps, tree holes, tree cavities and burrows made by environmental factors as well as various species of wildlife. However, these as a whole are generally not a pressing concern to our mosquito program, although tree holes play a major role in the biology of *Ochlerotatus sierrensis* which is a vector for dog heartworm in the west.

C. Man-made Environments

1. Ditches and canals are frequently suggested as sources of mosquito problems by the general public. However, these structures usually contain fish, and are seldom the primary source of a mosquito infestation, especially if these systems tend to hold water on a permanent basis. On the other hand, shallow, roadside ditches do contribute to mosquito populations at times. Such sites often remain dry throughout much of the year or because of temperature, oxygen content, or other factors do not support fish life. Mosquito species encountered in such sites include *Aedes vexans*, and many species of *Ochlerotatus*.

2. Ditches and canals do become a problem when they are used for agricultural purposes such as flood irrigation for livestock and fields. These fields can become a problem for the District because they can be a nursery for multiple

mosquito species. Ochlerotatus, Aedes and Culex species can all be found depending on how long the water stays in the field.

3. Construction projects can create new areas that were previously un-checked. Often such work tends to scar the land with trenches and ruts from heavy equipment used in the process. These newly established “lows” can hold water for prolonged periods of time. Such sites are productive as larval mosquito sites until they are developed.

4. Livestock pastures can pose a serious problem to mosquito abatement agencies, as the livestock not only provide a reliable blood meal for female mosquitoes, but form numerous larval habitats from their hoof prints. Maintenance of livestock water is critical to mosquito control as well. Water in troughs should be recycled frequently in order prevent the trough from becoming a mosquito nursery. Mosquito species associated with pastures include *Aedes vexans*, *Culex pipiens and Culex tarsalis.*

5. Storm drains, catch basins, backyard ponds and green pools are found in the more developed areas of the county, and provide a pristine environment for *Culex pipiens,* our primary West Nile Virus vector.

6. 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. Containers serve as a primary source for mosquitoes in urban areas. The District relies heavily on homeowners to either take care of these containers, or call us for assistance.

7. Other man-made sites include borrow-pits, agricultural fields, retention and detention ponds. These areas generally do not cause problems except during drought conditions as many will contain fish. Agricultural fields often have flood gates used for flood irrigation that can cause problems if the water is not changed often enough or left for no reason.

D. Pest Problem Description

1. The State of Utah is known to contain 50 species of mosquitoes, although Magna Mosquito Abatement actively surveys and conducts control efforts primarily on 10 species. These species are: *Ochlerotatus Campestris, Ochlerotatus Dorsalis, Ochlerotatus Sierrensis, Ochlerotatus Nigromaculis, Culex Erythrothorax, Culex Pipiens, Culex Tarsalis, Aedes Vexans, Culiseta Inornata* and *Anopheles Freeborni.* Other mosquito species that may be found within the State of Utah have not been found within the boundaries that the District controls and are therefore not listed. Should these species be found in the future they will be listed here and controlled in some measure. *

    a. *Ochlerotatus Campestris*: A single-brooded species. The larvae occur from March until early June and are found chiefly in alkaline pools at elevations

below 7,000 feet. Adults emerge from April to mid-June and may persist until late August. This species can be a severe nuisance in localized areas in late spring and early summer. Larval behavior is unusual in that larvae often hang suspended at levels between the surface and bottom of the pool.

b. *Ochlerotatus Dorsalis:* A multi-brooded species. The larvae usually first appear in March and continue to occur until freezing weather in October. Larvae are found in pools produced by fluctuation water levels in marshy and salt grass areas. Irrigation waste water is also an important source. Alkaline waters appear to be preferred. Under favorable conditions as many as ten successive broods may occur during a single season. Adults are on the wing from March until October. The species occurs in all counties of the state and is one of the most abundant and annoying pests; females often migrate several miles from emergence sites. The species has also been implicated as a vector of California Encephalitis (CE).

