SHASTA MOSQUITO AND VECTOR CONTROL DISTRICT

19200 Latona Road, Anderson, CA 96007
Telephone: (530) 365-3768 Fax: (530) 365-0305
Web: shastamosquito.org

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Philip Isorena, Chief
NPDES Wastewater Unit
State Water Resources Control Board
Division of Water Quality
PO Box 100
Sacramento, CA 95812-0100

Mr. Isorena,

Enclosed is the requested addendum to the District's Pesticide Application Plan (PAP) for the NPDES Vector Control Permit Application No. CAG 990004.

If more information is required, please contact the District.

Sincerely,

Peter Bonkrude
District Manager

ADDENDUM to Shasta Mosquito and Vector Control (SMVCD) Pesticides Application Plan (PAP) for General Permit No. CAG 990004

Description of ALL target areas: surface waters and waters of the U.S. within District boundaries

In prior years, the District has applied adulticides and/or larvicides directly to or in the vicinity of the following water bodies:

Sacramento River	Shasta Lake	Anderson Creek	Battle Creek	Bear Creek	Churn Creek	Clear Creek	Cottonwood Creek	Cow Creek
Stillwater Creek	Sulphur Creek	McCloud River	Pit River-Big Bend	Pit River-Burney	Upper Sacramento River	Upper Clear Creek	Falks Lake	Middle Creek
Olinda Creek	Buckeye Creek	Dry Creek	Oak Run Creek	Clover Creek	Ash Creek	Sheridan Creek	Swede Creek	French Creek
Clough Creek	Jenny Creek	Basin Hollow Creek	Deep Hole Creek	Yank Creek	East Valley Creek	Elks Creek	Manzanita Creek	Mirror Lake
Moody Creek	Nelson Creek	Newtown Creek	Oat Creek	Olney Creek	Salmon Creek	Soda Creek	Fall Creek	Deer Creek
Flume Creek	Sweetbriar Creek	Spring Branch						

In prior years, the District has applied adulticides and/or larvicides directly to or in the vicinity of canals, ditches, or other constructed conveyance facilities owned and controlled by:

Keswick CSD	Buckeye WTP	Shasta CSD	Centerville CSD
City of Redding	City of Shasta Lake	Mountain Gate CSD	Anderson-Cottonwood Irrigation District

SEE ATTACHED Shasta Mosquito and Vector Control Best Management Practices (BMP)

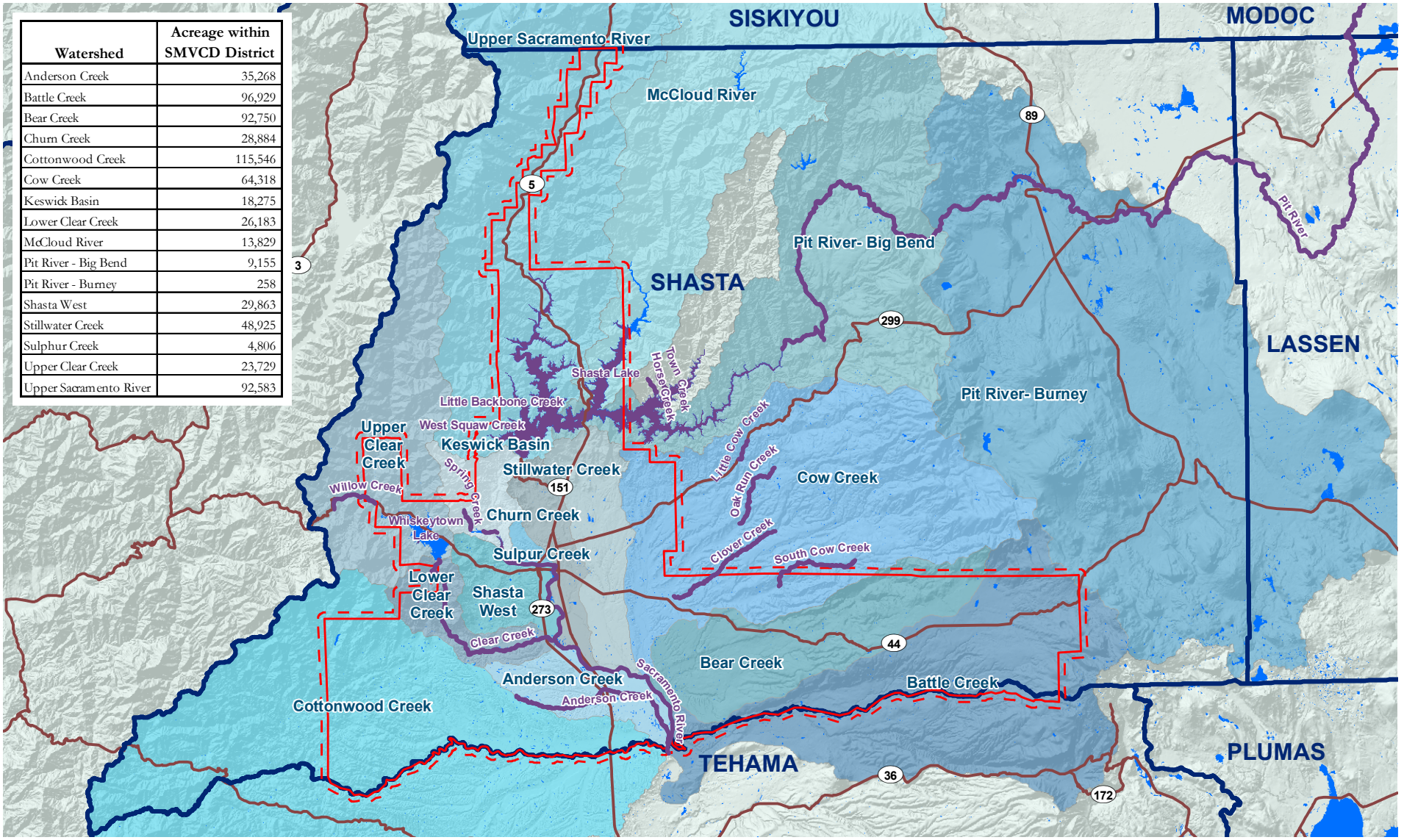
Other control methods used (alternatives) and their limitations;
With any source of mosquitoes or other vectors, the District's first goal is to look for ways to eliminate the source, or if that is not possible, for ways to reduce the potential for vectors. The District employs a

full scale IVMP as detailed in the SMVCD Best Management Practices (see attached) and the Best Management Practices of Mosquito Control in California.

Specific methods used by the District include, but are not restricted to the following: educating the public through outreach, website, brochure development and annual reports; physical control, which includes maintenance and management of certain waterways, consulting during the planning phases of new development, removal of standing water sources, and installation of Clemson Pond Levelers. Biological Control includes the planting of mosquito fish and the encouraging of natural predators. See Shasta MVCD BMP document for further information.

Limitations for alternative methods include: Logistical limitations, cost of wide-scale implementation, environmental limitations (biological/physical), access problems, etc.

Watershed	Acreage within SMVCD District
Anderson Creek	35,268
Battle Creek	96,929
Bear Creek	92,750
Churn Creek	28,884
Cottonwood Creek	115,546
Cow Creek	64,318
Keswick Basin	18,275
Lower Clear Creek	26,183
McCloud River	13,829
Pit River - Big Bend	9,155
Pit River - Burney	258
Shasta West	29,863
Stillwater Creek	48,925
Sulphur Creek	4,806
Upper Clear Creek	23,729
Upper Sacramento River	92,583



Section 303(d) Water Quality Limited Segment

Section 303(d) Water Quality Limited Waterbody

Waterbody

SMVCD District Boundary

Half-Mile Buffer Around SMVCD District

VESTRA

SOURCE: USGS 2007

0 5 10 20 Miles

FIGURE 5.4.1
HYDROLOGY
SHASTA MOSQUITO AND VECTOR CONTROL DISTRICT
SHASTA COUNTY, CALIFORNIA

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2011

Shasta Mosquito and Vector Control Best Management Practices

Shasta Mosquito and Vector Control District

2011

Contents

Shasta Mosquito and Vector Control Mission Statement

"To protect the public's health from vector-borne disease and nuisance, through a comprehensive mosquito and vector control program focused on innovation, experience and efficiency."

