FINAL

SCH# 2010081067

Programmatic Environmental Impact Report/ Environmental Impact Statement

for

Integrated Vector Management Practices of the
Orange County Vector Control District

Prepared for:

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VOLUME I – FINAL EIR & RESPONSE TO COMMENTS

1 INTRODUCTION

This document has been prepared in the form of an addendum to the Public Draft Programmatic Environmental Impact Report (PEIR) for Integrated Vector Management Practices of the Orange County Vector Control District. The PEIR assessed the likely environmental impacts of the Orange County Vector Control District's current and foreseeable future programs and outlined several mitigations measures to reduce their impact on the environment to a less than significant level.

The PEIR was made available for public comment on April 26, 2012. The draft was circulated to all local and State responsible and trustee agencies, and comments by the public were solicited through notices in local newspapers and posting by the County Clerk as required by CEQA. In addition, an electronic copy of the draft was posted on the OCVCD's website, and copies for viewing were located at four Orange County libraries. The 45-day public comment period ran through June 9, 2012.

A Public Hearing to received public comments was held along with the regular meeting of the OCVCD Board of Trustees on May 17, 2012, at the OCVCD's Headquarters located at 13001 Garden Grove Boulevard, Garden Grove, California. The Public Hearing was advertised along with the Notice of Availability of the PEIR that was posted in local libraries and newspapers. No comments were received during the Public Hearing. A list of commenters and all comments received during the public comment period are included in this document along with responses to those comments and explanations of revisions to text of the PEIR, as necessary.

None of the revisions change the Project Description or findings significantly, which would trigger the need to recirculate the PEIR. The OCVCD Board of Trustees accepted the draft PEIR at their regular board meeting on May 17, 2012. This document, together with the draft PEIR, will constitute the Final EIR if adopted by the OCVCD Board of Trustees.

2 SUMMARY OF REPORT

This chapter contains the Executive Summary of the Draft PEIR reprinted from that document, with necessary changes made in this Final EIR shown in double underline for additions and strikethrough for deletions.

EXECUTIVE SUMMARY

This Program Environmental Impact Report (PEIR) has been prepared to cover ongoing activities of the Orange County Vector Control District (OCVCD or "District"), an independent special district charged with protecting citizens of Orange County from vectors (i.e., any insect or other organism capable of harboring and transmitting agents of human disease) and vector-borne diseases. Originally established in 1947 as the Orange County Mosquito Abatement District, the District's name was changed to the

Orange County Vector Control District in 1975 and its services expanded from control of mosquitoes and surveillance of mosquito-borne diseases to include control of flies and rodents and surveillance of bubonic plague. Control of red imported fire ants (RIFA) was later added to the District's operations in 2004. The District currently provides services primarily to residents of Orange County but also provides vector control under contract to the University of California at Irvine, the San Joaquin Marsh of the University of California Natural Reserve System, Orange County Sanitation District, the Irvine Ranch Water District, the California State Lands Commission and the Naval Weapons Station at Seal Beach. The District is funded by property taxes, a service fee added in 1990-1991, and an assessment for control of red imported fire ants and enhanced vector-borne disease surveillance under Proposition 218, which was approved by the voters in July 2004.

The District has developed and adopted Integrated Vector Management practices to guide control programs for targeted species. Species targeted by the District include many species within several genera of mosquitoes that are vectors of serious diseases, such as West Nile, Saint Louis and Western equine encephalitis viruses, or nuisance species; the non-native roof rat (*Rattus rattus*), which can spread diseases such as bubonic plaque and fleaborne typhus; the red imported fire ant (*Solenopsis invicta*), an exotic species with a very painful sting; and filth flies and black flies, a group of flies that create nuisance conditions and bite humans. Integrated Vector Management practices include surveillance for vectors and disease, source reduction to limit breeding by vectors, education of the public in ways to aid source reduction and protect against disease-carrying vectors, and control of vector species using both chemical and biological agents.

The OCVCD uses a combination of physical inspections, trapping of vector species, remote sensing, and laboratory tests to establish the extent of vector populations and potential disease organisms. Information from field inspections is supplemented by contacts from the public about the presence and numbers of vectors and hosts. When vector populations surpass established thresholds and cannot be controlled with source reduction alone, the District applies chemical or biological control agents to reduce vector populations. Chemicals are rotated to reduce development of resistance in vectors and applied strictly according to label and safety requirements established by the U.S. Environmental Protection Agency and the California Department of Pesticide Regulation. The District has a general permit from State Water Resources Board (Order No. 2011-002-DWQ; General Permit No CAG 990004) for the application of mosquito pesticides to waterways and is a member of the Mosquito and Vector Control Districts' Monitoring Coalition, which has recently been instituted to monitor effects of chemical mosquito control on water quality. The District's program is overseen and monitored by the California Department of Public Health and the County Agricultural Commissioner.

CEQA/NEPA Process

Mosquito and vector control districts in California were established prior to the enactments of the National Environmental Policy Act (NEPA) in 1969 and the California Environmental Quality Act (CEQA) in 1970 and have been historically considered exempt from CEQA and NEPA analysis. However, recent federal court cases have raised questions about the potential effects upon rare and endangered species and water quality from habitat management activities and from pesticides. In 2001, the 9th Circuit

Federal Court issued the first of three decisions (*Headwaters Inc. v. Talent Irrigation District*) that pesticides applied to waters of the United States constitute chemical wastes or biological material under the Clean Water Act, which resulted in the adoption of an order requiring National Pollution Discharge Elimination System (NPDES) permits for the public health use of larvicides (pesticides to kill larval mosquitoes) by the California State Water Resources Control Board (SWRCB). A 2009 6th Circuit Federal Appeals Court decision (*National Cotton Council v. United States Environmental Protection Agency; USEPA*) required NPDES permits for the use of pesticides to kill adult mosquitoes (adulticides) for public health.

The District is preparing this Environmental Impact Report (EIR)/Environmental Impact Study (EIS) to serve as a basis for any future state or federal permits required for their operations and to disclose to the public the nature of the District's activities and their potential effects on the environment.

The CEQA/NEPA process was initiated by preparation of an Initial Study to determine if there were gaps in information on environmental issues and to assess the extent of potentially adverse environmental impacts. The Initial Study revealed that there are potential adverse impacts from the District's programs in the areas of Air Quality, Biology, Water Quality, Greenhouse Gases, and Hazardous Materials; these areas are the focus of the program EIR/EIS.

Potential Areas of Controversy

Potential areas of controversy include concerns of the public about exposure to toxic chemicals and the effect of these chemicals on human health and health of rare and endangered wildlife and other organisms such as honeybees.

Alternatives

Three alternatives are discussed in this PEIR. Alternative 1, the "No Project" Alternative is a continuation of the present programs of the District and is the preferred alternative.

The current District program includes the following main activities that are analyzed within this PEIR:

Mosquitoes

- Monitoring and estimating mosquito populations;
- Surveillance of West Nile virus and other arboviruses (viruses transmitted by arthropod vectors) in mosquitoes, trapped wild Mourning Doves (*Zenaida macroura*), House Finches (*Carpodacus mexicanus*), House Sparrows (*Passer domesticus*) and American Crows (*Corvus brachyrhynchos*). [Note: The District no longer uses sentinel chicken flocks, but some results from previous chicken flock surveillance are reported within the document].
- Source reduction by vegetation management with hand-held tools to increase water flow and emptying of artificial containers;

- Use and distribution of mosquitofish (*Gambusia affinis*) to the public for biological control of mosquitoes in unmaintained ornamental ponds and swimming pools;
- Chemical treatment with various larvicides (pesticides to kill larval mosquitoes, predominantly methoprene, water surface films, and bacterial larvicides) applied at ground level with truck-mounted or hand-held sprayers or very occasionally via helicopter;
- Application of adulticides (pesticides to kill adult mosquitoes, predominantly synthetic pyrethroids) to marsh habitats and inside underground storm drains using ultra-low volume (ULV) sprayers mounted on trucks;
- Public education about diseases risks and source reduction methods and responding to service requests made by the public;
- Surveillance activities and application of mosquito pesticides occasionally involve vegetation management with hand-held tools or limited use of an herbicide along upland trails to maintain access to treatment areas.

RIFA

- Surveillance of RIFA colonies using baited traps and information from public complaints;
- Treatment of RIFA colonies with a number of red imported fire ant baits (pyriproxifen, s-methoprene, indoxacarb, hydramethylnon);
- Public education;

Rodents

- Surveillance of roof rat populations through trapping and observation of sign;
- Surveillance of rodent-borne diseases within the County;
- Source reduction by public education on removal of harborage areas and conditions favorable to rats;
- Placement of rodenticide baits (bromadiolone) in tamper resistant bait stations on private residential properties only;

Flies

- Surveillance of filth and black fly populations through identification of larval sources and public complaints;
- Control of populations through source reduction of decaying organic matter or conditions favorable to fly generation;
- Chemical control of flies with pyrethroids in very rare instances of extreme nuisance conditions.

A second alternative, Alternative 2, is the elimination of or reduction in the application of chemical pesticides. Scenarios examined under this alternative include elimination of all pesticide application, discontinuation of ground-based ultra-low volume pesticide applications over marsh areas and/or in the underground storm drain systems, discontinuation of application of larvicides in natural waterways, and discontinuation of the use of red imported fire ant and rodenticide baits. None of the scenarios considered presented clear significant environmental benefits over the current program when weighed against the potential risks to human health by eliminating some or all of the chemical control of vectors. In addition, the use of the pesticides currently applied by the District for public health is a small fraction of the overall pesticide usage in Orange County and their elimination would not significantly decrease the amount of these pesticides in the environment.

Additional alternatives were considered but rejected as infeasible. They include a no vector control alternative, use of only biological organisms for control, and use of abatement proceedings to accomplish vector control.

Findings of Significance

The assessment for the Initial Study eliminated a number of areas of potential environmental effects because the project does not include new construction, any changes in land form or land use, or significant changes in activities. The project, as proposed, is a continuation of ongoing policies and activities.

None of the District's operations or policies induces, facilitates or stimulates growth. No major changes in activities or practices are currently being considered that would create additional impacts under the preferred alternative.

Because the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they are unlikely to accumulate or produce long-term impacts when used in ultra-low volume vector control applications. Current information suggests that impacts to water quality or the water supply from vector control pesticide applications are unlikely. The formation of the Mosquito and Vector Control Association of California (MVCAC) Monitoring Coalition to oversee water quality monitoring in conjunction with the issuance of the NPDES General Permits for application of mosquito larvicides and adulticides to waters of the U.S. offers additional assurance that water quality impacts will be detected and addressed should they be found to occur.

None of the active ingredients used by OCVCD is expected to have significant adverse effects on human health when applied as specified on the product labels as in the current vector control program. Based on studies by USEPA and several universities, there will be no cumulative impacts to human health with continued use of the pesticides at label rates and in the manner specified by USEPA. The District should continue to follow best management practices (BMPs) to protect human health.

The air quality and greenhouse gas impacts of the OCVCD will continue at below action threshold levels for the South Coast Air Quality Management District and are not cumulatively considerable. While the

OCVCD is limited in its ability to reduce vehicle miles traveled as part of vector control operations, the policies of the program, such as upgrading and converting its fleet to alternative fuels and electric vehicles, are consistent with measures to reduce air pollutants including greenhouse gases.

No potentially significant impacts to urban and rural land uses would result from Alternatives 1 & 2. The District's operations do not have a significantly incremental or cumulative impact upon public services.

While scientific literature suggests District activities are unlikely to adversely affect non-endangered wildlife or plants significantly, several activities of the District were identified as having potential to adversely impact rare and endangered species or their habitats. The following impacts were identified, and mitigations were developed to reduce the impacts to less than significant:

Impact Bio-1: The use of certain mosquito control products may adversely affect listed rare or endangered species if used within occupied habitat.

Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.

The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. The District biologist and supervisor shall also meet with USFWS personnel on an annual basis at the beginning of the treatment season to receive updated occurrence information and to review potential impacts from District activities to listed species and critical habitats. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas, as recommended by USFWS. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats.

Impact Bio-2: Application of petroleum distillate oils in habitats where Light-footed Clapper Rails are present is likely to significantly adversely affect this species and may impact other species of wetland nesting birds.