c. *Ochlerotatus Sierrensis*: This species is apparently restricted to northern Utah from Salt Lake County north along the Wasatch Front and northeast along the Weber River drainage and into cache County. Larvae have not been collected east of the Wasatch Mountains. Larvae have been collected in tree holes in many different species of deciduous tree, but are more commonly collected in maples and cottonwoods. Larvae overwinter during mild winters and in large tree holes. Females are a source of considerable annoyance in urban areas. Biting occurs more intensively at dusk, but will occur in shaded areas during the day. Mating occurs when males are attracted to females attempting to bite. This species is a major vector of dog heart worm and has been implicated in producing the infection in dogs in northern Utah.

d. *Ochlerotatus Nigromaculis*: A single-brooded mountain species. The larvae occur from early June until early July at elevations between 8,000 to 10,500 feet. The adults emerge from mid-June to mid-July and remain until early August. The females are persistent biters and readily enter dwellings to feed.

e. *Culex Erythrothorax*: This species is widely distributed in Utah. Larvae are usually found in deeper water marshy areas with heavy grass, tules and cattails. Larvae have also been found in muskrat runs. Mature larvae usually overwinter unless winter temperatures are severe. Females are aggressive biters particularly in late afternoon and after sunset. This species is known to be a vector of West Nile Virus.

f. *Culex Pipiens*: This species is one of the most common and abundant species in Utah. Larvae are found in a wide variety of natural and artificial sources which are often highly polluted with organic wastes. Larvae have been found in containers of various types, catch basins, ornamental pools, cesspools, swimming pools not completely drained, ditches and even tree holes. Females in Utah will readily enter dwellings and may be a source of

considerable annoyance even though they rarely bite. Major hosts are birds. Studies in the western United States show birds are taken over 95% of the time with various mammals constituting the rest. Humans represent less than 1% of the total. This species is known to be a vector of West Nile Virus.

g. *Culex Tarsalis*: This species is the chief vector of Western Equine Encephalitis, St. Louis Encephalitis and West Nile Virus in Utah (WEE, SLE, WNV). This species is one of the most common and widely distributed species in Utah with larvae being found from spring until early fall. Collections have been made at elevations up to 9000 feet. Females overwinter and become active in the spring when birds serve as a major host. Later females will turn to mammals and humans as a source of blood. WEE infections can thus be picked up from birds and transmitted to horses and humans. Light trap collections reach their peak during the summer months of June July and August and drop sharply in September. Larvae are found in a wide variety of semi-permanent and permanent sources of water in both rural and urban areas. Females bite primarily at dusk and after dark. Because of their abundant and vector capacity they are the most important mosquito in Utah. This mosquito has been responsible for several outbreaks of WEE and WNV in humans and horses in the state.

h. *Anopheles Freeborni*: This species is the most common *Anopheles* species in Utah and is widely distributed having been collected throughout the state. Larvae occur in a wide variety of fresh water pools or stream sides where growths of algae are present. Adults are avid biters and have been the most important vector of malaria in the western United States including Utah in the 19^{th} century.

i. *Aedes Vexans*: A multi-brooded species. Larvae occur principally in overflow pools along streams in the lower river valleys, but very commonly appear in pools created by irrigation water. In the Salt Lake Valley larvae are frequently found in marshy areas with fluctuating water levels, areas which also produce *Ochlerotatus Dorsalis*. Larvae may be encountered from March until early October and adults from April until October. *Aedes Vexans* is a very important pest mosquito in Utah and is widely distributed.

j. *Culiseta Inornata*: A common Utah species which has been collected in 23 counties, and probably occurs in all the rest. Larvae are found in a wide variety of permanent and semi-permanent waters, generally showing a preference for brackish or polluted waters in direct sunlight or partial shade. Larvae have been collected during the winter from pools covered with ice and may possibly, like the females, survive through the winter. The species has a great altitudinal range, having been collected from 2700 to over 9000 feet. Adult females will attack man, but prefer larger mammals. Females are capable of natural infection with the California Encephalitis Virus. This species is also known to be a very significant vector of West Nile Virus in horses.