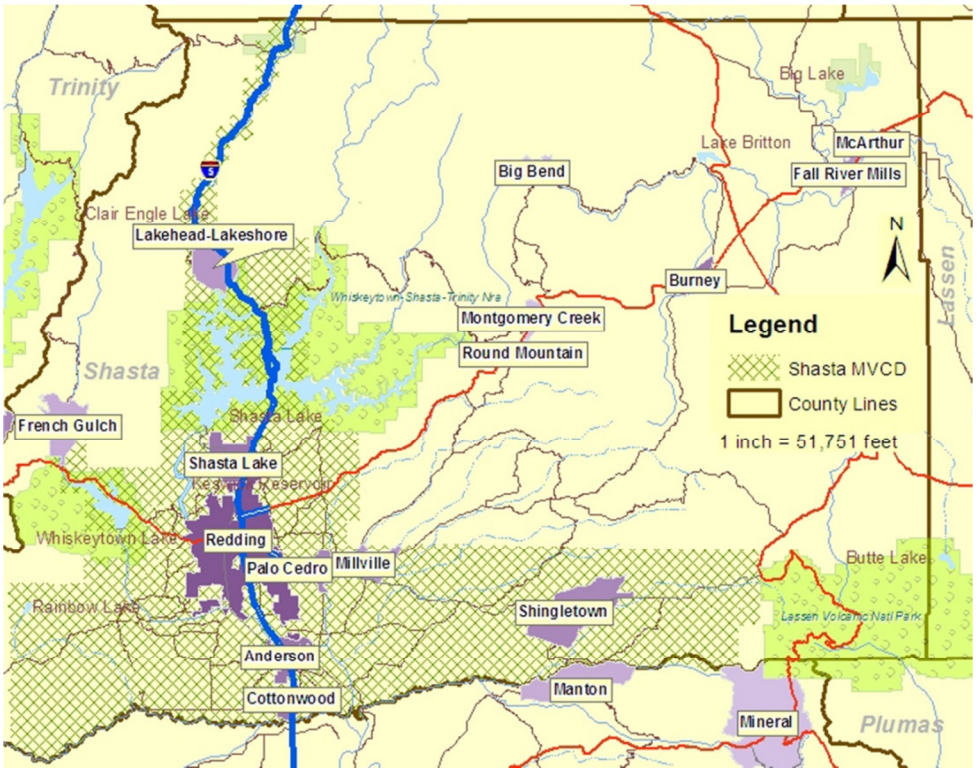
General Information about the District

The Shasta Mosquito and Vector Control District (SMVCD) is an independent, non-enterprise, special district.

SMVCD serves a population of over 110,000 throughout a District of approximately 1,100 square miles. The District does not serve all areas of Shasta County. Two other mosquito abatement districts, Burney Basin and Pine Grove Mosquito Abatement Districts, serve limited areas of northeastern Shasta County.

The District boundaries extend from Castella on the north to Cottonwood Creek on the south and from the town of French Gulch on the west to Viola on the east.

District Boundaries



The District is governed by a five-member Board of Trustees. The Board meets on the third Tuesday of every month at the District Office in Anderson at 1:30 p.m. The District is financed by a combination of *ad valorem* property taxes and by Mosquito and Vector Control Special Benefit Assessment charges. Currently, SMVCD employs a full-time staff of 15. The District's field technicians are certified by the California Department of

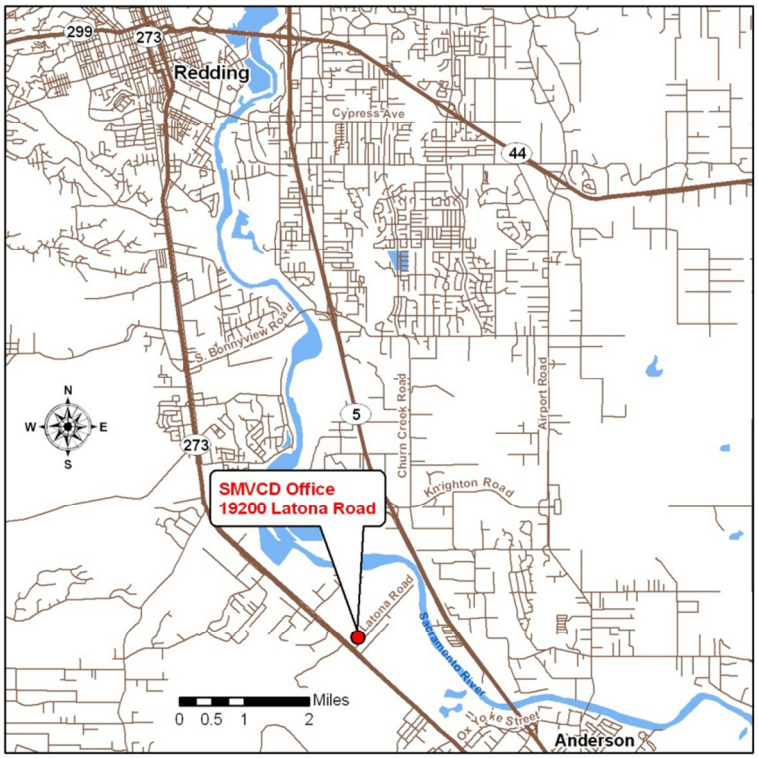
Public Health for the use of public health pesticides, and some maintain Qualified Applicators Licenses through the California Department of Pesticide Regulation (CDPR). The SMVCD has a fleet of specialized mosquito control vehicles including ARGO All-Terrain Vehicles (ATVs), larviciding and adulticiding trucks, a backhoe, a boat, and ATVs.

District Powers

The District operates under the provisions of Sections 2200-2093 of the California Health and Safety Code (CHSC). Pursuant to the CHSC, the District Board may do all of the following:

(a) Take all necessary or proper steps for the control of mosquitoes, either in the District or in territory not in the District, but so situated with respect to the District that mosquitoes may disperse from the territory into the District.
(b) Abate as nuisances all standing water and other breeding places for mosquitoes, either in the District or in territory not in the District, but so situated with respect to the District that mosquitoes from the territory disperse into the District.
(c) Purchase the supplies and materials, employ the personnel, and contract for the services which may be necessary or proper in furtherance of the objects of this chapter.
(d) If necessary or proper in the furtherance of the objects of this chapter, build, construct, repair, and maintain the necessary dikes, levees, cuts, canals, or ditches upon any land and acquire by purchase, condemnation, or by other lawful means, in the name of the District, any lands, rights-of-way, easements, property, or material necessary for any of those purposes.
(e) Contract to indemnify or compensate any owner of land or other property for any injury or damage necessarily caused by the use or taking of property for dikes, levees, cuts, canals, or ditches.
(f) Enter upon any property without hindrance or notice, either within the District or so reasonably adjacent thereto that vectors may disperse into the District, for any of the following purposes:
    (1) To inspect to ascertain the presence of vectors or their breeding places.
    (2) To abate public nuisances in accordance with this article, either directly or by giving notice to the property owner to abate a nuisance.
    (3) To ascertain if a notice to abate vectors has been complied with.
    (4) To treat property with appropriate physical, chemical, or biological control measures.