Mitigation Measure Bio-2: Prohibit petroleum distillate use within natural wetlands and waterways draining into intertidal areas to protect Light-footed Clapper Rail.

The District shall develop and adopt a BMP that prohibits use of petroleum distillate oils within natural marshes or wetlands that flow into intertidal areas to reduce the impacts to Light-footed Clapper Rail and other marsh nesting birds in these habitats.

Impact Bio-3: Distribution of mosquitofish by OCVCD to the public and subsequent unintended releases into natural environments has potential to adversely affect listed species of invertebrates, amphibians and/or fish in Orange County.

Mitigation Measure Bio-3: Limit mosquitofish release to isolated artificial systems.
Mosquitofish shall only be introduced into isolated systems that are not connected to natural waterways to prevent inadvertent introduction of mosquitofish into natural ecosystems by the District. Determination of whether a system is isolated or not shall be made by OCVCD supervisory personnel, with the assistance of the GIS mapping department. If a determination cannot be made regarding the connectivity of a system to natural waterways, the system shall not be treated with mosquitofish.

Impact Bio-4: Vegetation management incidental to surveillance and control operations and intrusion of vector control inspectors into occupied habitat may adversely impact listed shrub-nesting birds if performed during the breeding season or adversely impact their breeding habitat.

Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than ~~3 days~~ 48 hours prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. Flagging will be removed as soon as work is complete to avoid attracting predators to nests. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists, consult with agencies if necessary, and conduct an~~d~~y necessary pre-activity surveys for special-status species to avoid them.

Impact Bio-5: Application of the rodenticide, bromadiolone, has potential to adversely impact some listed wildlife species.

See Mitigation Measure Bio-1. The District's current BMPs help reduce the risk of significant adverse impacts to listed species to bromadiolone. However, the incidence and impact of secondary poisoning is difficult to evaluate because of lack of data. Mitigation Measure Bio-1 increases the ability of the District to avoid areas adjacent to habitat for listed species within Orange County by improving the ability of the District to detect where certain treatments or activities may be less favorable or where more caution is needed because of the presence or likely presence of rare or threatened or endangered species. This mitigation will also reduce the potential for bromadiolone applications to adversely impact listed species to less than significant.

No significant unavoidable adverse impacts or significant irreversible environmental changes were identified by this PEIR.

3 REVISIONS TO THE DRAFT EIR

This section of the document demonstrates specific changes to the text of the Draft EIR that are being made in response to comments by reviewing agencies, organizations and members of the public. For each revision, the revised page and location on the page is referenced and followed by the textual revision. New text is indicated with double underline formatting, and removed text is indicated with strikethrough. None of the changes made constitutes significant changes to the Draft EIR, so recirculation of the Draft EIR is not required. All changes shown in this section are supported by responses indicated in Section 5.

Page vi, second to last paragraph:

"Because the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they are unlikely to accumulate or produce long-term impacts when used in ultra-low volume vector control applications. Current information suggests that impacts to water quality or the water supply from vector control pesticide applications are unlikely. The formation of the Mosquito and Vector Control Association of California (MVCAC) Monitoring Coalition to oversee water quality monitoring in conjunction with the issuance of the NPDES General Permits for application of mosquito larvicides and adulticides to waters of the U.S. offers additional assurance that water quality impacts will be detected and addressed should they be found to occur."

Page vii, fifth paragraph:

"Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.
The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. The District biologist and supervisor shall also meet with USFWS personnel on an annual basis at the beginning of the treatment season to receive updated occurrence information and to review potential impacts from District activities to listed species and critical habitats. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas, as recommended by USFWS. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats."

Page viii, fourth paragraph:

"Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds. Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than ~~3 days~~ 48 hours prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. Flagging will be removed as soon as work is complete to avoid attracting predators to nests. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists, consult with agencies if necessary, and conduct and~~d~~y necessary pre-activity surveys for special-status species to avoid them."

Page 1-6. Section to follow last paragraph:

"California Department of Fish and Game

The District also maintains a scientific collection permit (SC-009202) for the handling of wild birds for surveillance activities."

Page 3- 61, first paragraph:

Groundwater Resources

~~Orange County has two principal ground basins that underlie Orange County: the Coastal Plain Basin and the San Juan Valley Basin. According to the Orange County Water District, they supply 60- 75% of the water delivery for municipal, industrial and agricultural use (Orange County Water District 2010).~~ The Orange County Water District manages the Orange County Groundwater Basin that supplies approximately 60-75% of the water supply for north and central Orange County.

Page 3-61, second paragraph:

The Coastal Plain Basin, 360-square miles underlying 45% of Orange County, is the largest basin in the County. Drained by the San Ana River and Santiago Creek, this basin has a well that yields 600 gallons per minute (gpm) on average to a maximum of 1,000 gpm. ~~Storage capacity is estimated at 40 million acre-feet with recharge estimated at 221,000 acre-feet per year; the useable storage capacity is undetermined. Intensive irrigation and municipal, industrial and domestic use have increased water extraction rates.~~ The groundwater basin is recharged primarily with water from the Santa Ana River and Santiago Creek. The OCWD estimates that 66 million acre-feet of fresh water is stored in the Basin when full, although only a fraction of this water can be pumped out without causing physical damage such as seawater intrusion or the potential for land subsidence. Groundwater production averages approximately 250,000 to 300,000 acre-feet per year. Water quality problems include high total

dissolved solids (TDS) and nitrogen (TDN) concentrations, overdrafting and sea water intrusion. Water basins underlying Los Angeles, north of the County, interchange somewhat with the basin (Orange County Water District 2010).

Page 4-86, second paragraph:
"The OCVCD applies several different pesticides to both terrestrial and aquatic environments, a practice which has the potential, according to Federal Court decisions, to violate water quality standards by providing a source of pesticides to ~~streams and other~~ natural aquatic environments. However, none of the pesticides used in vector control by the District ~~is a chemical currently contributing~~ is currently known to contribute significantly to the impaired water quality of the listed regional streams and water bodies that are monitored by the SWRCB and the Regional Water Quality Control Boards. Monitoring specified by the new General Permit will ~~additionally facilitate the evaluation of~~ and concurrent toxicity studies will clarify water quality impacts from vector control practices."

Page 4-100, second paragraph:

"Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.
The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. The District biologist and supervisor shall also meet with USFWS personnel on an annual basis at the beginning of the treatment season to receive updated occurrence information and to review potential impacts from District activities to listed species and critical habitats. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas, as recommended by USFWS. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats."

Page 4-103, first paragraph:

"Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than ~~3 days~~ 48 hours prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the

species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. Flagging will be removed as soon as work is complete to avoid attracting predators to nests. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists, consult with agencies if necessary, and conduct and~~y~~ necessary pre-activity surveys for special-status species to avoid them."

4 LIST OF COMMENTERS

Comments were received from the following agencies and organizations.

Commenter	Agency/Organization	Address	Correspondence Date
Dave Singleton, Program Analyst	Native American Heritage Commission	915 Capital Mall, Room 364, Sacramento, CA 95814	May 24, 2012
Michael Balsamo, Manager, OC Community Development OC Public Works/OC Planning	Orange County Public Works	PO Box 4048, Santa Ana, CA 97202-4048	May 29, 2012
Stephen Juarez, Environmental Program Manager	State of California-The Natural Resources Agency	Department of Fish and Game, South Coast Region 3883 Ruffin Road, San Diego, CA 92123	June 5, 2012
Christopher Herre, Branch Chief	State of California Department of Transportation	District 12, Local Development/Intergovernmental Review 3347 Michelson Drive, Suite 100, Irvine, CA 92612-8894	June 6, 2012
Michael R. Markus, P.E., D.WRE, General Manager	Orange County Water District	PO Box 8300, Fountain Valley, CA 92728-8300	June 7, 2012
Jonathan Synder for Karen A. Goebel, Assistant Field Supervisor	United States Department of the Interior	FWS-OR-11B0041-12TA0391 Fish and Wildlife Service, Ecological Services Carlsbad Fish and Wildlife Office 6010 Hidden Valley Road, Suite 101, Carlsbad, CA 92011	June 7, 2012
Susan Sheakley, Acting Co-Chairman, Conservation Committee	Sea & Sage Audubon	PO Box 5447, Irvine, CA 92616-5447	June 8, 2012

5 COMMENTS AND RESPONSES TO COMMENTS

This section includes the full text of each comment. Each comment letter is numbered, and individual sections of the letter are marked with numbers that correspond to responses. Responses to each comment follow the comment letter.

STATE OF CALIFORNIA — Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
ds_nahc@pacbell.net

May 24, 2012

RECEIVED
MAY 2 8 2012
ORANGE COUNTY
VECTOR CONTROL DIST.

\Mr. Albert J. Beck
Orange County Vector Control District
13001 Orange Grove Boulevard
Garden Grove, CA 92843-2102

Re: SCH#2010081067; CEQA Notice of Completion; draft Programmatic Environmental impact Report (PEIR) for the **"Integrated Vector Management Practices of the Orange County Vector Control District;"** located in Orange County, California.

Dear Mr. Beck:

The Native American Heritage Commission (NAHC), the State of California 'Trustee Agency' for the protection and preservation of Native American cultural resources pursuant to California Public Resources Code §21070 and affirmed by the Third Appellate Court in the case of EPIC v. Johnson (1985: 170 Cal App. 3rd 604).

This letter includes state and federal statutes relating to Native American historic properties of religious and cultural significance to American Indian tribes and interested Native American individuals as 'consulting parties' under both state and federal law. State law also addresses the freedom of Native American Religious Expression in Public Resources Code §5097.9. 1-1

The California Environmental Quality Act (CEQA – CA Public Resources Code 21000-21177, amendments effective 3/18/2010) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR) per the CEQA Guidelines defines a significant impact on the environment as 'a substantial, or potentially substantial, adverse change in any of physical conditions within an area affected by the proposed project, including ...objects of historic or aesthetic significance." In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential effect (APE), and if so, to mitigate that effect. The NAHC did conduct a Sacred Lands File (SLF) search within the 'area of potential effect (APE) and Native American cultural resources were not identified.

The NAHC "Sacred Sites,' as defined by the Native American Heritage Commission and the California Legislature in California Public Resources Code §§5097.94(a) and 5097.96. Items in the NAHC Sacred Lands Inventory are confidential and exempt from the Public Records Act pursuant to California Government Code §6254 (r). 1-2

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries of cultural resources or burial sites once a project is underway. Culturally affiliated tribes and individuals may have knowledge of the religious and cultural significance of the historic properties in the project area (e.g. APE). We strongly urge that you make contact with the list of Native American Contacts on the attached list of Native American

contacts, to see if your proposed project might impact Native American cultural resources and to obtain their recommendations concerning the proposed project. Pursuant to CA Public Resources Code § 5097.95, the NAHC requests cooperation from other public agencies in order that the Native American consulting parties be provided pertinent project information. Consultation with Native American communities is also a matter of environmental justice as defined by California Government Code §65040.12(e). Pursuant to CA Public Resources Code §5097.95, the NAHC requests that pertinent project information be provided consulting tribal parties. The NAHC recommends *avoidance* as defined by CEQA Guidelines §15370(a) to pursuing a project that would damage or destroy Native American cultural resources and Section 2183.2 that requires documentation, data recovery of cultural resources.

Furthermore, the NAHC if the proposed project is under the jurisdiction of the statutes and regulations of the National Environmental Policy Act (e.g. NEPA; 42 U.S.C. 4321-43351). Consultation with tribes and interested Native American consulting parties, on the NAHC list, should be conducted in compliance with the requirements of federal NEPA and Section 106 and 4(f) of federal NHPA (16 U.S.C. 470 *et seq*), 36 CFR Part 800.3 (f) (2) & .5, the President's Council on Environmental Quality (CSQ, 42 U.S.C 4371 *et seq.* and NAGPRA (25 U.S.C. 3001-3013) as appropriate. The 1992 *Secretary of the Interiors Standards for the Treatment of Historic Properties* were revised so that they could be applied to all historic resource types included in the National Register of Historic Places and including cultural landscapes. Also, federal Executive Orders Nos. 11593 (preservation of cultural environment), 13175 (coordination & consultation) and 13007 (Sacred Sites) are helpful, supportive guides for Section 106 consultation. The aforementioned Secretary of the Interior's *Standards* include recommendations for all 'lead agencies' to consider the historic context of proposed projects and to "research" the cultural landscape that might include the 'area of potential effect.'