E. Action Threshold

1. To better guide the Magna Mosquito Abatement District treat areas for adult mosquitoes, thresholds have been established by staff according to certain criteria. These criteria have been established based on the fact that Magna Mosquito Abatement District was created to treat and control the emergence of public health/nuisance mosquitoes. (We exist to limit mosquito transmitted disease.) If weather conditions are within parameters that the label requires, adult treatments can be made based on the following:

    a. >50 mosquitoes that are vectors of West Nile Virus or Dog Heartworm, i.e. *Culex Tarsalis, Culex Pipiens and Ochlerotatus Sierrensis* collected in any trap within the district.

    b. >50 nuisance mosquitoes, i.e. *Aedes Vexans, Ochlerotatus Dorsalis,* or *Ochlerotatus Campestris*, collected in any trap within the district.

    c. Service requests from residents:

        i. If this is a zone where a threshold is already reached (nuisance or vectors) spraying is already scheduled for that zone

        ii. If this is a zone where a threshold has not been met, a CDC trap is set up to assess the problem. If needed (see thresholds) spraying will be performed.

    d. Field supervisors reporting a larvicide failure at any breeding site located near populated areas.

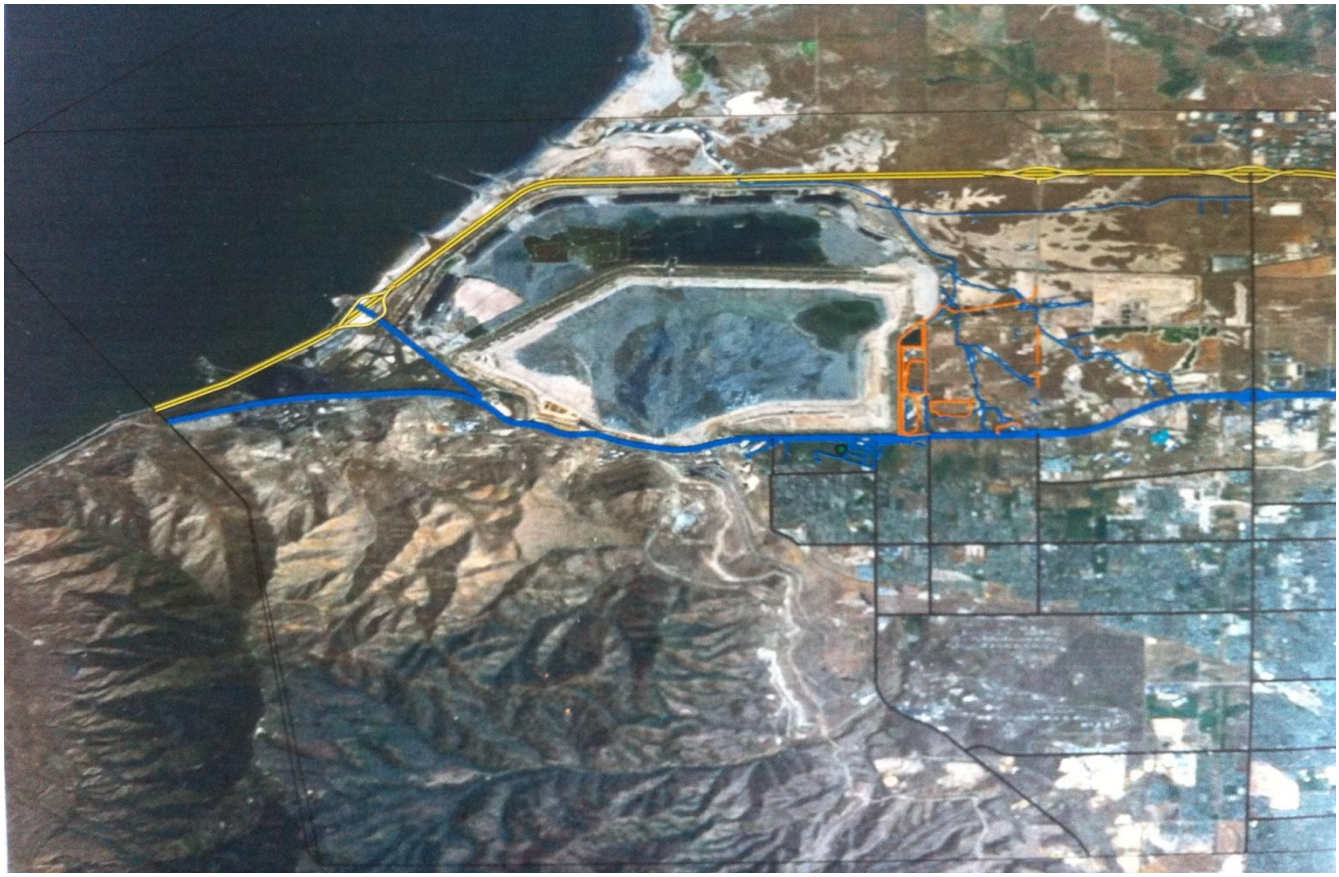
    e. Based on a service request, limited area treatments may be conducted prior to special events or community functions, i.e. 4th of July events, wedding receptions.
2. The following thresholds have been established to trigger larviciding treatments within our service area.