District Office Location



District Services

As an independent special district, SMVCD exists to provide direct service to the public. The District offers a number of direct services to the public including but not limited to:

- Respond to public complaints about mosquitoes or mosquito-like insects in the District and determine the source of the problem to correct as needed
- Deliver mosquitofish to residents of the District free of charge
- Monitor populations of disease carrying and nuisance mosquitoes
- Provide Vector-Borne Disease surveillance for District areas including: mosquitoes, ticks, and rodent/flea borne diseases
- Inspect and treat mosquito sources to control populations
- Identify mosquitoes and other insects
- Provide a comprehensive public education program to inform the public about vector biology and control
- Conduct routine surveillance and treatment for neglected swimming pools

Local Habitat Types

Mosquito habitats or sources are any place that can hold water and provide a place for mosquito larvae to grow. Most areas treated by the District are artificial catchments, but some natural waters are treated when necessary. The types of sources that produce mosquitoes within the SMVCD boundaries are:

Agricultural

Pastures: Irrigated and non-irrigated fields used for the purpose of raising livestock.

Stock Ponds: Artificially constructed ponds to catch and hold runoff water used for stock watering or irrigation.

Agricultural drains: Ditches used for draining excess water from agricultural operations.

Return Sumps: Holding ponds used to collect excess agricultural water for return to fields or disposal to another source.

Watering Troughs: Tanks, troughs, or other containers used for watering stock.

Tail Water: Water left in low portions of an agricultural field from irrigation.

Domestic/Urban/Commercial

Fish Ponds: Artificially constructed landscape ponds for fish or accent.

Septic Tanks: Underground storage and processing tanks for sewage.

Wells: Drilled or dug wells for water, usually old and no longer used.

Swimming Pools/Hot Tubs: In-ground or above-ground neglected swimming pools.

Bird Baths: Small pools or ornamental structures maintained for use by birds.

Cesspools: Open collection ponds for sewage (not legal).

Roof Gutters: Clogged or misaligned roof gutters that hold water.

Domestic Container: Any water-holding container, bucket, tub, boat, barrel, wheelbarrow, rubbish (e.g. tire), urn, or receptacle etc. found in a private or public urban environment or yard.

Catch Basins/Gutters: Basins or gutters used to collect and direct runoff water; found in streets, parking lots, loading docks, or private driveways.

Storm Drains: Underground structures for carrying runoff water.

Gravel Pits: Pond or pit created to mine gravel.

Borrow Pit: Pits or depressions created to obtain soil for construction; usually found along railroad tracks or occasionally buildings.

Sewer Ponds/Treatment Plants: Ponds and water-holding structures used for sewage treatment.

Utility Vaults: Underground structures for utilities: Pacific Gas & Electric, water departments, telephone, Redding Electric Utility, or private.

Sumps: Holding ponds or structures for collecting industrial waste water or runoff.

Sewer Lines: Underground structures for collecting and carrying sewage.

Log Mill Ponds: Ponds/ditches created by sprinklers being utilized over log decks to prevent lumber from drying out.

Channel (lined): Channels lined with rock or concrete used for flood control or to collect runoff.

Channel (unlined): Channels with soil bottoms and sides used for flood control or to collect runoff.

Waste Water Marsh: Marsh constructed to hold or treat waste water, usually sewage.

Broken/Leaking Pipes: Water sources created by broken or leaking pipes.

Seepage: Water sources created by seepage from natural or unknown sources.

Natural

Creeks: Natural or slightly modified main channels of creeks.

Creek Isolations: Isolations holding water that are separated from the main creek channel.

Marshes: Shallow marshy areas, artificial or natural, with emergent vegetation.

Lakes (20 acres+): Natural or artificial bodies of water, usually more than 20 feet deep.

Ponds (less than 20 acres): Natural or artificial bodies of water, usually less than 20 feet deep.

Treeholes: Rot cavities or cavities caused by tree damage or growth.

Temporary Pools (storm water): Areas that collect rain water or, in domestic areas, occasionally collect irrigation water.

Temporary Pools (vernal pools): Seasonal depression wetlands, which are covered by shallow water for variable periods from winter to spring but may be completely dry for most of the summer and fall.

Mosquito Species of Concern

Genus	Species	Common Larval Habitats	Adult Season	Blood Meal Pref.	Vector Signf.
Aedes	melanimon	Irrigated Fields	Spring-Summer	Animals and Man	High Pest Signf.
	nigromaculis	Irrigated Fields	Spring-Summer	Animals and Man	High Pest Signf.
	sierrensis	Treeholes, tires, containers	Spring-Summer	Animals and Man	High Pest Signf. and Vector of Canine Heartworm
	vexans	Temporary	Spring	Animals and Man	High Pest Signf. and Vector of Canine Heartworm
	washinoi	Temporary woodland pools	Spring	Animals and Man	High Pest Signf.
Anopheles	freeborni	Seepages, lakes, streams	Summer	Animals and Man	Low Pest Signf. and Vector of Malaria
	punctipennis	Temporary pools, streams	Summer	Animals and Man	Vector of human malaria in woodland/foothill habitats
	franciscanus	Shallow pools and streams, algae mats	Summer	Large animals and Man	Low potential as a vector of human malaria
Culex	pipiens	Storm drain systems, lumber mills, cemetery urns, containers	Spring, Summer, Fall	Birds, Animal, Man	High Pest Signf., Vector of WNV, SLE
	tarsalis	Creeks, marshes, fresh water, roadside ditches	Spring, Summer, Fall	Birds, Animal, Man	Moderate Pest Signf. and Vector of WNV, WEE
	stigmatosoma	Foul water, sewage, temporary pools	Spring, Summer, Fall	Birds, Animal, Man	Low Pest Signf.
	erythrothorax	Lakes and ponds, associated with tulles	Spring, Summer, Fall	Birds, Rarely Man	Low Pest Signf.
Culiseta	incidens	Fish ponds, catch basins, roadside ditches	Spring, Summer, Fall	Large animals and Man	High Pest Signf.
	inornata	Marshes, roadside ditches, temporary pools	Spring, Summer, Fall	Large animals and Man	High Pest Signf.
	particeps	Shaded clean pools, streams	Spring, Summer, Fall	Animals and Man	Low Pest Signf.
	impatiens	Man-made and natural waters rich in organic matter	Spring	Large animals and Man	Low Pest Signf.

Mosquito-Borne Diseases

The District is concerned with a number of mosquito-transmitted diseases that are endemic to California or could be potentially introduced into the District. The most important diseases are:

Western Equine Encephalitis (WEE): WEE is a virus closely related to Eastern and Venezuelan equine encephalitis. Symptoms range from mild flu-like illness to encephalitis, coma and death. WEE is primarily vectored by *Culex tarsalis*.

Saint Louis Encephalitis (SLEV): SLEV is a virus closely related to West Nile virus (family Flaviviridae), Yellow fever virus, and Dengue virus. Symptoms range from mild headache and fever to more severe neck stiffness, stupor, coma, tremors and death. SLEV is primarily vectored by *Culex tarsalis* and *Culex pipiens* mosquitoes.

West Nile Virus (WNV): WNV is also a virus belonging to the family Flaviviridae and, like ZLEV, yellow fever virus, and Dengue virus, symptoms range from fever, headache, and nausea to high fever, coma, vision loss, paralysis, permanent neurological effects and death. WNV is primarily vectored by *Culex tarsalis* and *Culex pipiens* mosquitoes.

Canine Heartworm: Canine heartworm is caused by the transmission of the organism *Dinofilaria immitis*, normally from canine to canine. Symptoms in canines include coughing, exercise intolerance, and indications of heart failure. Canine heartworm is primarily vectored by *Aedes sierrensis* and *Aedes vexans* mosquitoes.

Malaria: Although malaria is not presently considered a problem in California, malaria was found in California until the 1940s when it was finally eradicated. California had a high incidence of malaria from the 1850s until about 1920. This disease played an important role in organizing mosquito control in the state. Currently, the District works closely with state and local health departments to monitor imported malaria cases.