1-2 cont'd

Confidentiality of "historic properties of religious and cultural significance" should also be considered as protected by California Government Code §6254(r) and may also be protected under Section 304 of he NHPA or at the Secretary of the Interior discretion if not eligible for listing on the National Register of Historic Places. The Secretary may also be advised by the federal Indian Religious Freedom Act (cf. 42 U.S.C., 1996) in issuing a decision on whether or not to disclose items of religious and/or cultural significance identified in or near the APEs and possibility threatened by proposed project activity.

Furthermore, Public Resources Code Section 5097.98, California Government Code §27491 and Health & Safety Code Section 7050.5 provide for provisions for inadvertent discovery of human remains mandate the processes to be followed in the event of a discovery of human remains in a project location other than a 'dedicated cemetery'.

1-3

To be effective, consultation on specific projects must be the result of an ongoing relationship between Native American tribes and lead agencies, project proponents and their contractors, in the opinion of the NAHC. Regarding tribal consultation, a relationship built around regular meetings and informal involvement with local tribes will lead to more qualitative consultation tribal input on specific projects.

Finally, when Native American cultural sites and/or Native American burial sites are prevalent within the project site, the NAHC recommends 'avoidance' of the site as referenced by CEQA Guidelines Section 15370(a).

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton
Program Analyst

Cc: State Clearinghouse

Attachment: Native American Contact List

Native American Contacts
Orange County
May 24, 2012

Ti'At Society/Inter-Tribal Council of Pimu
Cindi M. Alvitre, Chairwoman-Manisar
3094 Mace Avenue, Apt. B Gabrielino
Costa Mesa, , CA 92626
calvitre@yahoo.com
(714) 504-2468 Cell

Gabrielino Tongva Nation
Sam Dunlap, Chairperson
P.O. Box 86908 Gabrielino Tongva
Los Angeles , CA 90086
samdunlap@earthlink.net

(909) 262-9351 - cell

Juaneno Band of Mission Indians Acjachemen Nation
David Belardes, Chairperson
32161 Avenida Los Amigos Juaneno
San Juan Capistrano CA 92675 m
chiefdavidbelardes@yahoo.
(949) 493-4933 - home
(949) 293-8522

Juaneno Band of Mission Indians Acjachemen Nation
Anthony Rivera, Chairman
31411-A La Matanza Street Juaneno
San Juan Capistrano CA 92675-2674
arivera@juaneno.com
(949) 488-3484
(949) 488-3294 - FAX
(530) 354-5876 - cell

Tongva Ancestral Territorial Tribal Nation
John Tommy Rosas, Tribal Admin.
Private Address Gabrielino Tongva
,
tattnlaw@gmail.com
310-570-6567

Gabrielino Tongva Indians of California Tribal Council
Robert F. Dorame, Tribal Chair/Cultural Resources
P.O. Box 490 Gabrielino Tongva
Bellflower , CA 90707
gtongva@verizon.net
562-761-6417 - voice
562-761-6417- fax

Gabrieleno/Tongva San Gabriel Band of Mission
Anthony Morales, Chairperson
PO Box 693 Gabrielino Tongva
San Gabriel , CA 91778
GTTribalcouncil@aol.com
(626) 286-1632
(626) 286-1758 - Home
(626) 286-1262 -FAX

Juaneno Band of Mission Indians
Alfred Cruz, Cultural Resources Coordinator
P.O. Box 25628 Juaneno
Santa Ana , CA 92799
alfredgcruz@sbcglobal.net
714-998-0721
714-998-0721 - FAX
714-321-1944 - cell

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed SCH#2010081067; CEQA Notice of Completion; draft Programmatic Environmental Impact Report (PEIR) for the Integrated Vector Management Control Practices; located in Orange County, California.

Native American Contacts
Orange County
May 24, 2012

Juaneno Band of Mission Indians
Anita Espinoza
1740 Concerto Drive Juaneno
Anaheim , CA 92807
neta777@sbcglobal.net
(714) 779-8832

United Coalition to Protect Panhe (UCPP)
Rebecca Robles
119 Avenida San Fernando Juaneno
San Clemente CA 92672
rebrobles1@gmail.com
(949) 573-3138

Gabrielino-Tongva Tribe
Bernie Acuna
1875 Century Pk East #1500 Gabrielino
Los Angeles , CA 90067
(619) 294-6660-work
(310) 428-5690 - cell
(310) 587-0170 - FAX
bacuna1@gabrieinotribe.org

Juaneno Band of Mission Indians Acjachemen Nation
Joyce Perry, Representing Tribal Chairperson
4955 Paseo Segovia Juaneno
Irvine , CA 92612
949-293-8522

Gabrielino-Tongva Tribe
Linda Candelaria, Chairwoman
1875 Century Pk East #1500 Gabrielino
Los Angeles , CA 90067
lcandelaria1@gabrielinoTribe.org
626-676-1184- cell
(310) 587-0170 - FAX
760-904-6533-home

Gabrieleno Band of Mission Indians
Andrew Salas, Chairperson
P.O. Box 393 Gabrielino
Covina , CA 91723
(626) 926-4131
gabrielenoindians@yahoo.com

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable for contacting local Native Americans with regard to cultural resources for the proposed SCH#2010081067; CEQA Notice of Completion; draft Programmatic Environmental Impact Report (PEIR) for the Integrated Vector Management Control Practices; located in Orange County, California.

COMMENT LETTER #1 – DAVE SINGLETON, PROGRAM ANALYST, NATIVE AMERICAN HERITAGE COMMISSION, 915 CAPITOL MALL, ROOM 364, SACRAMENTO CA 95814

1-1: This comment states that NAHC conducted a Sacred Lands File (SLF) search within the APE and cultural resources were not identified.

This is not a comment on the adequacy of the PEIR, and no response is required.

1-2: This comment advises that members of the list of Native American Contacts should be contacted to determine if the project might impact Native American cultural resources and to obtain their recommendations concerning the project and recommends compliance with federal NEPA, Section 106 NHPA, and other federal laws and statutes applicable to cultural resources, as appropriate..

An Initial Study was performed for the programs of the OCVCD to determine if there were areas of the environment on which the OCVCD's programs had no impact or less than significant impacts and to focus the subsequent EIR. Because the OCVCD programs do not include modification of historical resources and the OCVCD does not engage in activities that disturb the ground surface, the Initial Study found there would be no impact on cultural resources. Should the OCVCD significantly change its policies and engage in ground-breaking activities as a part of future programs or construct a new facility, for example, the District would be required by the County of Orange to consult with Native American parties prior to implementation of any such activity. Activities that would potentially result in significant impacts to Native American archaeological or historical resources would trigger the preparation of a separate EIR specific to those projects.

1-3: This comment suggests provisions regarding the inadvertent discovery of human remains pursuant to HSC Section 7050.5 should be included in the PEIR. Avoidance is recommended for occasions where Native American cultural sites or burial sites are prevalent within the project site.

Provisions regarding inadvertent discover of human remains are standard requirements for agencies permitting ground-disturbing projects. As mentioned above, no surface disturbances are anticipated as part of ongoing operations now or in the future.

COMMENT LETTER #2

ORANGE COUNTY
OC PublicWorks
Our Community. Our Commitment.

Jess A. Carbajal, Director
300 N. Flower Street
Santa Ana, CA

P.O. Box 4048
Santa Ana, CA 92702-4048

Telephone: (714) 834-2300
Fax: (714) 834-5188

NCL 12-012

May 29, 2012

RECEIVED
JUN 01 2012
ORANGE COUNTY
VECTOR CONTROL DIST

Michael G. Hearst, District Manager
Orange County Vector Control District
13001 Garden Grove Boulevard
Garden Grove, California 92843

SUBJECT: Notice of Availability/Public Hearing Draft Programmatic Environmental Impact Report for Integrated Vector Management Practices of the Orange County Vector Control District

Dear Mr. Hearst:

The County of Orange has reviewed the Notice of Availability/Public Hearing Draft Programmatic Environmental Impact Report for Integrated Vector Management Practices of the Orange County Vector Control District and offers the following comment:

Environmental Resources:

There is a statement on Page 4-86 that "none of the pesticides used in vector control by the District is a chemical currently contributing significantly to the impaired water quality of the listed regional streams and water bodies that are monitored by the SWRCB and the Regional Water Quality Control Boards". This is not supported in the document as to local impacts, and current knowledge is not sufficient to allow such a determination. Many local impairments are deemed due to "unknown toxicity" which could be caused by the synergistic effects of multiple pesticides (and/or other chemicals) in runoff arising variously from public and private, commercial and residential, industrial and institutional uses contributing to downstream toxicity. Little is known about break-down products of pesticides and synergistic effects amongst all the contaminants in runoff, from all sources. Chemical transformations may also occur as runoff infiltrates. Finally, there would be the possible synergistic effects of inactive ingredients and dispersal agents as well as the active ingredient pesticide to be considered. 2-1

The unknown toxicity issue in the Newport Bay watershed is being addressed by the Toxicity Reduction and Investigation Program (TRIP), and current-use pesticides are being examined as one of the most probable causes. Toxicity TMDLs for all Orange County impaired waters are expected to be completed by 2020, and more information will be available as these evaluations are completed.

Similarly, there is a statement on Page vi that "because the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, 2-2

moisture and soil, they are unlikely to accumulate or produce long-term impacts. Current information suggests that impacts to water quality...from vector control pesticide applications are unlikely". Again, this is not supported in the document as to local impacts, and current knowledge is not sufficient to allow such a determination. For example, parathyroid half-life in soil is generally 30 days, and there is no local information that gradually decreasing concentrations do not present a "long-term" impact. Sumithrin is one example of a parathyroid used by the District.

2-2 cont'd

As noted in the EIR, further "monitoring...will additionally facilitates the evaluation of water quality impacts from vector control practices".

If you require any additional information, please contact Grant Sharp at (714) 955-0674.

Project Management:

The extensive use of herbicide is identified in the document. Yet, impacts to native vegetation, including existing mitigation sites that serve as habitat to state and federal endangered species within Orange County Flood Control District right of way and other County of Orange properties, is not quantified. These sites represent substantial native plant habitat, which in some cases, are implemented for the purpose of endangered species recovery. Pesticide use by Orange County Vector Control District (OCVCD) could be detrimental to existing native plant habitat communities and may cause much distress to existing mitigation sites which are mandated by state and federal laws.

2-3

The Programmatic Environmental Impact Report should identify existing native plant habitat mitigation sites within the areas of vector control activity and mitigation measures that address impacts to these existing native plant communities, where minimum native plant coverage criteria is required by state and federal law.

If you require any additional information, please contact Rory Paster at (714) 667-3912.

Sincerely,

Michael Balsamo
Manager, OC Community Development
OC Public Works/OC Planning
300 North Flower Street
Santa Ana, California 92702-4048
Michael.Balsamo@ocpw.ocgov.com

cc: Chris Crompton, Environmental Resources
Vincent Gin, Project Management

COMMENT LETTER #2 – MICHAEL BALSAMO, MANAGER, ORANGE COUNTY COMMUNITY DEVELOPMENT, ORANGE COUNTY PUBLIC WORKS, P.O. BOX 8300, FOUNTAIN VALLEY, CA 92728-8300

2.1: This comment quotes the PEIR, Environmental Resources: Page 4-86. The statement reading "none of the pesticides used in vector control.....contributing significantly to the impaired water quality..." is not supported in the document as to local impacts due to the "unknown toxicity" category for those listed stream segments. These unknown toxicities could be caused by synergistic effects of multiple chemicals. This should be considered and discussed. The Newport Bay unknown toxicity issue is being addressed by the Toxicity Reduction and Investigation Program (TRIP).