    a. Treatments of larval mosquito habitat may be conducted in areas that are found to contain an average of at least 1 larva per dip (using a standard 12 oz. dipper). Actual treatments will be based on local demographics, mosquito species present, and other historic and current conditions.

    b. A limited number of known historic breeding sites may be treated after major rain or flooding event if there is insufficient time to inspect and treat all larval sites within the district.

F. General Location

1. General map of the Magna District. The yellow line is I-80. The large blue line running through the center of the map is Highway 201. The black line to the north of I-80 is 700 North, the north border. The east border is 4800 West on the edge of the picture. The south border is 6600 South near the bottom of the picture. The West border is the faint black line running diagonal into the Great Salt Lake and down across the Oaker Mountains which is the Tooele County line. Every water source within the boundaries of the district is a potential breeding source for mosquito larvae. Any water within the border has the potential to be monitored and treated. Of course, every sight monitored will *not* necessarily be treated.



(Fig. 3. Magna District Border Map with Utah Waters shown.)

A. Larviciding: Control of mosquitoes at the larval stage is the primary method of mosquito control. It is the most effective way to stop mosquitoes at the source. Trained technicians survey potential larval habitats and use larvicides when larvae are found. Larvicides are pesticides added to the water in order to kill the mosquito larvae before they emerge as adults. Many of the products are applied by hand or with a power sprayer. This is done on foot, on all terrain vehicles (ATV's) or from trucks.

Some of the pesticides used for larviciding, both in granular and liquid formulations would include:

i. Chemicals (nerve toxins)
ii. Bacterial products
iii. Surface agents
iv. Growth regulators

B. 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 primarily used when there is a large possibility of disease transmission in an area such as West Nile Virus (WNV) 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 air currents and quickly kill mosquitoes that come into contact with them. ULV adulticides are applied in the evening, the night or pre-dawn hours when mosquitoes are most active (different peaks of activity depending on the species). ULV applications are only done during environmental conditions that ensure desirable product movement.

2. Chemicals used

A. Labels and Material Safety Data Sheets (MSDS) of all larvicides and adulticides used in our program are listed on our programs website (www.magnamosquito.com) and are available to the public. The modes of action for those different families of products are also described on the website.

B. 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 purposefully 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.

G. Water Quality Standards

Waterways in Salt Lake County and more specifically within the Magna District are not impaired by any pesticides used by the Magna Mosquito Abatement District.