District Activities

Integrated pest management or, specifically, in this case, an Integrated Vector Management Program (IVMP), describes a systematic process that applies scientific knowledge regarding the target organisms to be controlled with information and technical data about the available products to develop a control strategy that simultaneously maximizes control and minimizes harm to the environment. By integrating a variety of methods that eliminate habitat, disrupt breeding, and limit population growth, more intensive methods (such as chemical control of larvae and

adults) are not required. Thus, with an IVMP a synergistic effect may be achieved where the control efforts are greater than the sum of the individual parts.

The basic tenets of the IVMP are to:

- Use a science-based approach to know which vectors pose a risk to human health and monitor populations. Treat populations when they are most biologically susceptible to treatments that limit population growth. Keep populations below thresholds that indicate a risk to public health exists.
- Limit the need for treating vector populations by eliminating breeding habitats near human receptors. Promoting natural predators and other beneficial organisms is a necessary first step.
- Target vectors in their sessile, immature life stages so that treatments can be limited in space and time (i.e. focused during breeding cycles and in aquatic habitats). Apply physical control measures that limit the survival of immature life stages and prevent maturation to the adult stage as the preferred method of control.
- Use the least intensive methods that effectively achieve the desired level of control so that any disruption of the natural environment is minimized.

The components of IVMP are:

- Surveillance: The collecting of information about mosquito and other vector abundance and prevalence of disease. Samples and organisms collected by the District are tested for disease by CDPH or other laboratories.
- Education: The presentation of information to the public regarding methods to reduce exposure to vectors, curtail practices that promote mosquito production and how to eliminate breeding sites and habitats.
- Physical Control: The removal or modification of structures, catchments, and habitats that provide breeding opportunities for vectors (primarily mosquitoes).
- Biological Control: The use of other organisms to reduce vector abundance or limit the transmission of vector-borne diseases. Biological control agents range from vertebrate predators such as mosquito fish to microbes that are pathogenic to specific groups of insect vectors.
- Chemical Control: The judicious use of pesticides to achieve specific vector control objectives and control resistance to pesticides by vector populations.

Potential Impacts to the Environment

The District's IVMP has the potential to impact the environment through the modification of habitat (including soils, air, water, and vegetation), direct disturbance (noise and light), or by the use of biological or chemical control agents. Most of these impacts are minor in scope. The primary resources potentially affected are human health and fish and wildlife (including plants). Cultural resources are considered, even though the IVMP poses very limited risk to such resources.

The Best Management Practice Approach

A set of Best Management Practices (BMPs) to reduce the risk of environmental harm that might result from the District's implementation of the IVMP is followed. These BMPs are in the form of hierarchical guidance that applies broadly (state BMPs) and more site-specifically (District BMPs). The State BMPs can be found in the document *Best Management Practices for Mosquito Control in California* developed by the Vector-Borne Disease Section (VBDS), California Department of Public Health (2011).

Methods to Avoid or Reduce Potential Impacts

As the first step, several sources of information and databases are checked prior to initiating any field activity. By knowing what sensitivities exist, methods to avoid impacts can be applied. Location data for sensitive wildlife and plant species and known cultural resource sites are maintained in several databases or records available to the District. Databases include the California Natural Diversity Database (CNDDB), the California Native Plant Society (CNPS) online inventory, the Shasta County General Plan list of cultural resource sites, and the Northeast Information Center (NEIC), one of 12 offices of the California Historical Resource Information System (CHRIS) established by the California Office of Historic Preservation (OHP) to maintain an inventory of the state's historical resources. Any work near these sites is conducted carefully, and field staff are trained to recognize biological or cultural resources that should be avoided or reported.

Similarly, when possible, sites are avoided upon request of residents who have expressed concerns about exposure to public health pesticides. The locations of other potentially sensitive receptors, such as schools, hospitals, nursing homes, etc., are known to the District, so impacts associated with noise, light, equipment exhaust, or pesticides can be avoided near these sites.

Awareness and vigilance are the primary keys to avoiding and reducing impacts. District staff are aware of the consequences of their actions in the field and are trained

to be respectful of public and private property, the environment, and associated wildlife and cultural resources. They are always observant and follow reporting procedures when noteworthy information or conditions are encountered. Additionally, when physical, biological or chemical control methods are employed, standard guidelines or regulatory requirements are followed to reduce or avoid any potential impacts.

General BMPs

BMP G1: Conduct activities as needed to achieve District objectives.

BMP G2: Comply with all laws, regulations, permits and agreements; consult with other agencies as needed.

BMP G3: Check databases for known sensitivities prior to conducting field work. Avoid, when possible, known locations of sensitive species occupied by listed plants and invertebrates. Do not damage or disturb cultural sites or resources.

BMP G4: Report any accidents, spills (including leaks in equipment and vehicles), or observed impacts to natural or cultural resources; clean up spills and repair leaks immediately. If environmental damage cannot be prevented or corrected immediately, take appropriate action such as notifying supervisor, other appropriate agencies, and initiating emergency response.

BMP G5: Previously unknown biological or cultural resources (such as a bald eagle nest or observed archeological site, etc.) should be recorded and reported. Consult with experts as needed.

Mosquito/Disease Surveillance

The practice of monitoring both mosquito densities and the diseases they carry is termed “surveillance.” Applied properly, surveillance provides the District with valuable information on what mosquito species are present, when they occur, how many there are, and if they are carrying diseases that affect humans. Equally important is the use of surveillance in evaluating the effectiveness of control actions in reducing mosquito abundance and mosquito-borne human diseases.

District technicians conduct surveillance work in areas where disturbance to fish and wildlife (including plants) may result. Driving near streams or wet areas, operating ATVs, or wading may increase turbidity or sediment transport. Damage to vegetation may result from trampling or driving; however, these impacts are of low intensity, of short duration, and temporary; thus, they are generally considered minimal.

Sampling Habitats for Immature Mosquitoes

SMVCD routinely targets the larval and pupal stages to reduce numbers of mosquitoes prior to emergence as adults. During this process, SMVCD staff document the presence, abundance, and species composition of mosquitoes in immature life stages. Sampling is accomplished using field collection techniques. The primary tool is the "dip count" which indicates whether a habitat is producing mosquitoes and estimates larval density. A 1-pint cup attached to a long handle is used to collect a standard volume of water ("dip sample"). The "count" may be expressed as the number of immature (larvae and pupae) mosquitoes per dip, per unit volume, or per unit surface area of the site. Operationally, the abundance of the immature mosquitoes in any identifiable breeding source is measured as the number of immature (includes numbers representing each individual instar of larval development as well as pupae) per unit volume/area of the source.

Adult Sampling

Adult mosquito populations are sampled by hand collection (sweep nets and landing counts), light traps, CO_2 baited traps, and collections from resting boxes. The District uses 20-plus fixed-location New Jersey light traps, 20-plus fixed-location Encephalitis virus surveillance (EVS) CO_2 baited traps and oviposition traps, resting boxes and fay traps in varying locations.

Disease Surveillance

Adult mosquito surveillance accounts for a large portion of disease surveillance for SMVCD. Mosquito trapping and several other tools are used to gauge the risk to the public's health from vector-borne disease.