The comment suggests that the statement in the PEIR about the chemicals applied by OCVCD not being on the State Water Resources Control Board (SWRCB) 303 d list of contaminated waterways is not supported because there are listed "unknown toxicities" associated with certain waterways, for example, Newport Bay, as the commenter points out. "Unknown toxicity" is the category given to water that displays some negative effect on organisms as measured by the SWRCB tests but has not yet been subject to a toxic identification evaluation; thus the cause of the toxic effect is unknown (personal communication, Jeffrey Shu, SWRCB; May 5, 2011). The commenter suggests that the unknown toxicities of stream segments may be due to synergistic interactions among multiple chemicals present in these waterways. A synergistic interaction among multiple chemicals is that which is observed when the resulting toxicity of several chemicals in combination is greater than the expected additive impact of the chemicals. Pesticides occur as mixtures in the environment, and it is difficult to understand and predict their risk because of the complex chemical and ecological interactions that may occur under highly variable conditions. Eco-Analysts agrees with the commenter's point that unknown toxicities measured by SWRCB could be caused by cumulative and/or synergistic effects of multiple chemicals, including chemicals utilized by OCVCD. However, based on the research regarding impacts of the ultra-low volume application of the pesticides application, the numerous Best Management Practices utilized by the District to avoid drift of compounds toxic to water dwelling organisms into waterways, and the contribution of the public health use of pesticides to the overall pesticide load in Orange County as measured by the Agricultural Commissioner's Office, we do not agree that it is likely that the District's use of pesticides is a significant contributor to these unknown toxicity designations for the affected waterways. Rather, it is much more likely that, if any of the pesticides the District uses is a contributor to the unknown toxicities, widespread use of pesticides for agriculture, landscaping and residential uses is the major source of these pesticides in these waterways.

The following changes are made to the text of the PEIR to acknowledge that there is uncertainty about the source of the water quality impairments listed by SWRCB:

Page 4-86, second paragraph:
"The OCVCD applies several different pesticides to both terrestrial and aquatic environments, a practice which has the potential, according to Federal Court decisions, to violate water quality standards by providing a source of pesticides to ~~streams and other~~ natural aquatic environments. However, none of the pesticides used in vector control by the District ~~is a chemical currently contributing~~ is currently known to contribute significantly to the impaired water quality of the listed regional streams and water bodies that are monitored by the SWRCB and the Regional Water Quality Control Boards. Monitoring specified by the new General Permit will ~~additionally facilitate the evaluation of~~ and concurrent toxicity studies will clarify water quality impacts from vector control practices."

2.2: This comment references Page vi of the PEIR and states "The statement '...current pesticides applied by the District are non-persistent compounds...' is not supported in the document as to local impacts and current knowledge is not sufficient to make such a determination. Parathyroid half-life in soil is generally 30 days and there is no local information that gradually decreasing concentrations do not present a long term impact. Sumithrin is a parathyroid."

The commenter appears to have substituted the word parathyroid for pyrethroid. The two terms have very different meanings. Pyrethroids are a class of insecticide that includes Sumithrin. Parathyroid is the name given to hormone-producing glands below the thyroid gland. For the purposes of this response it is assumed that the commenter intended to use the word "pyrethroid."

The commenter also states that current knowledge is insufficient to describe the pesticides used by OCVCD as non-persistent. The reference statement in the text of the PEIR reads "...the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they are unlikely to accumulate or produce long-term impacts." This statement is based on review Material Safety Data Sheets (MSDS) and environmental fate studies, which reflect the best available scientific data on these compounds, for all the products applied by the District.

Persistence of compounds used as pesticides is determined through rigorous peer-reviewed studies by the U.S. Environmental Protection Agency (USEPA) and approved by California Department of Pesticide Regulation (CDPR) prior to publication and development of label requirements. For pesticide products being registered in California, CDPR characterizes various physical-chemical properties of the products' active ingredients. Terrestrial field dissipation (TFD) half-life is one property that is characterized. The half-life of a substance is defined as the time it takes for a substance to decrease its amount by half. Of the various methods for determining a half-life of an active ingredient, DPR has adopted the method described by Johnson et al. (1992). CDPR establishes threshold values, or special numeric values (SNV) in regulation to distinguish leaching pesticides from non-leaching pesticides. SNVs were established, for water solubility, soil adsorption, hydrolysis half-life, aerobic soil metabolism half-life, and anaerobic soil metabolism half-life. CDPR has not yet established an SNV for terrestrial field dissipation data, although it is collected and evaluated as part of the pesticide registration process. CDPR's SNVs are equal to or more stringent than the values used by the USEPA. Pesticides that exceed the SNVs and have specified labeled uses will be placed on the Ground Water Protection List (3 CCR § 6800[b]). This information is

used to develop label requirements for each pesticide in order to reduce significant impacts from pesticide use. OCVCD complies with all label requirements.

The categorization by USEPA and CDPR of pyrethroids as "non-persistent" is made relative to chemicals, such as heavy metals and organochlorines, which persist in the environmental for much longer to an indefinite period in the case of heavy metals. The half-lives for compounds utilized by OCVCD are available through CDPR on Material Safety Data Sheets provided for each compound approved for use. These are included as an appendix (Appendix A) to this document. The statement regarding persistence on pg. vi is consistent with information available on these sheets and the categorizations made by USEPA/CDPR.

The comment suggests there may be long-term impacts from gradually decreasing concentrations of pyrethroids in soil. Eco-Analysts does not agree that long-term impacts are likely from pesticide application for vector control because of the ultra-low volume method of application of pyrethroids. Pyrethroids are used to control adult mosquitoes and applied from trucks with machines that create a mist or fog of very fine particles (typically 5-25 microns in size) applied over large areas. Research (see Schleier III 2008 for summary) has shown very little of the product reaches the ground surface using these techniques, and residues become non-detectable within 9-72 hours of application.

To clarify that long-term impacts are unlikely with vector control applications, the text in the second to last paragraph on Page vi is amended as follows:

"Because the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they are unlikely to accumulate or produce long-term impacts when used in ultra-low volume vector control applications. Current information suggests that impacts to water quality or the water supply from vector control pesticide applications are unlikely. The formation of the Mosquito and Vector Control Association of California (MVCAC) Monitoring Coalition to oversee water quality monitoring in conjunction with the issuance of the NPDES General Permits for application of mosquito larvicides and adulticides to waters of the U.S. offers additional assurance that water quality impacts will be detected and addressed should they be found to occur."

2.3: This comment states "Project Management. Extensive use of herbicide is identified in the document, yet impacts to native vegetation are not quantified. The programmatic EIR should identify native plant habitat mitigation sites within the areas of vector control activity and mitigation measures that address impacts to these existing native plant communities, where minimum native plant coverage criteria is required by state and federal law."

The commenter's statement that extensive use of herbicide is identified in the document is not consistent with the text of the document. Table 2.4, pg.2-29 of the PEIR, identifies only one herbicide is utilized by OCVCD (Roundup Pro) for offsite purposes. Use of herbicides is discussed in Section 2.1.5 Chemical Control, which reveals that only two gallons of the herbicide were utilized throughout the entire District during the 2009-2010 season. Applications were only made on for control of poison oak

along upland trails used to access mosquito breeding sites. Herbicides are not applied to aquatic environments by the District.

The impacts to native plant communities are considered minimal due to the extremely limited application of herbicides by the District. The measures suggested by Public Works, including identification of mitigation sites, quantification of impacts related to herbicide application, and development of mitigation measures to address these impacts are considered unwarranted for this minor impact. Because herbicides are not applied beyond existing access trails, and only on poison oak that has incurred within previously cleared trails, no new impacts are anticipated as a result of herbicide application.

State of California -The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
South Coast Region
3883 Ruffin Road
San Diego, CA 92123
(858) 467-4201
http://www.dfg.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

June 5, 2012

RECEIVED
JUN 06 2012
ORANGE COUNTY
VECTOR CONTROL DIST.

Mr. Albert J. Beck
Orange County Vector Control District
13001 Orange Grove Blvd.
Garden Grove, CA 92843-2102

Subject: Comments on the Draft Programmatic Environmental Impact Report for Integrated Vector Management Practices: Orange County, CA (SCH No. 2010081067)

Dear Mr. Beck:

The Department of Fish and Game (Department) has reviewed the above-referenced Programmatic Draft Environmental Impact Report (PDEIR) for the Integrated Vector Management Practices Project. The comments provided herein are based on information provided in the PDEIR and associated documents, our knowledge of sensitive and declining vegetation communities in the County of Orange, and our participation in regional conservation planning efforts.

The Department is a Trustee Agency with jurisdiction over natural resources affected by the project (California Environmental Quality Act [CEQA] Guidelines §15386) and a Responsible Agency under CEQA Guidelines Section 15381 over those aspects of the proposed project that come under the purview of the California Endangered Species Act (Fish and Game Code §2050 et seq.), Fish and Game Code Section 1600 et seq., and other sections of the Fish and Game Code. The Department also administers the Natural Community Conservation Planning Program.

The proposed project is intended to cover ongoing activities of the Orange County Vector Control District (OCVCD), an independent special district charged with protecting citizens of Orange County from disease transmitting vectors and vector-borne diseases. OCVCD provides vector control and disease surveillance for the 798 square miles of Orange County and immediately adjoining lands such as University of California Irvine's San Joaquin Marsh, Orange County Sanitation District, Irvine Ranch Water District, California State Lands Commission, and Naval Weapons Station Seal Beach. 3-1

The proposed project is the combination of physical inspections, trapping of vector species, remote sensing, and laboratory tests to establish the extent of vector populations and potential disease organisms. When vector populations surpass established thresholds and cannot be controlled with source reduction alone, the OCVCD applies chemical or biological control agents to reduce vector populations. Chemicals are rotated to reduce development of resistance in vectors and applied strictly according to label and safety requirements established by the U.S. Environmental Protection Agency and the California Department of Pesticide Regulation. The OCVCD program is overseen and monitored by the California Department of Public Health and the County Agricultural Commissioner. The vectors OCVCD is charged with monitoring and controlling include mosquitoes, red imported fire ants, rodents, and flies

Sensitive species in program boundaries with greatest potential to be affected by on-going activities include: Riverside fairy shrimp (*Streptocephalus woottoni*), San Diego fairy shrimp (*Branchinecta sandiegonensis*), Santa Ana sucker (*Catostomus santaanae*), southern steelhead (*Oncorhynchus mykiss irideus*), arroyo chub (*Gila orcuttii*), Santa Ana speckled dace (*Rhinichthys osculus ssp.*), tidewater goby (*Eucyclogobius newberryi*), arroyo toad (*Anaxyrus californicus*), northern leopard frog (*Lithobates pipiens*), coast range newt (*Taricha torosa*), western spadefoot toad (*Spea hammondii*), coast horned lizard (*Phrynosoma blainvillii*), orangethroat whiptail (*Aspidoscelis hyperythra*), western pond turtle (*Emys marmorata*), California least tern (*Sternula antillarum browni*), least Bell's vireo (*Vireo bellii pusillus*), light-footed clapper rail (*Rallus longirostris levipes*), southwestern willow flycatcher (*Empidonax traillii extimus*), californica gnatcatcher (*Polioptila californica californica*), western snowy plover (*Charadrius alexandrinus nivosus*), Belding's savannah sparrow (*Charadrius alexandrinus nivosus*), California black rail (*Laterallus jamaicensis coturniculus*), black skimmer (*Rynchops niger*), grasshopper sparrow (*Ammodramus savannarum*), tricolored blackbird (*Agelaius tricolor*), yellow-breasted chat (*Icteria virens*), coastal cactus wren (*Campylorhynchus brunneicapillus sandiegensis*), southern California salt marsh shrew (*Sorex ornatus salicornicus*), south coast marsh vole (*Microtus californicus stephensii*), big free-tailed bat (*Nyctinomops macrotis*), pallid bat (*Antrozous pallidus*), pocketed free-tailed bat (*Nyctinomops femorosaccus*), western mastiff bat (*Eumops perotis californicus*), western red bat (*Eumops perotis californicus*) and western yellow bat (*Lasiurus xanthinus*).

The Department offers the following comments and recommendations to assist the OCVCD in avoiding, minimizing, and adequately mitigating potential project impacts on biological resources.

1. The PDEIR proposes that vegetation management incidental to surveillance and control activities may adversely affect listed shrub-nesting bird's breeding habitat or nesting success if performed during the nesting season. The PDEIR proposes mitigation measure BIO-4 to reduce significant impacts below a level of significance by having a qualified biologist conduct pre-maintenance surveys for nesting birds and establishing a minimum 25 foot buffer for songbird nests and 200 to 500 feet for raptor nests, depending on location. No work within the nest setback zone would occur until the qualified biologist puts verification into OCVCD files that the nest is vacant and young have fledged.