3. Control Measure Description

1. 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:

   a. No Action or at least delayed action may be taken by the Magna Mosquito Abatement District at times when a major portion of the district has been inundated with water. When a large 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 date 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 surrounding areas. 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 mosquito larvae can complete their aquatic life cycle and no adults emerge.

   b. 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 Magna Water. Mechanical/Physical and cultural methods manipulate larval habitat to prevent favorable conditions for mosquito development. Physical manipulation of environments such as removing blockages in ditches that serve as barriers to natural predators of mosquitoes are sometimes quick and effective means to resolve problems on a localized level.

   c. Educational program and area events allow the opportunity to suggest ways that residents can assist in the prevention of mosquito problems by cleaning out and emptying containers in their yard that may provide larval habitat. Also be mindful of things like birdbaths and pet water bowls that can serve as mosquito sanctuaries if not properly maintained.

   d. Biological control products* can be used for the control of larval stages of mosquitoes. Formulation containing *Bacillus sphaericus* and/or *Bacillus thuringiensis israelensis* is used to treat flood water and other larval sites.

   e. 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.

   ***** A list of all insecticides (biological and chemical) used in the past or still in use is provided on the Magna Mosquito Abatement District website (www.magnamosquito.com). You can also find on our 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.

2. **Operators must consider impact to non-target organisms.** Operators must consider impact to water quality, pest-resistance, feasibility, and cost-effectiveness when evaluating and selecting the most effective and efficient means of pest management. The purpose of these precautions is to minimize pesticide discharge into the waters of Utah. Control measures are evaluated separately on the basis of mosquito life stage as follows:

   a. **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.

   b. **Larval control efficacy** is determined by dip counts pre and post treatment when using monomolecular films, larvicide oils, organophosphates and biological products (i.e. *Bti* and *B.sphaericus).* Efficacy can also be determined by trap counts pre and post treatment. Larval efficacy is more difficult than adult efficacy to determine depending on the method of treatment. With growth regulators the mosquito does not reach mortality until the later stages of its water life cycle.

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

A. Application rate and frequency procedures

1. Application rate determination

    a. Determine species and age of target mosquitoes

    b. Evaluate environmental conditions

    c. Consider target area flora and fauna

    d. Determine appropriate application rate based on product label recommendations, previous experience and efficacy tests

2. Frequency determination

    a. Determine target site treatment history with selected pesticide

    b. Evaluate effect of selected pesticide use on frequency and quantity thresholds for active ingredient

    c. Consider alternate treatment options

3. Resistance considerations

    a. 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.

    b. Consider the use of alternate control options

B. Spill prevention procedures

1. Perform weekly inspections of chemical storage rooms and the warehouse (garage) areas. Maintain buildings to full function capability

2. Keep OSHA requirements log (spill response supplies, PPE locations, chemical list) up to date.

C. Pesticide application equipment procedures

1. Ground adulticiding

a. 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 startup of spray equipment.

- Routine cleaning and maintenance of the spray system must be performed to ensure system is operating properly.

b. Maintenance:

- Daily, weekly and monthly checks – visually check the fog generator each day before use and make any necessary adjustments/repairs. Before making any adjustments/repairs make sure that proper PPE is worn.

- Repairs and services on ULV equipment will be performed by an appointed mechanic only.

    a. Check all gasoline hoses, pesticide lines and fittings for cracks, leaks and wear. Replace as needed.

    b. Check all bolts and fasteners. Tighten as necessary.

    c. Ensure that all pesticide tanks have sufficient chemicals for the assigned treatment task.

    d. Check all nozzle parts for wear or physical damage.

    e. Inspect blower air filter for cleanliness and serviceability.

    f. Check engine oil. Add oil as needed.

    g. Check fuel level.

    h. Start engine, listen for any unusual noises and watch for excessive smoke and oil leaks