Encephalitis virus surveillance (EVS) mosquito trapping: In addition to providing population data as a measure of exposure risk for mosquito-borne diseases, mosquitoes caught live in CO_2-baited EVS traps and gravid traps are routinely submitted to the UC Davis Center for Vector-borne Disease Research to be directly tested for the presence of disease-causing viruses. Mosquitoes are sent on a weekly basis from approximately May through September, and whenever sufficient numbers of mosquitoes can be caught to provide samples suitable for testing.
Detection of arboviral transmission to bird populations can be accomplished by

1. Using caged chickens as sentinels and routinely collecting blood samples that are analyzed to detect viral antibodies (seroconversions)
2. Collecting and bleeding wild birds to detect viral antibodies (which currently the District does not participate in)
3. Testing dead birds reported by the public for WNV

Sentinel Chickens: Flocks of 5-10 chickens are placed in locations of the District where mosquito abundance is known to be high or where there is a history of virus activity. Blood is collected from each chicken once every 2 weeks by pricking the comb and collecting blood on a filter strip. The blood is tested at the CDPH Viral and Rickettsial Disease Laboratory for antibodies to SLEV, WEE, and WNV. Frequent testing of strategically placed flocks of sentinel chickens provides one of the most sensitive and cost-effective methods to monitor encephalitis virus activity in an area. Because chickens are continuously available to host-seeking mosquitoes, they are usually exposed to more mosquitoes than can be collected by trapping, especially when adult mosquito abundance or viral infection rates are low.

Dead Birds: Unlike the endemic encephalitides, WNV frequently causes death in North American birds, especially those in the family Corvidae. Dead bird surveillance was initiated by SMVCD to provide early detection of WNV. Dead bird surveillance has been shown to be one of the earliest indicators of WNV activity in a new area. Birds that meet certain criteria are shipped, necropsied, and tested at the UC Davis, California Animal Health and Food Safety Laboratory and the Center for Vectorborne Diseases (CVEC) or in some cases rapid antigen tests are conducted at the District.

Other Infections

As part of a statewide, integrated program, detection of mosquito-borne diseases largely relies on the surveillance of other organisms.

Tree Squirrels: In 2004, CDPH included tree squirrels as a WNV surveillance tool based upon evidence that they are susceptible to WNV and could provide information on localized WNV transmission. In conjunction with dead birds, dead tree squirrels were reported to the California WNV hotline, shipped, and necropsied at the California Animal Health and Food Safety Laboratory; kidney tissue was tested at CVEC.

Equine Infections: Currently, equine disease due to WEE and WNV is not a sensitive indicator of epizootic activity in California because of the widespread vaccination of equines against these viruses. Confirmed cases are a strong indication that WEE or WNV has amplified to levels where tangential transmission has occurred in that region of the state.

Human Infections: The District relies on rapid detection and reporting of human vector-borne disease cases to facilitate a timely and effective response. However, human cases of arboviral infection are and insensitive surveillance indicator of virus activity because most human infections cause no, or only mild, symptoms.

Analysis and Interpretation of Disease Surveillance Data

1. All weather reports received from state and local agencies that can affect mosquito breeding are reviewed and analyzed by District staff. Weekly and biweekly mosquito occurrence reports from the SMVCD laboratory and from CDPH-VBDS statewide are used for forecasting purposes.
2. Reports from CDPH-VBDS and University of California –Davis on virus isolations in mosquito pools* and chicken blood samples tested, confirmed human cases and horse cases of encephalitis or any other indicator of the presence of an arboviral threat to human health will be used for operational planning.

(*A mosquito "pool" refers to a collection of mosquitoes from a particular area that is tested for the virus)

Mosquito/Disease Surveillance BMPs

BMP S1: Be as unobtrusive as possible, do not knowingly step or drive over sensitive plants, nest sites, dens, etc. Use vehicles with care or walk.

BMP S2: Drive slowly to allow wildlife to move out of the way. Do not drive in saturated areas where ruts are created or sedimentation occurs.

BMP S3: Return water to source following sampling.

BMP S4: Place sentinel chicken coops where they will not contaminate water.

BMP S5: Place lighted traps where they will not create a nuisance.

BMP S6: Because most District activities take place within one major river basin, the Sacramento River Drainage, the spread of exotic species between invaded and non-invaded watersheds is not a major concern. However, the District strives to not spread noxious weeds or invasive species via clothing, sampling equipment, or vehicles. The CDFG California Aquatic Invasive Species Management Plan (2008) and Salmon Spawning Survey Procedures Manual (ODFW, 2010) are followed to the extent practicable when transporting equipment and personnel between isolated water bodies within the District.

Physical Control and Source Reduction

Physical control, also known as source reduction, is one part of the District's IVMP. Physical control is usually the most effective technique available and is accomplished by eliminating mosquito breeding sites or modifying these sites to favor natural

predation or to be unfavorable to mosquitoes. Source reduction can virtually eliminate the need for costly chemical control treatments. The primary means for reducing potential effects from physical control activities is to conduct only that work which is necessary to protect public health. Minor mechanical clearing of vegetation and removal of rubbish that holds water, poses virtually no risk to the environment. Scope, intensity, and duration are limited; effects are minor and most are temporary. Some minor level of disturbance to wildlife may occur but not more than that which might be associated with residential lawn mowing or street or highway maintenance.

Where herbicides are used to clear vegetation, labels are followed and applications are made by Certified Vector Control Technicians. Herbicides are selected over mechanical clearing when they are less intrusive (i.e. reduce noise, in areas of limited equipment access, near areas where equipment would create ruts or damage soils, etc.). Other factors such as nearness to water, the presence of known special status plant species, etc., are also considered when evaluating the appropriateness of herbicide treatments.

Where drainage facilities are maintained via excavation, each site is evaluated to determine possible impacts to "waters of the U.S." that would trigger the need to obtain a permit from the U.S. Army Corps of Engineers (USACE). Most District activities that are conducted to facilitate drainage or reduce water holding time are conducted in artificial facilities such as agricultural ditches or irrigated areas. Where appropriate, State and federal permits (California Department of Fish and Game Code 1602, State Water Quality Control Board Section 401 Certification, and USACE Section 404 permit) are acquired and each contains site-specific requirements that limit potential environmental impacts. In cases where CEQA compliance is required, the District's PEIR can be used to tier subsequent analyses and provide a baseline for evaluating potential effects.

Physical Control activities include the following:

- Improving or repairing drainage facilities
- Emptying containers
- Vegetation management
- Planning review (to avoid creation of vector habitat)
- Dewatering
- Ditching
- Creating a fish reservoir

Physical Control BMPs

BMP P1: Minimize physical disturbance and consider herbicides if use of equipment will cause damage to soils or other problems. Consider cultural resources and ground disturbance, especially near known sites.

BMP P2: If using herbicides consider potential impacts to surface waters and sensitive plants or non-target organisms. Follow labels, particularly the avoidance of aquatic habitats.

BMP P3: Do not spread noxious weeds or invasive species (via equipment)

BMP P4: In the unlikely event that historic or cultural artifacts or remains are encountered, work shall cease at the site of discovery and a professional archeologist shall be consulted.

BMP P5: District staff shall attend annual training aimed at identification of protected wildlife and plant species and other sensitive habitats.

Biological Control of Mosquitoes

Biological control of mosquitoes is the intentional use of mosquito pathogens or predators to reduce the size of target mosquito populations. It is one of the principle components of a rational and integrated vector control program and does not contribute to pesticide resistance.

The District uses biological agents to reduce larval mosquito populations and promote predation on immature mosquitoes. These agents include bacteria which selectively target mosquito and other vector larvae but have few effects on other organisms, and mosquito fish (*Gambusia affinis*), which feed on immature mosquitoes.

Mosquitofish and Mosquito Control

Gambusia affinis is the most commonly used biological control agent for mosquitoes all over the world. Mosquitofish were first introduced into California in the 1920s and have been used by SMVCD since the 1930s. Correct use of these fish can provide safe, effective, and persistent suppression of a variety of mosquito species in many types of mosquito sources. As with all safe and effective control agents, the use of mosquitofish requires a good knowledge of operational techniques and ecological implications, careful evaluation of stocking sites, use of appropriate stocking methods and regular monitoring of stocked fish.

Biological Control BMPs

BMP B1-Use only biological control agents approved for use in California

BMP B2- Only District technicians release mosquitofish.

BMP B3- Mosquitofish are not released into open waters, only closed basins.