   The Department recommends that the measure be revised because significant impacts may still occur after implementation of BIO-4. The Department recommends that the qualified biologist submit survey results to the supervisory personnel of OCVCD for review to document compliance with applicable State and Federal laws pertaining to the protection of native birds. Additionally, the nest setback zone should be established based on the tolerances of the species to disturbance and the method of surveillance and control activities. For example, in Bolsa Chica Ecological Reserve (BCER) (Reimbursable Area see PDEIR figure 1-3), implementation of OCVCD program activities requires access across areas known to support breeding ground nesting birds. The activities conducted there frequently involve backpack applications during the nesting bird breeding season with equipment that is reported to produce noise volumes of approximately 70 A weighted decibels (dB(A) Leq.)(pers. comm. K. O' Reilly).

   These applications occur in coastal salt marsh habitat, and their effects on sensitive ground nesting species are not well documented, but the same application methods conducted within riparian habitat may result in adverse significant impacts to sensitive bird species

3-1 cont'd

given the nest protective distances described in BIO-4. RECON (1990) estimated that noise levels above 60 dB(A) Leq from March 15 to September 15 may impact vireo reproductive success. While vireos often continue to occupy areas subject to noise levels above 60 dB(A), studies have documented significantly reduced reproductive success (U.S. Marine Corps 1995) and delayed reproduction (BonTerra Consulting 2000) due to noise impacts. It is expected that above some yet unknown noise threshold, vireos abandon an otherwise suitable habitat area. The Department recommends that the noise disturbance tolerances for least Bell's vireo be utilized for the majority of sensitive avian passerine species. Therefore, vegetation management or program surveillance and control methods that have potential to generate significant noise during the nesting season should only be conducted at distances that do not exceed 60 A weighted decibels at outermost edge of nesting territories in riparian environments.

3-1 cont'd

2. In addition to noise disturbances the Department recommends that OCVCD consider other program activities (e.g., vegetation manipulation, human disturbance, line of sight) and their effect on nesting birds when establishing a nest protective zone. More specifically, the determination of site-specific nest protective zones should consider the following:

   a. existing ambient conditions (human activity within line of sight - cars, bikes, pedestrians, dogs, noise);
   b. type and extent of disturbance (e.g., noise levels and quality - punctuated, continual, ground vibrations - proximate to tern colonies are known to make the birds flush the nests);
   c. visibility of disturbance;
   d. duration and timing of disturbance;
   e. influence of other environmental factors; and
   f. species' site-specific level of habituation to the disturbance (Postovit, H. R., and B. C. Postovit 1987, in part).

3-2

3. The Department recommends BIO-4 be revised to require the qualified biologist be present when surveillance and control activities are conducted or flagging the nest protective zone at 20-foot intervals should only be conducted on the day of treatment before program surveillance and control activities are conducted and not left in place overnight. This is because many areas within the project are subject to public use and utilized by urbanized predators and the establishment of flagging can encourage unauthorized human access or additional attention by avian or ground based predators such as crows and coyotes).

3-3

4. The PDEIR indicates (page 2-18) that wild birds are trapped by OCVCD for surveillance for presence of viruses along with those reported by local residents as dead. In 2009-2010 the OCVCD captured 1,493 wild birds and conducted testing to determine infectiveness for West Nile Virus. A Scientific Collection Permit is required to take, collect, capture, mark, or salvage, for scientific, educational, and non-commercial propagation purposes, mammals, birds and their nests and eggs, reptiles, amphibians, fishes, invertebrates, and any other form of plant or animal life (Fish and Game Code Section 1002 and Title 14 Sections 650 and 670.7).

   The OCVCD should retain a qualified individual with an active Scientific Collection Permit (SCP) when "taking" native bird species. The process and application for obtaining an SCP can be accessed by the internet at: http://www.dfg.ca.gov/wildlife/nongame/research_permit/.

3-4

The Department appreciates the opportunity to comment on the PDEIR. Please contact Department staff for additional questions or coordination regarding the project, Mr. Matthew Chirdon at (858) 467-4284.

Sincerely,

Stephen Juarez
Environmental Program Manager
South Coast Region

cc: State Clearinghouse, Sacramento

REFRENCES:

BonTerra Consulting. 2000. Breeding season 2000 weekly monitoring reports of least Bell's vireo and coastal California gnatcatcher for the Crown Valley Parkway Bridge project, Orange County, California. Unpublished reports prepared for the U.S. Fish and Wildlife Service.

Postovit, H. R., and B. C. Postovit. 1987. Impacts and mitigation techniques. Pages 183-213 in B. A. Giron Pendleton, B. A. Millsap, K. W. Cline, and D. M. Bird, eds. Raptor management techniques manual. Natl. Wildl. Fed., Washington, D.C.

RECON (Regional Environmental Consultants). 1990. Draft Comprehensive Species Management Plan for the Least Bell's Vireo. Unpublished report submitted to the San Diego Association of Governments (SANDAG); San Diego, California.

U.S. Marine Corps. 1995. Programmatic groundwater/riparian habitat assessment at Marine Corps Base Camp Pendleton, California. Marine Corps Base Camp Pendleton, Environmental Security Office, San Diego County, California.

COMMENT LETTER #3 – STEVEN JUAREZ, ENVIRONMENTAL PROGRAM MANAGER, STATE OF CALIFORNIA – THE NATURAL RESOURCES AGENCY, DEPARTMENT OF FISH AND GAME, SOUTH COAST REGION, 3883 RUFFIN ROAD, SAN DIEGO, CA 92123

3-1: The comment recommends revision of Mitigation Measure BIO-4 to include a nest setback zone based on known noise disturbance tolerances of the Least Bell's Vireo. Vegetation management and control methods with potential to generate significant noise should be conducted only at distances that do not exceed 60 A weighted decibels at the outermost edge of nesting territories in riparian environments.

Equipment potentially used for vegetation management and mosquito control in riparian areas includes motorized backpack foggers, hedge trimmers, and a chainsaw for clearing fallen trees that prohibit access. Note that the majority of OCVCD vegetation management activities occurs in late fall or late winter when birds are not nesting so hedge trimmers and chainsaw would not likely be used during the nesting period. Furthermore, equipment is used periodically and does not present a constant source of noise in natural areas. CDFG had already reviewed and approved the equipment used by the District prior to this comment, and using a single nest setback distance at which 60 decibels is not exceeded for all management activities may make necessary treatment infeasible in some situations. To address CDFG's concerns, Mitigation Measure Bio-4 will be modified to include the provision that the District will consult with agency representatives as necessary to allow identification of appropriate nest setback zones for sensitive species during vegetation maintenance. See below.

3-2: The comment recommends that determination of nest protective zones also take into consideration additional environmental factors, such as ambient disturbance conditions, visibility of disturbance, disturbance duration and timing, and species' site-specific level of habituation to disturbance.

The biologist used by the District will review the potential for disturbance from field activities and make recommendations for any required buffers or avoidance considering the above factors.

3-3: The comment recommends further revision of Mitigation Measure Bio-4 to require a qualified biologist be present during surveillance and control activities <u>or</u> that the nest protective zone be flagged at 20-foot intervals the day before surveillance or control to avoid attracting predators.

The scale of surveillance and control activities makes having a biologist present at all surveillance and control sites infeasible. The biologist(s)employed by OCVCD will flag the no disturb or buffer zones around nests before vegetation maintenance work begins and will routinely check back on nest flagged for monitoring. District personnel already undergo an extensive environmental awareness training that includes review of all sensitive species and environmental regulations. A change will be made to Mitigation Measure Bio-4 to incude consultation with agencies, if necessary, to minimize impacts to sensitive species. In addition, changes made to Mitigation Measure Bio-1 (see pages 6, 9, 11 and 51 of this document) that also address comments made by USFWS will require the District to meet with USFWS on an annual basis to receive updated occurrence information on listed species and

recommendations for avoidance or minimization of impacts. These changes will reduce the impact of control and surveillance activities to less than significant.

The text on Pages vii and 4-100 will be amended as follows to incorporate recommendations of CDFG:

Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than ~~3 days~~ 48 hours prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. Flagging will be removed as soon as work is complete to avoid attracting predators to nests. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists, consult with agencies if necessary, and conduct an~~d~~y necessary pre-activity surveys for special-status species to avoid them.

3-4: This comment advises that a Scientific Collection Permit (SCP) from CDFG is required to take, collect, capture, mark or salvage for scientific, education and non-commercial propagation purposes mammals, birds, nests and eggs, reptiles, amphibians, fishes and invertebrate and any other form of plant or animals life, as required by Fish and Game Code, and recommends the District retain one or qualified .individuals with an active SCP.

The District has a biologist on staff with a current SCP, as well a federal bird banding permit, for the surveillance work requiring capture of wild birds. Text on p. 1-6 will be amended to add the following section after the last paragraph on that page to clarify that the District does maintain the necessary State permits.

"California Department of Fish and Game

The District also maintains a scientific collection permit (SC-009202) for the handling of wild birds for surveillance activities."

COMMENT LETTER #4

DEPARTMENT OF TRANSPORTATION
District 12
3347 Michelson Drive, Suite 100
Irvine, CA 92612-8894
Tel: (949) 724-2241
Fax: (949) 724-2592

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JUN 11 2012
ORANGE COUNTY
VECTOR CONTROL DIST.

June 6, 2012

Albert J. Beck
Orange County Vector Control District
13001 Garden Grove Boulevard
Garden Grove, California 92843

File: IGR/CEQA
SCH#: 2010081067
Log #: 2577A
All

Subject: Integrated Vector Management Practices Project

Dear Mr. Beck,

4-1

Thank you for the opportunity to review and comment on the **Programmatic Environmental Impact Report (PEIR) for the Integrated Vector Management Practices Project.** The proposed project involves the increased use of vector species or genus-specific chemicals and species and genus-specific biological control, use of less persistent chemicals, and improved methods of delivery, including replacement of gasoline-fueled vehicles with those using alternative fuels, Public information efforts may also be expanded or modified as new disease threats arise. The project area includes all land within the political boundaries of Orange County, and immediately adjacent areas which may produce vectors and create the potential for disease transmission within Orange County.

The Department of Transportation (Department) is a commenting agency on this project and has no comment at this time. However, in the event of any activity in the Department's right-of-way, an encroachment permit will be required.

Please continue to keep us informed of this project and any future developments that could potentially impact State transportation facilities. If you have any questions or need to contact us, please do not hesitate to call Marlon Regisford at (949) 724-2241.

Sincerely,

Christopher Herre, Branch Chief
Local Development/Intergovernmental Review

C: Scott Morgan, Office of Planning and Research

COMMENT LETTER #4 - CHRISTOPHER HERRE, BRANCH CHIEF, STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION, DISTRICT 12, LOCAL DEVELOPMENT/INTERGOVERNMENTAL REVIEW, 3347 MICHELSON DRIVE, SUITE 100, IRVINE, CA 92612-8894

4-1: The comment states that in the event of any activity in the Department of Transportation's (DOT) right-of-way an encroachment permit will be required.

OCVCD is aware that any activities that could interfere with the normal flow of traffic on roadways within the Department of Transportation's (DOT) right-of-way may be subject to permitting. OCVCD will contact DOT District 12 to determine the need for permitting prior to conducting such activities within a DOT right of way.

DIRECTORS
CLAUDIA C. ALVAREZ, ESQ.
PHILIP L. ANTHONY
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SHAWN DEWANE
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SINCE 1933

ORANGE COUNTY WATER DISTRICT
ORANGE COUNTY'S GROUNDWATER AUTHORITY

CLAUDIA C. ALVAREZ, ESQ.
First Vice President
PHILIP L. ANTHONY
Second Vice President
DON BANKHEAD
General Manager
MICHAEL R. MARKUS, P.E., D.WRE

June 7, 2012

RECEIVED
JUN 11 2012
ORANGE COUNTY
VECTOR CONTROL DIST.