2. Ground Larviciding

a. Ground larviciding is conducted by the Magna Mosquito Abatement District in a number of situations using various products throughout the season.

b. Hand treatments are conducted within the Magna district by licensed personnel using their best professional judgment. These treatments usually take place on a daily basis. Mapped sites are visited weekly and surveyed for the presence of larvae. Some sites may be pre-treated where historical data justifies such action. Equipment used for hand treatments include 3-6 gallon spray cans, granule bags that hold up to 20 lbs, herd seeders mounted on the back of a 4-wheeler (holds 50 lbs of granules), and a 120 gallon spray tank mounted on the back of a swamp track vehicle that is calibrated prior to each season.

D. Pest Surveillance Procedures

1. Adult Surveillance

a. Service request inspections are taken from telephone, telephone messages and emails (on our website). Many of these are simple requests for treatments, although occasionally these calls will lead to finding problems that need closer inspection and attention. Technicians will generally check for mosquito larvae and determine what if any treatment should occur. Technicians also observe adult populations in the area and determine whether the population densities warrant treatment.

b. CDC trap collections are paramount to our vector surveillance (including WNV). This trap is very effective in catching *Culex Tarsalis* and *Culex Pipiens*. Both primary vectors of West Nile Virus. Between six to twelve traps are deployed throughout the district every week during the mosquito season.

c. New Jersey Light traps along with CDC traps are used weekly for population surveys of nuisance and vector mosquitoes. Up to Twenty-four traps are distributed throughout the district on a weekly basis.

2. Larval Surveillance

a. Service request inspections performed by our field technicians will check for mosquito larvae and determine whether adult populations warrant treatment during these inspections.

b. Breeding site inspections are conducted by our field technicians following flooding events caused by rain, snow melt, and irrigated fields. Larval surveillance entails locating the larval source (if not already known), sampling for larvae, estimating larval density, determining larval developmental stage(s) and collection of larvae for identification purposes. Other factors considered during larval inspections include the type of environment (pond, drain, etc.), presence of aquatic vegetation, and if any natural predators (like fish) are present.

3. Disease Surveillance

a. Mosquito pool analysis is a useful indicator for the presence of WNV in our service area. Up to 100 adult mosquitoes (RT-PCR technology) are grouped to form a single sample and sent to the Utah State Health Laboratory for analysis. When WNV is detected in one of our mosquito pools surveillance and treatment activities are intensified in that area.

b. Chicken flock surveillance is another method used by Magna Mosquito Abatement District to determine WNV activity. Three flocks are placed in separate locations in May. Blood samples are taken every other week until WNV is detected and then samples are taken each week. Blood samples are mailed to the Utah Veterinary Diagnostic Lab in Logan, Utah to be tested. When WNV is found in a chicken, surveillance and treatment activities are intensified in that area.

c. Both methods of disease surveillance used by Magna Mosquito Abatement District provide different information. Positive mosquito pools show that WNV is present in the area. A positive blood test for WNV means that the virus is being transmitted from host to host.

E. Assessing Environmental Conditions Procedures

1. 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. Depending on the product used, time and temperature are specified on the label.

2. Adult Mosquito Treatments

Treatments for adult mosquitoes occur in both urban and rural areas of the district. Applicators are always aware of nearby crops, blooming crops and bee hive locations. Applicators are instructed to turn off spray equipment when necessary to avoid drift into such areas. Similarly, equipment is turned off when approaching large bodies of water, such as lakes and ponds to avoid any adverse reactions to non-target organisms in these environments.

a. 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.

- Apply during the cooler hours of the night or early morning when thermal activity is low. Do not apply when ambient temperature is lower than 50°F.

- Apply when ground wind speeds are equal or greater than 1 mph or less than 10 mph.

- 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.