BMP B4- Natural mosquito predators are favored, and sensitive locations such as vernal pools or sites occupied by sensitive species are not treated with biological control methods that may impact those species. For example, mosquitofish would not be used since they may consume listed fairy shrimp species, but bacteria (Bti or Bs) could be used because they do not affect fairy shrimp.

Chemical Control

Two basic chemical control methods are used to control mosquitoes: larval control and adult control. Only those pesticides registered by the United State Environmental Protection Agency (U.S. EPA) and California Environmental Protection Agency (Cal EPA) are used by the District for mosquito control. With the existing federal and state limitations and regulations, the pesticides available for mosquito control are environmentally sensitive and are unlikely to cause adverse environmental impacts. The District follows label instructions strictly and carefully monitors environmental and meteorological conditions to maximize effectiveness while avoiding and minimizing non-target exposure and adverse environmental effects. These practices substantially reduce the potential for environmental harm as the result of the use of public health pesticides under the District's IVMP. District personnel performing chemical treatments are certified by the CDPH as Vector Control Technicians.

Larval Control (Larviciding)

Larviciding is a general term for the process of controlling mosquitoes by applying natural agents or commercial products designed to control larvae and pupae (collectively called larvicides) to aquatic habitats. Larviciding is the preferred chemical control strategy because it targets discrete areas with high densities of the target organisms at their most susceptible life stage. There are three general types of larvicides:

- Stomach toxins
- Contact Pesticides
- Surface Active Agents

Larval Control Products Used by the District:

- *Bacillus thuringiensis*, subspecies *israelensis* (Bti: e.g., Aquabac 200G, VectoBac 12AS, Teknar HP-D)
- *Bacillus sphaericus* (Bs: e.g., VectoLex CG)
- Spinosad (bacteria derived natural insecticide: e.g., Natular G)
- (S)-Methoprene (e.g. Altosid pellets)
- Larviciding Oils (BVA oil)
- Monomolecular films (e.g., Agnique MMF)
- Organophosphate compounds (Temephos (e.g., Abate))

Larval Control Compounds currently approved and used by SMVCD are listed in Appendix B.

Adult Mosquito Control (Adulticiding)

Adult mosquitoes can only be effectively controlled with adulticides; pesticides that target the winged adult lifestage. The use of adulticides is an integral component of the District's IVMP. Adulticiding falls into two categories – barrier applications and ultra-low volume (ULV) applications. Barrier applications target resting mosquitoes by applying pesticides to vegetation and structures. Barrier applications typically cover relatively small areas and are applied to alleviate specific problems rather than an area - wide adult mosquito problem.

In general, ULV applications are used to control adult mosquitoes over large areas. An "ultra-low volume" (typically less than 2 oz/acre total volume) of tiny oil or water droplets carrying an insecticide are emitted from specialized equipment mounted to trucks or aircraft. The District does not currently use aircraft during adulticiding, but would consider this practice if faced with an emergency public health situation or threat of an epidemic that could be prevented through aerial applications of adulticides. The goal of ULV applications is to immediately reduce mosquito populations and halt disease transmission. Multiple applications in a particular area may be utilized when the objective is to kill a high enough proportion of older adult mosquitoes to break a disease transmission cycle.

The District's IVMP initiates adult mosquito control when action levels or thresholds are reached or exceeded. Thresholds are based on sampling of the adult mosquito population and/or when the risk of mosquito-borne disease increases above levels established by SMVCD. Thresholds are an integral component of mosquito control because they are used to trigger predetermined actions based on quantified data. Thresholds establish expectations and limitations for responses that ensure appropriate

mosquito control activities are implemented at the appropriate time. The thresholds used by the District for adult mosquito control depend on several factors including:

- Presence of mosquito-borne disease in the region.
- Abundance of mosquito species that are vectors of disease.
- Overall mosquito abundance.
- How local citizens tolerate nuisance mosquitoes by evaluating public service requests.
- Local acceptance of adult mosquito control activities.
- Meteorological and climate data.

Chemicals currently registered for ULV application against mosquitoes in California include organophosphates (e.g. malathion and naled), pyrethrins, (e.g. pyrethrum) and pyrethroids (e.g., sumithrin, permethrin, and etofenprox). With the exception of the active ingredient etofenprox, formulations of both pyrethrins and pyrethroids include the synergist piperonyl butoxide (PBO), which increase their activity against mosquitoes.

1. Organophosphates: Malathion and naled are neurotoxins that act by inhibiting neurologic transmission. Malathion may be used early and late in the season as a pesticide resistance control measure.
2. Pyrethrins: Pyrethrins and pyrethroids are neurotoxins that act by causing uncontrolled firing of neurons. Pyrethrum is a natural insecticide derived from chrysanthemum flowers. Adult mosquitoes are rapidly paralyzed and killed on contact. Pyrethrins are degraded rapidly by sunlight and chemical processes. Residual pyrethrins from ULV applications typically remain less than 1 day on plants, soil, and water.
3. Pyrethroids: Pyrethroids are manufactured pyrethrins that have very low toxicity to birds and mammals but are toxic to fish if misapplied.

   Adult Control Compounds currently approved and used are listed in Appendix B.

Chemical Control BMPs

BMP C1: Make determination based on all available information and verify that chemical application is needed to protect the public health.

BMP C2: Follow all label instructions including weather and climate guidelines.

BMP C3: Precisely follow equipment calibration and application rate recommendations.

BMP C4: Consult with agencies as directed.

BMP C5: Monitor results for effectiveness.

BMP C6: Report use and identify treated areas as required

BMP C7: Follow emergency spill or accidental release procedures.

Relationship with CDPH

Many aspects of the District IVMP are conducted under the direction of the CDPH. The District maintains an annual agreement with CDPH. This is an agreement between CDPH and vector control agencies that obligates signatory agencies to certain practices that promote safe and effective vector control. The Cooperative Agreement also ensures that all state and federal pesticide use requirements are met and adherence to the conditions of the agreement constitute BMPs. The areas, terms, conditions, and specifications of the Cooperative Agreement are prescribed by the CDPH Director (CHSC 116180). The current requirements include:

- Regular and proper calibration of all application equipment and maintenance of calibration records;
- Maintenance of comprehensive pesticide application records;
- Monthly submission of pesticide use reports;
- Reporting any conspicuous or suspected adverse effects upon non-target organisms or property from pesticide applications;
- Appropriate employee certification and maintenance of continuing education information; and
- Regular compliance inspections by the county agricultural commissioner's office.

Certification, Education, and Training

All technical staff employed by the District are certified by the CDPH in Pesticide Safety and Use and at least one of the following four categories:

A. Pesticide Application and Safety Training for Applicators of Public Health Pesticides
B. The Biology and Control of Mosquitoes in California
C. Arthropods of Public Health Significance in California
D. Vertebrates of Public Health Importance in California

Most District employees have all four certifications. Several staff are also licensed by the CDPR and the Structural Pest Control Board. To maintain these certifications, employees take at least the minimum hours of continuing education each cycle.

Certification in each category is based upon passing a standardized test administered by CDPH VBDS. Following certification, continuing education is required consisting of programs officially approved by CDPH VBDS every two years as follows:

Category A: 12 Hours
Category B: 8 Hours
Category C: 8 Hours
Category D: 8 Hours

Per District standards, full-time employees conducting field work must be certified or directly supervised by a certified technician. New staff are required to complete their certification in Categories A & B by the end of their 1-year probationary period. Further advancement generally requires certification in the remaining two categories.

District personnel also receive training in first aid, CPR, equipment operation and maintenance, computer use, and other job-related training. Additional training on wildlife identification and habitat associations is conducted annually so that District staff can recognize the various taxa that inhabit the District and understand how to avoid impacting sensitive wildlife and habitats while implementing the IVMP.

Agency Cooperation and Consultation

Although the District is an independent special district created under the CHSC, every effort is made to work closely and cooperatively with other agencies and associations to ensure that the IVMP BMPs are applying cutting-edge methods to adequately protect the environment and public trust resources.