Orange County Vector Control District
13001 Garden Grove Blvd.
Garden Grove, CA 92843

RE: Draft Programmatic Environmental Impact Report for Integrated Vector Management Practices of the Orange County Vector Control District SCH # 2010081067

To Whom It May Concern:

Please accept the following comments of the Orange County Water District on the Draft EIR for the Orange County Vector Control District's Integrated Vector Management Practices.

The Orange County Water District (OCWD) is a special district formed in 1933 by an act of the California Legislature. The OCWD manages the groundwater basin that underlies north and central Orange County. Water produced from the basin is the primary water supply for approximately 2.4 million residents living within OCWD boundaries. 5-1

Protection of the water quality of the groundwater basin is an important aspect of OCWD's management of the basin. As such, OCWD conducts a comprehensive monitoring program of the groundwater basin and surface water in the watershed to properly manage water supplies and to safeguard the basin's water quality. We are concerned about the potential impacts of the use of pesticides on groundwater quality and impacts to the beneficial uses of the Orange County Groundwater Basin. The Santa Ana Region Water Quality Control Plan (Basin Plan) lists the beneficial uses of the Orange County Groundwater Basin as MUN (municipal and domestic supply), AGR (agricultural Supply), IND (industrial service supply) and PROC (industrial process supply).

Thank you for the opportunity to comment on the Draft PEIR. OCWD provided comments in response to the Notice of Preparation of the DPEIR in a letter dated September 21, 2010. We appreciate that some of this information has been included in the DPEIR and request that the remainder be addressed in the Final PEIR. Information that does not appear to be in the DPEIR includes the following:

PO Box 8300
Fountain Valley, CA 92728-8300
18700 Ward Street
Fountain Valley, CA 92708
(714) 378-3200
(714) 378-3373 fax
www.ocwd.com

- Are pesticides that are considered for use in Orange County evaluated for their potential to cause groundwater contamination, as well as persistence in sediments and groundwater? If yes, what criteria are used for the assessment to determine which chemicals will not pose a potential threat of groundwater contamination? 5-1 cont'd

- Does OCVCD consider potential downstream impacts of pesticide applications to open water bodies? Does OCVCD provide advance notice to downstream agencies prior to each pesticide application? 5-2

- Do the monthly reports on pesticide applications that are filed with the local County Agricultural Commissioner and the Regional Water Quality Control Board include a record of each application, the application rates, the concentration of chemicals, and the locations of applications? How long are historical records maintained? 5-3

- Is post-application monitoring conducted? If yes, please explain the post-application monitoring protocols (method of analysis, detection limit, monitoring plan, analyzing laboratories, etc.) used by OCVCD. 5-4

Please replace the following sentence from the first paragraph on page 3-61 shown with strikeouts with the underlined sentence: 5-5

~~According to the Orange County Water District, they supply 60-75% of the water delivery for municipal, industrial and agricultural use.~~ The Orange County Water District manages the Orange County Groundwater Basin that supplies approximately 60-75% of the water supply for north and central Orange County.

Delete the second and third sentence in the second paragraph on page 3-61 and replace with the following:

The groundwater basin is recharged primarily with water from the Santa Ana River and Santiago Creek. The Orange County Water District estimates that 66 million acre-feet of fresh water is stored in the basin when full, although only a fraction of this water can be pumped without causing physical damage such as seawater intrusion or the potential for land subsidence. Groundwater production averages approximately 250,000 to 300,000 acre-feet per year.

Thank you.

Sincerely,

Michael R. Markus, P.E., D.WRE
General Manager

COMMENT LETTER #5 - MICHAEL R. MARKUS, P.E., D.WRE, GENERAL MANAGER, ORANGE COUNTY WATER DISTRICT, P.O. BOX 8300, FOUNTAIN VALLEY, CA 92728-8300

5-1: "Explain if (and with what criteria) pesticides considered for use by OCVCD are evaluated for their potential to cause groundwater contamination, persistence in sediments, and persistence in groundwater."

Rationale for the use of specific chemicals by OCVCD is provided in Section 2.1.5, Chemical Control, of the EIR. A list of chemicals then used by the District is also provided. The chemicals used are those that have been evaluated and approved by the USEPA and CDPR. While they are not specifically evaluated in terms of potential groundwater pollution, they are used in very low doses over large areas. However, these chemicals are applied in accordance with all State and federal laws, under the oversight of the California Department of Public Health, and according to all label requirements.

MSDS sheets and USEPA reregistration data were examined for any potential to contaminate ground water. Because public health pesticides are applied in low doses over large areas and do not include large quantities of solvents, there is little likelihood of movement downward in soils. Most bind to soil particles and are rapidly degraded by moisture and sunlight. Pesticide persistence in groundwater has been documented for a number of older agricultural pesticides which were, and are, used in much higher doses than public health pesticides (c.f. California Department of Food and Agriculture 1998).

5-2: The comments states "Consider and discuss the potential for downstream impacts of pesticide applications to open water bodies. Describe how (or why not) advance notice to downstream agencies is provided prior to each pesticide application."

Potential impacts from pesticides to surface water, including stream segments and other bodies of water, are discussed in Section 3.2.4, Environmental Setting: Water Quality, and evaluated in Section 4.2, Water Quality, of the EIR. Pesticides applied to aquatic systems are specifically evaluated for impacts to water quality in Section 4.2.3, Water Quality Impact Analysis. The potential for impacts to water quality arising from OCVCD operations is considered less than significant due to compliance with the SWRBB's National Pollutant Discharge Elimination System (NPDES) General Permit for Vector Control Districts. Label safety guidelines and District Best Management Practices avoid the introduction of many of the other pesticides used in the District's control programs into aquatic systems. Chemicals specifically introduced into aquatic systems are specifically addressed and discussed in the EIR.

No applications of pesticides are made to flowing water or reservoirs. These waters typically do not produce significant numbers of mosquito larvae. Exceptions include the local storm drain systems, which may have water throughout the year. The current monitoring program conducted by the Coalition of Mosquito and Vector Control Districts of California may provide some information of any presence of mosquito control pesticides in surface water.

Public health pesticides are applied in ultra-low volumes considered safe for the public. Advance notice is not specifically provided to downstream agencies prior to each pesticide application for a number of reasons. Because OCVCD operations are continuous throughout the County, it would be infeasible to provide advance notice to all parties. In addition, advance notice of pesticide applications is not required under State or federal law. The District does have a list of people who have reported medical sensitivity to chemical sprays, but because the District does not use ultra-low volume aerosols within 200 feet of residences, no notification is necessary.

5-3: This comment asks for a description of the contents of monthly pesticide application reports and whether they include a record of each application, application rates, chemical concentrations, and application locations. The comment also asks how long these records are maintained.

Monthly Summary Pesticide Use Report contents include operator identification, address, location, month/year of use, total number of applications, product name and registration number, total product used, number of applications for each product, commodity or site treated, and treatment area data (See attached sample sheets, Appendix B). Records are available through the Orange County Agricultural Commissioner for at least one year after submission and are permanently available from CDPR after annual reports have been filed.

5-4: This comment asks for a description of the appropriateness (and protocols) of post-application monitoring efforts, if any.

Post-application monitoring for larvicide and adulticide application is coordinated through the Mosquito and Vector Control Association of California (MVCAC) as a requirement of the SWRCB's NPDES permit, using an independent contractor. The MVCAC Monitoring Plan (updated March 4, 2011) utilizes representative sites to evaluate the impact of public health pesticide applications. The Monitoring Plan includes sampling in urban, wetland, and agricultural areas; a complete copy of the Plan is attached as Appendix A of the PEIR.

5-5: This comment asks for specific revision of language within the Environmental Setting of the PEIR, describing groundwater basins. The following text was changed as follows.

Eco-Analysts concurs with the revisions and amends the text as follows:

Page 3- 61, first paragraph:

Groundwater Resources

~~Orange County has two principal ground basins that underlie Orange County: the Coastal Plain Basin and the San Juan Valley Basin. According to the Orange County Water District, they supply 60- 75% of the water delivery for municipal, industrial and agricultural use (Orange County Water District 2010).~~ The Orange County Water District manages the Orange County Groundwater Basin that supplies approximately 60-75% of the water supply for north and central Orange County.

Page 3-61, second paragraph:

The Coastal Plain Basin, 360-square miles underlying 45% of Orange County, is the largest basin in the County. Drained by the San Ana River and Santiago Creek, this basin has a well that yields 600 gallons per minute (gpm) on average to a maximum of 1,000 gpm. ~~Storage capacity is estimated at 40 million acre-feet with recharge estimated at 221,000 acre-feet per year; the useable storage capacity is undetermined. Intensive irrigation and municipal, industrial and domestic use have increased water extraction rates.~~ The groundwater basin is recharged primarily with water from the Santa Ana River and Santiago Creek. The OCWD estimates that 66 million acre-feet of fresh water is stored in the Basin when full, although only a fraction of this water can be pumped out without causing physical damage such as seawater intrusion or the potential for land subsidence. Groundwater production averages approximately 250,000 to 300,000 acre-feet per year. Water quality problems include high total dissolved solids (TDS) and nitrogen (TDN) concentrations, overdrafting and sea water intrusion. Water basins underlying Los Angeles, north of the County, interchange somewhat with the basin (Orange County Water District 2010).

Sea & Sage Audubon

P.O. BOX 5447, IRVINE, CA 92616-5447

June 8, 2012

Michael G. Hearst
District Manager
Orange County Vector Control District
13001 Garden Grove Blvd.
Garden Grove, CA 92843

Re: Draft Programmatic Environmental Impact Report
For Integrated Vector Management Practices

Dear Mr. Hearst:

Sea & Sage Audubon is the primary Orange County chapter of the National Audubon Society. Our more than 3500 Orange County members are dedicated to a wholesome environment for both people and wildlife.

6-1

Our Conservation Committee has reviewed the Draft Programmatic Environmental Impact Report (DPEIR) and we appreciate this opportunity to make comments. First, let us say that we are grateful for the service Vector Control provides the community and acknowledge the huge challenges it faces.

We appreciate that the DPEIR describes potential environmental impacts of vector control activities and that it prescribes mitigation measures to help alleviate the harm to the environment. Given the unknowns and the potential for unexpected consequences, Sea and Sage Audubon urges continued efforts, now and in the future, to identify such environmental impacts and the best measures to alleviate harm for the health of the environment and the people and wildlife of Orange County.

The types of activity that are of greatest concern to us for their potential impact on the environment, in general, and on natural habitats and the birds and other wildlife that depend on them, include:

- Introduction of pesticides (including petroleum distillates) into the environment
- Introduction of non-native species
- Reduction of vegetation, especially in marsh habitats
- The use of anticoagulants as rodenticides and the impacts of secondary poisoning

Following are some comments on the DPEIR relating to the above concerns. 6-1 cont'd

DPEIR, Section

Introduction of pesticides (including petroleum distillates)

We could not find any references in the DPEIR to the literature on the impact of petroleum products on birds. The DPEIR should acknowledge those potential impacts directly and include references.

DPEIR, Section 2

Anticoagulants and Secondary Poisoning

6-2

The DPEIR is insufficient in its descriptions of the impacts and current widespread knowledge of secondary poisoning to raptors and other predators, many of which are very common in Orange County's urban areas. The DPEIR incorrectly states the risks of secondary poisoning to be sub lethal and cites an outdated paper published in 1980. There are many recent papers that identify the risk to raptors and mammalian predators to be a serious, often lethal, threat, especially from so called second generation anticoagulants (brodifacoum, bromadiolone, and difethialone).

In a *Journal of Wildlife Management* article, "Anticoagulant Exposure and Notoedric Mange in Bobcats and Mountain Lions in Urban Southern California" (Seth Riley, et al 2007), the authors list close to a dozen recent papers describing the serious and lethal affects of secondary anticoagulant poisoning.

In recent years, Sea and Sage Audubon has collected several raptor carcasses in Orange County urban interface areas, for which we funded necropsies and laboratory testing for anticoagulants, with 66% of results showing high levels of anti-coagulants, and confirming the cause of death as secondary anti-coagulant poisoning.