- If a pesticide is highly toxic to bees exposed to direct treatment on blooming crops or weeds, applicators do not apply that 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 state, tribal, 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 the hazard to bees it is recommended that the product is not applied more than two hours after sunrise or two hours before sunset, limiting application to times when bees are least active

- Known bee keepers will be notified at the beginning of the season of areas susceptible to be sprayed during the season based on spraying of previous years. Bee keepers can then decide whether moving the bees would be in their best interest to protect bee colonies.

3. Larval Mosquito Treatments

Two major environmental considerations are 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.

F. Pertaining to Other Actions Necessary to Minimize Discharges.

1. Spill Response Procedures
   a. The suggested guidelines in the event of a chemical spill are known as the three C's: Control the spill, contain the spill 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).

2. Adverse Incident Response Procedures

   a. To help avoid or at least minimize adverse incidents, Magna Mosquito Abatement District applicators turn off spray equipment when approaching areas with high human activity, such as outdoor sport practices, games or other events.

   b. If requested, we can also maintain a proactive courtesy call list for individuals that inform us of any sensitivity to the products we use, enabling these individuals to avoid contact from these products all together.

   c. In addition our courtesy call list extends to backyard organic gardeners and beekeepers to insure the integrity of their crop and ensure the safety of their apiary, respectively.

3. 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:

     a. Date, time, and areas where application occurred.

     b. Dilution (if applied), application rate and speed of application vehicle.

c. A description of the pesticide delivery system used for the specific application.

d. Climate factors (ambient temperature, wind speed/direction) as determined using a reliable means.

e. Employees involved in mixing, loading and applying the pesticides.

f. 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.

5. Insecticides – Modes of Action

Most People know that insecticides kill insects however the way in which these chemicals work is a mystery to most of us. How a pesticide 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 effect broader targets. Although most insecticides have multiple biological effects, toxicity is usually attributed to a single major effect.

A. Larvicides and Adulticides – Organophosphates

Organophosphorus 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 organophosphorus insecticides bind to an enzyme found in the synapse called acetyl cholinesterase. This enzyme is designed to stop a nerve impulse after it has crossed the synapse. Organophosphorus 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.

B. 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 the 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 larvae 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 solubilized toxins. Bti-based products are not insecticides of contact. The active ingredient (crystals) must be ingested to show any toxic activity. This very specific mode of action makes it 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 crystalline proteins (as in Bti but different) toxic for many species of mosquito larvae upon ingestion

C. Larvicides – Growth Regulators

These chemicals are usually known as insect growth regulators or IGR's. IGR's 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 IGR's 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.

D. Larvicides / Pupicides

Very refined oil or surfactants can be used as larvicides/pupicides. These products have the ability to kill both larvae and pupae. The district uses both oil and surfactants in our control efforts.

Golden Bear 1111 is a highly refined petroleum based product that is used only on the pupal stage of the mosquito. This is a last resort material that is used to prevent adult emergence. It works by changing the surface tension of the water surface, causing both the larval and pupal stages to drown. Because of its potential to affect other air-breathing aquatic insects, this insecticide is the least preferred mosquito control method used by the District. This insecticide does break down quickly in the environment, persisting as an effective surface film for only a few hours at best. Complete breakdown of this insecticide occurs within a few days.***

The surfactant is also called a monomolecular film (MMF). Using conventional spraying methods, the invisible MMF quickly spreads over standing water habitats. 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 adult mosquitoes are unable to fully emerge and therefore drown. MMF's are effective on all mosquito species that breed in standing water and require the air/water interface in their lifecycle.

E. 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 the 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 most of the time used with piperonyl butoxide (PBO) which is a synergist which is usually incorporated in 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.

6. Certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

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References:

*(All mosquito descriptions are taken from the Utah Mosquito Abatement Association's, Mosquitoes of Utah and are used with permission from the UMAA.)

Insecticides Used in the Urban Environment: Mode of Action. S.M. Valles and P.G. Koehler, http://edis.ifas.ufl.edu/in077

*** http://www.napamosquito.org/Pesticide/pesticide.htm