Federal Agencies

United States Army Corps of Engineers (USACE) - When wetlands and watercourses may be impacted by the IVMP (Physical Control), USACE is consulted as to jurisdiction and applicability of Section 404 of the Clean Water Act (CWA). Depending on the exact nature of the activity, the District may be required to obtain a permit from the USACE.

The US EPA- oversees compliance with the Clean Air Act and Clean Water Act. The District relies heavily on the federal pesticide registration process used by the EPA for establishing pesticide application procedures such that impacts to air and water resources are minimized or avoided.

Occupational Health and Safety Administration (OSHA)- The District complies with OSHA regulation and requirements. OSHA laws and regulations are administered by California OSHA.

United States Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) Fisheries Service (Services)- are the federal agencies responsible for overseeing the U.S. Endangered Species Act (ESA) and other laws designed to protect fish and wildlife resources. The District complies with laws and regulations relating to endangered and threatened wildlife and habitats and informally consults with the Services when District operations pose a risk of impacts to protected species or habitats. Pesticide labels often specifically direct the procedure for coordinating applications or consulting with the Services. The District adheres to these procedures and follows label requirements.

State of California Agencies

CDPH - The District maintains an annual Cooperative Agreement with CDPH. This agreement specifies how the District activities will comply with certain California regulations for Public Health Pesticide use and vector control. The agreement also requires recordkeeping and reporting of pesticide use to the County Agricultural Commissioner each month as well as the certification of Mosquito Control Technicians. The detailed training and ongoing professional development of certified technicians is one of the primary means of avoiding adverse environmental impacts. This training is conducted by CDPH and emphasizes all aspects of BMPs (i.e. identification and avoidance of hazard resulting from pesticide use). The CDPH also requires ongoing continuing education that ensures District technicians are using “state of the art” methods and materials at the highest professional level.

California Department of Fish and Game (CDFG)- The District interacts with the CDFG on several fronts. For biological control activities, the Distinct complies with laws and regulations relating to transport and use of biological organisms, such as mosquitofish, and each release site is carefully evaluated to ensure that adverse ecological effects do not result from introducing this non-native species into sensitive areas. The District also works closely with CDFG to identify areas where habitat for endangered and threatened species is present so that appropriate protection measures can be applied during vector control activities. This includes activities involving vegetation management and use of herbicides to reduce mosquito habitat and maintain access to control sites. For activities that can substantially divert, obstruct, or alter the natural flow, banks, or channel of any river, stream, or lake, the District complies with

the Streambed Alteration Agreement it has maintained with DFG for many years (SAA No. R1-98-0819 and renewals)

Cal-EPA- This agency administers federal and state environmental laws and regulations within California and is comprised of several departments, two of which regulate activities and resources potentially affected by the District's IVMP.

CDPR- This agency is part of Cal-EPA and is responsible for all aspects of pesticide sales and use to protect public health and the environment. It registers pesticides for use in California.

Central Valley Regional Water Quality Control Board RWQCB (5R)- This Board is also part of Cal-EPA and regulates the protection of surface and ground waters within the District and other parts of the Central Valley. The State of California acts to enforce the federal CWA and may issue National Pollutant Discharge Elimination System (NPDES) permits. A NPDES permit is required of any entity that discharges pollutants through a point source into any water of the United States. A point source is any discharge that flows directly into a water body. These permits are tailored specifically to the entity that will be discharging the pollutant and include limits on what can be discharged, monitoring and reporting requirements, and other provisions designed to protect the quality of the water and the public health.

Department of Motor Vehicles (DMV)- The operation of District vehicles, material transport, insurance requirements and the driver licensing of all District employees is subject to regulation by DMV.

Local Agencies and Other Groups

Shasta County Agricultural Commissioner- The District provides the Agricultural Commissioner's office with monthly reports of pesticide usage and is subject to periodic inspections of equipment, facilities, and records.

Shasta County Public Health- This county department coordinates information regarding incidence of disease, health risks, and special conditions requiring responses to threats to public health. They directly facilitate the exchange of useful information among affected agencies and health care providers.

Cities- The cities of Redding, Anderson, and Shasta Lake exchange information that helps residents stay fully informed about District activities and potential health risks related to vectors in the local area.

Vector Control Joint Powers Authority (VCJPA)-This is a joint powers authority formed by participating vector and mosquito control district in California to provide insurance pooling and administration for Workers Compensation, vehicle insurance, and general liability insurance. The District complies with their requirements and participates in the VCJPA training program to reduce risks to the District.

Memberships

Memberships and participation with technical and trade associations and professional societies provides professional development for District staff. The District maintains memberships and participates in technical workshops, conferences, and symposia with the American Mosquito Control Association (AMCA), the California Special District Association (CSDA), the Mosquito and Vector Control Association of California (MVCAC), and the Society of Vector Ecologists (SOVE). The District's participation in these organizations ensures the science-based application of the IVMP at the highest professional level including the proper use of widely accepted BMPs.

Follow-up, Feedback, and Adaptive Response

The District routinely re-visits sites to follow-up on previous control efforts and ensure that treatments have effectively reduced the public health risk for which the treatment was originally applied. Also, surveillance is conducted on an ongoing basis. Repeated sampling at specific locations provides data regarding trends in vector populations, species composition, and prevalence of disease. The data is fed back to agencies such as the CDPH and Shasta County Health Department to keep health care agencies and professionals apprised of the status of vector-borne diseases at state and local levels.

Several of the District's activities include reporting of conditions that help influence public decision making with respect to vector control. The District provides feedback on planning efforts such that new projects do not create new significant sources of mosquito production. Surveillance data and specimens collected by the District are submitted to several laboratories so that indices of disease transmission capability can be developed. Pesticide use data is provided the Shasta County Agricultural Commissioner's office so that the amount of each product used can be tracked over time, and a complete record of public health pesticide usage is available to the CDPR, CDPH, and other relevant agencies (i.e., CVRWQCB, CARB, etc.).

In consultation with professional wildlife biologists, observations of special status wildlife and plant species can be reported to the CNDDB so that a more complete record of sensitive species locations and habitats within the District can be developed. Similarly, artifacts or other cultural resources that are encountered in the field can be reported to a

professional archeologist for investigation. Sites judged to be significant can be recorded with the Northeast Center of the California Historic Resource Information System so they are protected in the future.

The ongoing effort to record new sensitive locations as they are discovered leads to improved protection for biological and cultural resources over time. The site-specific data that is submitted to larger, more comprehensive databases serves as a feedback loop that leads to better protection of sensitive resources across space and time.

As the District's ongoing collection and reporting of information occurs, successes are recognized as are practices where effectiveness can be improved. Adjustments to site-specific practices can be made to increase the efficiency or reduce any adverse impacts that may occur. This adaptive-response methodology leads to improvements in the overall IVMP that can be applied within the District and shared among other vector control professionals.

Triggers for Initiating Mosquito Control Activities

1. A human illness caused by a mosquito-borne virus or pathogen is detected within the District.
2. Mosquito-borne virus or pathogen is detected in a dead bird or other animal within the District boundaries.
3. Testing indicates a sentinel chicken or other animal within the District boundaries has been exposed to a mosquito-borne virus or pathogen.
4. Mosquito collected within the District boundaries tests positive for a disease causing virus or pathogen.
5. Trapping or collecting efforts capture more mosquitoes than the number established in thresholds*.
6. Mosquitoes creating a public health nuisance at a residence as verified by the District.