The DPEIR needs to address this issue with references to current research. In the introduction section of the DPEIR it states that there is conflicting evidence related to the impacts to wildlife from secondary poisoning. Although we can find research with

differing levels of lethal impacts, we cannot find any literature or research denying lethal results. If there is literature of citable studies suggesting there is not a high lethal risk, the DPEIR should include them in the analysis. 6-2 cont'd

While we agree with the restrictions on the use of anti-coagulants listed in the DPEIR, such as avoiding parks and sensitive habitats, the DPEIR must (1) acknowledge that many of Orange County's urban neighborhoods are inhabited by populations of raptors and other predators, some of which are sensitive species, and, (2) address the potential impact to these species. 6-3

We are pleased to see the four mitigation measures (Bio-1 through -4) incorporated into this document.

Again, we are grateful for the service Vector Control provides the community and acknowledge the huge challenges it faces. We thank the staff of OCVCD for their dedication to quality of life for people and wildlife of Orange County.

Susan Sheakley
Acting Co-Chairman
Conservation Committee

COMMENT LETTER #6 - SUSAN SHEAKLEY, ACTING CO-CHAIRMAN, CONSERVATION COMMITTEE, SEA & SAGE AUDUBON, P.O. BOX 5447, IRVINE, CA 92616-5447

6-1: The comment addresses concerns of Sea & Sage Audubon with respect to impacts on natural habitats, birds and other wildlife, and states that the commenter could not find any literature regarding impacts of petroleum pesticides on birds in the PEIR. The commenter states that literature and a discussion of these impacts should be included.

On Page 4-93, the PEIR references the impact of oiling of feathers on birds observed with the use of the petroleum distillate, Golden Bear-1111, in a study by Miles et al. 2002.

On Page 4-100, the PEIR references the USFWS Biological Opinion for the District's Special Use permit, which prohibits the use of petroleum distillates that could coat feathers of Light-footed Clapper Rail. A discussion of the potential impact is provided in this section of the document and a mitigation measure, Mitigation Measure Bio- 2 was developed.

6-2: The comment refers to use of anticoagulant rat baits and secondary poisoning of wildlife. The comment states that the PEIR incorrectly characterizes the effect of secondary poisoning as non-lethal. The comment also suggests that the PEIR does not include current research on the topic, such as the Journal of Wildlife Management paper by Riley et al. 2007.

The USEPA recognized the secondary poisoning problems associated with the current generation of anticoagulants in Final Risk Mitigation Decision for Ten Rodenticides (2008). They recognized that the general availability of these newer rodenticides in general retail stores and the fact that they were available without USEPA approved bait stations were major factors in accidental poisoning exposure in small children and pets. The availability of the 2nd generation rodenticides is now restricted to sale only by licensed dealers and only in tamper-resistant bait stations.

The 2006 USEPA memo by Bill Erickson entitled, "Rodenticide Incidents Update," discusses secondary poisoning incidents in 27 avian species and 17 mammalian species. The analysis distinguished between different rodenticides and their specific effects on wildlife. Unfortunately, the Audubon Society comment does not distinguish between the known effects of bromadiolone used by OCVCD and other 1st and 2nd generation rodenticides.

Eco-Analysts did consult recent research on secondary poisoning of wildlife by anticoagulant rat baits for the purposes of the PEIR. On page 4-103, Potential Effects of Rodenticide Usage, we referenced the Journal of Wildlife Management paper by Riley et al. 2007, as well as other recent studies. We also consulted the USEPA risk analyses and accompanying data summaries on anticoagulant rodenticides.

6-3: The comment recommends the EIR acknowledge and address potential impacts to urban wildlife of secondary poisoning from use of rodenticides.

There are limited scientific data on potential impacts to urban wildlife in Southern California, other than the studies on owls and the USEPA summaries. The 2nd generation rodenticide found in most hawks, owls and small mammalian carnivores in New York and California was brodifacoum, which was present in addition to bromadiolone. All of this data was collected while the 2nd generation rodenticides were freely available to the public. The USEPA studies concluded that the rodenticides posing the greatest secondary risk to birds are brodifacoum and difethialone (USEPA 2004). Neither of these is used by OCVCD.

One must also use caution in determining the cause of death in birds and mammals. Assuming that the presence of any rodenticide in the liver is the cause of death of an animal when its carcass is found can lead to erroneous conclusions. A proper necropsy should be performed to eliminate other potential causes, including West Nile Virus in birds.

On page 4-104, under Potential Effects of Rodenticide Usage, the PEIR does acknowledge there may be a potential impact to wildlife in an urban setting. It also recognizes the inherent problems with data accuracy and the ability to determine a potential impact of the District's program when the same compound is widely applied by many other users. Uses by the public have been uncontrolled, and amounts applied are not reported to CDPR.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Carlsbad Fish and Wildlife Office
6010 Hidden Valley Road, Suite 101
Carlsbad, California 92011

In Reply Refer To:
FWS-OR-11B0041-12TA0391

JUN 07 2012

Mr. Michael G. Hearst, District Manager
Orange County Vector Control District
13001 Garden Grove Boulevard
Garden Grove, California 92843

Subject: Draft Programmatic Environmental Impact Report for Integrated Vector Management Practices of the Orange County Vector Control District

Dear Mr. Hearst:

This letter provides comments on the Draft Programmatic Environmental Impact Report (DPEIR) prepared to address impacts from the ongoing integrated vector management practices of the Orange County Vector Control District (OCVCD) within Orange County, California. The DPEIR addresses impacts from OCVCD's practices to control vectors, including mosquitos, flies, rodents, and red imported fire ants. These practices include surveillance for vectors and disease, source reduction to limit breeding by vectors, education of the public, and control of vector species using chemical and biological agents. The DPEIR has been prepared to serve as the basis for any future State or Federal permits that may be required for OCVCD's operations. 7-1

Our primary concern and mandate is the protection of public fish and wildlife resources and their habitats. We have legal responsibility for the welfare of migratory birds, anadromous fish, and endangered animals and plants occurring in the United States and are responsible for administering the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*), Migratory Bird Treaty Act (16 U.S.C. 703-712), and Bald and Golden Eagle Protection Act (16 U.S.C. 668).

Section 7 of the Endangered Species Act requires Federal agencies to consult with the Service if their actions "may affect" federally threatened or endangered species or designated critical habitat. Section 9 of the Act prohibits the "take" (e.g., harm, harassment, pursuit, injury, kill) of federally listed wildlife. Take incidental to otherwise lawful activities can be permitted under the provisions of section 7 (Federal consultations) and section 10 (private permits) of the Act. We offer the following comments based on our conservation mandates and our knowledge of sensitive species and habitats within Orange County.

1. The chemical agents currently used by the OCVCD are reported to be of comparatively low persistence (e.g., versus that for organochlorine pesticides) under certain conditions, but some

chemicals are more persistent and/or are more likely to bioaccumulate than others. For instance, there are reports of pyrethroids detected in aquatic sediments that have been shown to be the source of toxicity to benthic invertebrates. Because environmental conditions are highly variable and there remains uncertainty about the actual fate of insecticides in the environment, water quality monitoring is a valuable mitigation measure that can help lead to better informed management practices for application of pest control products on or near aquatic systems. The DPEIR states that OCVCD will implement new water quality monitoring requirements once they are finalized in association with the Statewide National Pollutant Discharge Elimination System General Permit for vector control districts. Because data on the fate and effects of insecticides in terrestrial settings are lacking, we support water quality monitoring as a mandatory component of the NPDES permit or, in the absence of such a requirement, as an independent mitigation measure to be included as part of the DPEIR.

7-1 cont'd

2. The DPEIR acknowledges that the use of certain mosquito control products may adversely affect rare or State and Federally listed species if used within occupied habitat. However, all of the chemicals that are mentioned in the DPEIR pose some risk to non-target species. In particular, mosquito adulticides are broad-spectrum insecticides that are toxic to many arthropods, and, depending on the compound, are potentially toxic to vertebrates as well. The formulation that the OCVCD uses includes PBO, which can be toxic on its own and greatly enhances the toxicity of the active ingredient (pyrethroids). Impacts may include toxicity to organisms from exposure to active ingredients and/or adjuvants used in commercial formulations, and loss of food for species within the spray zone that rely on non-target invertebrates as a source of nutrition.

   The DEIR offers some mitigating measures for the use of mosquito adulticides, which include preferential use of source reduction and larvicides and application strategies (ultra-low volume spraying with hand held equipment) that will help minimize applications in sensitive areas. To help inform OCVCD of those areas that may be occupied by listed species, Mitigation Measure Bio-1 requires OCVCD to maintain an updated occurrence database by regularly accessing Federal and State listed species occurrence information, including information from California Department of Fish and Game's California Natural Diversity Database, California Department of Pesticide Regulation's Endangered Species Protection Program and Pesticide Use Limitations, U.S. Fish and Wildlife Service's Critical Habitat Portal for threatened and endangered species, and any other reliable source of information accessible to OCVCD staff. Because species occurrence information in these databases is sometimes incomplete and there often is a time-lag between species documentation and entry of occurrence information into these databases, we recommend that Mitigation Measure Bio-1 be modified to include a commitment by OCVCD to meet in person with U.S. Fish and Wildlife Service staff on an annual basis to review OCVCD management practices within suitable habitat for listed species, and to allow for sharing of updated species occurrence information.

7-2

3. The DPEIR proposes to minimize the potential for adverse impacts from pesticide application and other work performed in areas known or suspected to support protected species by requiring the prior review of such work by supervisory staff to determine if the proposed work is restricted by a pesticide's label data or use limitations. If this review indicates that adverse impacts to sensitive species are possible, the work shall be modified to avoid impacts or shall not be implemented. Because it is not evident what criteria will be used to determine that it is safe to proceed with pesticide application in areas known or suspected to support protected species, we recommend that OCVCD staff coordinate and obtain concurrence from USFWS prior to proceeding with pesticide application or other work in areas known or suspected to support listed species. 7-3

4. Mitigation Measure Bio-2 prohibits OCVCD from using petroleum distillates within natural marshes and wetlands that drain into intertidal areas to protect the federally endangered light-footed clapper rail and other marsh nesting birds. The application of petroleum distillates where any listed aquatic species occurs (e.g., Santa Ana sucker, Riverside fairy shrimp, San Diego fairy shrimp, arroyo toad, tidewater goby, southern steelhead) may affect those species and should be avoided.

   Application of petroleum distillates will be implemented through the adoption of a Best Management Practice (BMP) that presumably will identify the locations where the use of petroleum distillate oils is prohibited. While adoption of such a BMP is appropriate, we cannot comment on the adequacy of this mitigation measure at avoiding impacts to listed species without specific information on the areas where the use of petroleum distillate oils will be prohibited. Based on current practices, please identify the specific waterways where the use of petroleum distillate oils is prohibited so that we can evaluate the potential for impacts to listed species. 7-4

5. The DPEIR acknowledges that the release of mosquitofish into natural environments has potential to adversely impact listed invertebrates such as fairy shrimp as well as sensitive and listed amphibian and fish species. To minimize the potential for adverse impacts to these species, Mitigation Measure Bio-3 limits the release of mosquitofish to isolated artificial systems such as unmaintained swimming pools and ornamental ponds. While this may avoid significant impacts to these species, the effectiveness of this measure relies on what is judged to be an isolated artificial system. Within several locations in Orange County where ranching is or was practiced listed fairy shrimp species including the Riverside fairy shrimp and San Diego fairy shrimp, and the sensitive western spadefoot toad reside within ephemeral pools that were once maintained as impoundments for watering cattle. Such isolated wetlands are known from the former El Toro Marine Corps Base, properties in the vicinity of the Lomas de Santiago and the Foothill Trabuco Specific Plan area, conserved lands surrounding Rancho Santa Margarita and ranchlands on the Rancho Mission Viejo. Other isolated wetlands are known from Fairview Park in Costa Mesa and the Banning Ranch property in Newport Beach. Due to the historic manipulation of these wetlands, many of them have a 7-5

depauperate native plant community and may not be recognized as having the attributes of an intact vernal pool or natural environment. Nevertheless, these isolated wetlands support listed and sensitive species that could be adversely impacted by the introduction of mosquitofish or use of certain pesticides such as methoprene. Therefore, to avoid impacts to listed and sensitive species residing within these pools they must be treated as being part of the natural environment and the introduction of mosquitofish within them prohibited. This may in part rely on maintenance of an accurate GIS database by OCVCD of species occurrence information as is required pursuant to Mitigation Measure Bio-1. To help ensure that impacts to listed species from the introduction of mosquitofish and use of pesticides are avoided, we recommend that OCVCD confer with us prior to the release of mosquitofish or use of pesticides in any isolated ephemeral pool that is found within an undeveloped setting. 7-5 cont'd

6. The DPEIR acknowledges that vegetation management incidental to surveillance and control operations and intrusion of vector control inspectors into occupied habitat may adversely impact listed shrub-nesting birds if performed during the breeding season or if vegetation clearing adversely impacts their breeding habitat. Mitigation measure Bio-4 requires that a qualified biologist perform pre-maintenance surveys for nesting birds if such work is to be performed during the nesting season and commits to deferring work until young birds have fledged if a nest is encountered. While this measure minimizes the potential for direct impacts to nesting birds and their young, the DPEIR does not quantify the extent of vegetation management that is performed on an annual basis at any of the locations indicated in Figure 2-5, or address the indirect impacts that may result from vegetation management.