**Threshold values vary by mosquito species (some are more prone to carry diseases) and sampling methods (some traps target virus carrying mosquitoes). Threshold values range from 8 to 35 mosquitoes captured per sample.*

Determining Need and Options for Control of Larvae

1. Will mosquitoes develop in the habitat (standing water present more than 72 hours)?
2. Is the site close enough to humans or livestock to be of concern?
3. Does abundance of mosquito larvae of the proper life stage exceed the threshold values:

- *Culex* sp.: ≥ 1/10 dips
- *Aedes* sp.: ≥ 1/10 dips
- *Anopheles* sp.: ≥ 1/10 dips
- *Coquillettidia* sp.: ≥ 2/10 dips
- *Culiseta* sp.: ≥ 2/10 dips

4. Is the site a vernal pool?
5. Are threatened, endangered, or otherwise protected species present?
6. Are there cultural or historic or other sensitive resources present that could be impacted?
7. Can physical control or habitat modification be used to eliminate the source without harming some sensitive habitat or resource?
8. Can biological agents be used effectively without harming beneficial or protected species?
9. Can a combination of physical and biological control be used to increase effectiveness?
10. Is larvacidal chemical control needed as an initial or follow-up treatment?
11. Are there sensitive human receptors present or concerns with water quality?
12. Is pesticide resistance a concern?

When sensitivities exist, consult with supervisor and/or other responsible resource agencies prior to applying selected control methods. Comply with existing permit conditions. For long-term projects, apply for site-specific permit(s) if necessary. Select most appropriate treatment method while considering pesticide label restrictions and resistance avoidance techniques.

Considerations or Conditions that Influence Adult Control Options

1. Presence of mosquito-borne disease or pathogen in any organism tested (mosquito, dead bird or other animal, sentinel chicken, livestock, or human) confirmed and source presumed within District boundaries.
2. Will adulticiding effectively protect human health?
3. Is pesticide resistance a concern?
4. Are climate and meteorological conditions favorable for ULV application?
5. Should aerial application be considered based on risk of epidemic or seriousness of threat?
6. Can pesticide use be avoided near sensitive human receptors or areas where residents have made requests to limit applications?
7. Are organic agricultural operations likely to be affected; can they be avoided?

8. Do labels require specific avoidance of habitats?
9. Are sensitive environmental resources present and will they be potentially affected?
10. Is consultation with other agencies required or prudent?

Continuance/Termination Criteria

Once initiated, treatments generally continue until surveillance and sampling indicate mosquito abundance has fallen below thresholds, no more incidence of disease or pathogens are detected, climate or meteorological conditions become unfavorable, or seasonal considerations and the biology of the mosquito species reduces risk (i.e. species that are die or become inactive during winter months).

Appendix A. Explanation of Acronyms

SMVCD-Shasta Mosquito and Vector Control District

MAD-Mosquito Abatement District

ATV-All Terrain Vehicle

WNV-West Nile Virus

WEE-Western Equine Encephalomyelitis

SLEV-St. Louis Encephalitis

CVEC-Center for Vector-borne Diseases

IVM-Integrated Vector Management

IPM-Integrated Pest Management

IMM-Integrated Mosquito Management

Bti-Bacillus thuringiensis israelensis

IGR-Insect Growth Regulator

MMF-Monomolecular Film

PHP-Public health Pesticide

ULV-Ultra-Low Volume

PBO-Piperonyl butoxide

EVS-Encephalitis Surveillance

FEMA-Federal Emergency Management Agency

SEMS-Standardized Emergency Management System

Appendix B. Mosquito-Control Pesticides Currently used by the District

EPA Registration No.	Trade Name	Chemical Name/Family	Mode of Action	Signal Word/Category	Hazardous/Non Hazardous (DOT)	Comments
Larvacides						
2724-448	Zoecon Altosid pellets	(S)-Methoprene / Terpenoid	Growth regulator	Caution / III	Not Regulated as Hazardous Material	Prevents adult emergence
2724-375	Zoecon Altosid Briquetes	(S)-Methoprene / Terpenoid	Growth regulator	Caution / IV	Not Regulated as Hazardous Material	Prevents adult emergence
2724-421	Zoecon Altosid XR Extended Release Briquetes	(S)-Methoprene / Terpenoid	Growth regulator	Caution / IV	Not Regulated as Hazardous Material	Prevents adult emergence
2724-392	Zoecon Altosid liquid	(S)-Methoprene / Terpenoid	Growth regulator	Caution / IV	Not Regulated as Hazardous Material	Prevents adult emergence
73049-10	Vectobac G (granules)	*Bacillus thuringiensis*, subsp. *Israelensis (Bti)*	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Selective biological agent
73049-20	Vectolex CG	*Bacillus thuringiensis*, subsp. *Israelensis* (Bti)	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Selective biological agent
73049-57	Vectolex WDG	*Bacillus sphaericus (Bs)*	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Selective biological agent
73049-429	VectoMax CG	*Bti* & *Bs* combined	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Selective biological agent
83362-3	Fourstar Briquetes	*Bti* & *Bs* combined	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Extended release product
73049-38	Vectobac 12AS	*Bti* in aqueous suspension	Spore forming bacterium, disrupts digestion in midgut of insects	Caution / IV	Not Regulated as Hazardous Material	Selective biological agent
70589-1	BVA 2 Mosquito Larvicide Oil	Aliphatic solvent, non-hazardous mineral oil	Surface oil, suffocates larval and pupal stages	Caution / IV	Not Regulated as Hazardous Material	Use in areas that do not support fish

8329-72	Mosquito Larvicide GB-llll, aka "Golden Bear Larvicide Oil"	Aliphatic solvent, non-hazardous mineral oil	Surface oil, suffocates larval and pupal stages	Caution / IV	Not Regulated as Hazardous Material	
8329-70	5% Skeeter Abate	Temephos / organophosphate	Neurotransmitter (cholinesterase) inhibitor	Warning / II	Non-Hazardous	May only be applied by public vector control agencies in agreement with CDPH
8329-80	Natular G (granules)	Spinosad	neural excitation in susceptible organisms	Caution / IV	Not Regulated as Hazardous Material	Spinosad is derived from a naturally occurring soil microbe
8329-84	Natular XRT (extended release tablets)	Spinosad	neural excitation in susceptible organisms	Caution / IV	Not Regulated as Hazardous Material	Spinosad is derived from a naturally occurring soil microbe
Adulticides						
1021-1688	Anvil 10 + 10 ULV	Sumithrin / pyrethroid	Neurotransmitter disrupter (ionic pathway, not cholinesterase inhibitor)	Caution / IV	Non-Hazardous	May only be applied by public vector control agencies in agreement with CDPH
1021-1795	Duet Dual-Action	Prallethrin and Sumithrin / pyrethroid	Neurotransmitter disrupter (ionic pathway, not cholinesterase inhibitor)	Caution / III	Non-Hazardous	May only be applied by public vector control agencies in agreement with CDPH
67760-34	Fyfanon ULV Mosquito	Malathion /organophosphate	Neurotransmitter (cholinesterase) inhibitor	Caution / III	Hazardous (slight hazard, NFPA rating 1)	Used to combat resistance to pyrethroids
432-1050	Pyrenone 25-5 Public Health	Pyrenone / pyrethroid	Neurotransmitter disrupter (ionic pathway, not cholinesterase inhibitor)	Caution / IV	Hazardous (Class 9)	May only be applied by public vector control agencies in agreement with CDPH
2724-791	Zenivex E20	Etofenprox / pyrethroid	Neurotransmitter disrupter (ionic pathway, not cholinesterase inhibitor)	Caution / IV	Chronic Health Hazard.	May only be applied by public vector control agencies in agreement with CDPH

Category I - **High Toxicity**. Signal words "Danger" or "Poison". Acute oral LD50 < 50 mg/kg
Category II - **Moderate Toxicity**. Signal word "Warning". Acute oral LD50 > 50 to 500 mg/kg
Category III - **Low Toxicity**. Signal word "Caution". Acute oral LD50 > 500 to 5000 mg/kg
Category IV -**Very low Toxicity**. Signal word "Caution" optional. Acute oral LD50 > 5000 mg/kg