   Vegetation management has potential to be harmful to resident avian species if the amount of habitat available to support essential behaviors such as feeding, breeding, and sheltering is appreciably reduced within a given area. Due to the number of locations where vegetation management is performed, locally insignificant impacts may be cumulatively significant. If areas where vegetation is managed are not maintained on a consistent basis, the re-establishment of vegetation in those areas has potential to lead to the colonization of those areas by listed species, such as the endangered least Bell's vireo. Because animal species distributions change over time, to adequately address whether vegetation management activities have potential to significantly impact sensitive or listed species routine field assessments are needed, particularly in areas where new trails or vegetation management will be implemented and in areas where vegetation management has lapsed but is proposed to resume. The creation of trails may also facilitate human access to otherwise inaccessible habitat and promote the spread of invasive weeds, both of which could cause long term habitat degradation. Finally, sensitive and listed plant species could be directly removed or trampled during trail creation and vegetation removal. 7-6

   We, therefore, request that the DPEIR expand on the information provided in Figure 2-5 by providing an inventory of the locations and amount of vegetation management that is proposed at each location, with vegetation impacts summarized for each plant community.

To support a determination that vegetation management activities are not cumulatively significant, existing and future impacts to sensitive plant communities (i.e., from new trail creation and vegetation management) must be quantified. To offset cumulative impacts we recommend the DPEIR incorporate a mitigation measure to conserve, restore and/or enhance the affected sensitive plant communities (e.g., riparian woodland and coastal sage scrub) in a manner that will replace the biological functions and values that will be lost from programmatic vegetation management. 7-6 cont'd

To address the potential for new trail creation to impact special status and listed species, the DPEIR includes a commitment to have a qualified biologist review species lists and conduct any necessary pre-activity surveys for special status species to avoid them. We request that this commitment be strengthened to include performing such surveys at an appropriate time of year to detect sensitive or listed plant species that may be present, and to include performing pre-activity surveys in those areas where vegetation management has lapsed and the re-established vegetation has potential to support sensitive and listed animal species.

7. The DPEIR states that little research has been performed to assess the environmental impact of using chemical baits to control red-imported fire ant (RIFA). Use of these chemical baits has potential to harm non-target native ant species that perform important ecological functions. Through their role as seed predators, native ants influence the structure of plant communities. Native ants also serve as prey for a variety of sensitive taxa including the coast horned lizard and the orange throated whiptail lizard. Loss of native ants in association with the invasion of Argentinian ants has been correlated with declines in herpetofauna diversity (reviewed in Holway *et al.* 2002). Because the effect of chemical baits is poorly understood and loss of native ant diversity may have far ranging ecological impacts we recommend that the DPEIR include as a mitigating measure a commitment to investigate how native ant species diversity and abundance is affected by the use of chemical baits in natural environments. 7-7

8. The DPEIR acknowledges that application of the rodenticide bromadiolone has potential to adversely impact wildlife species via secondary poisoning, but the incidence and impact of secondary poisoning is difficult to evaluate because of lack of data. Secondary poisoning of the top predators in conserved areas in Orange County adjoining urban development is of increasing concern (Riley *et al.* 2007, L. Lyren pers. comm.) because of their importance in regulating populations of smaller bodied mesopredators, such as skunks and opossums. The release of mesopredators from the population regulating influence of top predators such as coyotes and bobcats has been implicated as a factor contributing to the loss of songbird diversity in conserved habitat fragments (Crooks and Soule 1999). Because the effect of rodenticides is poorly understood and could have significant ecological impacts we recommend that the DPEIR include as a mitigating measure a commitment to investigate the incidence and impacts of secondary poisoning on non-target animal species. 7-8

In conclusion, our ability to comment on the likely impacts from OCVCD's use of chemicals is limited by the lack of data for many of the compounds that are proposed to be used. General concerns include uncertainty about the toxicity of "inert" compounds in product formulations, potential for cumulative toxicity caused by exposure to multiple compounds with similar modes of action in the environment and/or one compound from multiple sources, and potential for adverse impacts from exposure to chemical controls in the presence of other environmental stressors (e.g., water with high temperature and low dissolved oxygen). Given this uncertainty we support efforts to avoid application of pest control products in habitat supporting sensitive and listed species through the use of available information, performing appropriate field investigations, and incorporating buffers if possible. We suggest that closer coordination with our agency on a routine basis should help improve OCVCD's effectiveness at avoiding impacts to sensitive and listed species. Where data is lacking, we recommend incorporating investigations and monitoring as a best management practice that can lead to better informed management practices for application of pest control products within or near sensitive habitats. 7-9

Our comments pertain to the products, application protocols, and mitigating measures discussed in the DPEIR. Should practices be modified in the future to include the use of other products, protocols or applications than those specified in DPEIR we may have additional comments, concerns, or recommendations.

Thank you for the opportunity to comment on the DPEIR addressing OCVCD's Integrated Pest Management Program. Should you have questions or wish to coordinate regarding OCVCD's pest management practices please contact William B. Miller of our office at 760-431-9440 ext. 206.

Sincerely,

Jonathan Snyder

for Karen A. Goebel
Assistant Field Supervisor

cc: Steve Juarez, CDFG

COMMENT LETTER #7 - JONATHAN SYNDER FOR KAREN A. GOEBEL, ASSISTANT FIELD SUPERVISOR, UNITED STATES DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE, ECOLOGICAL SERVICES, CARLSBAD FISH AND WILDLIFE OFFICE, 6010 HIDDEN VALLEY ROAD, SUITE 101, CARLSBAD, CA 92011(FWS-OR-11B0041-12TA0391)

7-1: The comment recommends the PEIR include an independent mitigation measure requiring water quality monitoring as part of the DPEIR in the case where water quality monitoring is not a mandatory component of the NPDES permit.

Water quality monitoring is an integral part of the new NPDES permits and is carried out in all regions of the State by an independent consulting firm hired by MVCAC coalition.

7-2: The comment suggests BIO-1 should be modified to include a commitment by OCVCD to meet in person with USFWS staff on an annual basis to review OCVCD management practices within suitable habitat for listed species, and to allow for sharing of updated species occurrence information.

Eco-Analysts concurs with the comment. The text of the Mitigation Measure Bio-1 on pages vii and 4-100 of the PEIR is amended as follows.

"Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.

The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. The District biologist and supervisor shall also meet with USFWS personnel on an annual basis at the beginning of the treatment season to receive updated occurrence information and to review potential impacts from District activities to listed species and critical habitats. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas, as recommended by USFWS. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats."

It should be noted that OCVCD is a leader in environmental awareness training for the region and has expanded their program to include an annual power point presentation that includes a review of sensitive habitats and species.

7-3: The comment suggests OCVCD staff should coordinate and obtain concurrence from USFWS prior to proceeding with pesticide application or other work in areas known or suspected to support listed species.

This action will be part of the annual consultation with the Service specified in revised text of Mitigation Measure Bio-1.

7-4: The comments suggest the PEIR identify the specific waterways where the use of petroleum distillate oils is prohibited so that the Service can evaluate the potential for impacts to listed species.

The specific water bodies to be treated with petroleum distillate oils may change over time depending on rainfall and other conditions that determine the size of mosquito populations. The changes to the text of Mitigation Measure Bio-1 to meet with USFWS to evaluate impacts will allow the Service to review the areas where treatment with petroleum distillate oils is desired to minimize adverse impacts to listed species.

7-5: The comment recommends OCVCD confer with USFWS prior to the release of mosquitofish and the use of pesticides in any isolated ephemeral pool that is found within an undeveloped setting.

Again, amendment of Mitigation Measure Bio-1 to require the District to confer with USFWS annually will identify any isolated (vernal) pools that USFWS finds treatment with mosquitofish to be inappropriate or potentially harmful so that the District can find alternative methods of control. Isolated natural vernal pools produce few if any mosquitoes and are rarely a problem requiring mosquito control.

7-6: This comment requests expansion of the information provided in Figure 2.5 by providing an inventory of the locations and amount of vegetation management that is proposed at each location, with vegetation impacts summarized for each plant community. It also recommends incorporating a mitigation measure to conserve, restore, or enhance the affected sensitive plant communities and that the OCVCD's commitment (to have a qualified biologist review species lists and conduct any necessary pre-activity surveys for special status species to avoid them) should be strengthened to include performing such surveys at an appropriate time of year to detect sensitive or listed plant species that may be present and include performing pre-activity surveys in those areas where vegetation management has lapsed and the re-established vegetation has the potential to support sensitive and listed animal species.

OCVCD personnel are well aware of the need to conduct vegetation surveys at correct time of the year. In review of the HCCPs for the County, very few areas of concern were noted, and those were for avian species, not plants. The vegetation management activities of the District are mainly pruning back overgrowth next to existing trails or cutting narrow paths through vegetation along drainage ways to reach ponded water. They do not do major clearing or vegetation removal to create new roadways or paths. The mitigation to confer annually with the Service will reveal any concerns regarding sensitive plant species in areas requiring vegetation management, should they exist.

7-7: The comment recommends that the EIR include a mitigation measure confirming a commitment by OCVCD to investigate how native ant species diversity and abundance is affected by the use of chemical baits in natural environments.

RIFA occur in irrigated landscape areas. As nests are located they, and the immediate area, are treated. The OCVCVD does not broadcast ant baits in natural habitats; therefore, the use of ant baits should have no impact on native ant populations.

7-8: This comment suggests inclusion of a mitigation measure that makes a commitment by the District to investigate the incidence and impacts of secondary poisoning on non-target animal species.

See responses to the Sea and Sage Audubon Chapter comments (Comment Letter #7). Because there are numerous other users of anticoagulant rodenticides besides the District and other sampling difficulties associated with investigating the impact of secondary exposure to bromadiolone, imposing a mitigation on the District to research this problem places and undue burden upon the District staff and resources. The District, however, will remain abreast of current research on impacts of rodenticide on wildlife and consider it when making decisions to apply baits. Elimination of rat harborage areas is always the first recommendation of the District when responding to a rat service request.

7-9: This comment reiterates the Service's recommendations for coordination with the agency, avoidance of sensitive species habitats when possible, incorporation of buffers and monitoring when data are lacking.

These comments have been addressed by response to the previous comments.

6 LITERATURE CITED

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Patterson GM. 2009. The mosquito crusades: a history of the American anti-mosquito movement from the Reed Commission to the first Earth Day. Rutgers University Press. 270 p.

US Environmental Protection Agency (USEPA). 2004. Potential risks of nine rodenticides to birds and nontarget mammals: a comparative approach. Office of Pesticides ProgramsEnvironmental Fate and Effects Division. Prepared by: William Erickson, Biologist, Environmental Risk Branch 2 and Douglas Urban, Senior Biologist, Environmental Risk Branch 3. 225 p.

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7 FINAL EIR PREPARATION PERSONNEL

Eco-Analysts

Albert J. Beck, Ph.D. - Principal Analyst

Lauren C. Wemmer, Ph.D. – Senior Biologist, Avian Specialist

Rodney W. Lacey, B.S. – Botanist, Environmental Analyst

Anita N. Grey, B.S. – Physical Science Analyst, Adminstrator

APPENDICES

APPENDIX A

MATERIALS SAFETY DATA SHEETS

MSDS Sheets for Pesticides and Herbicides applied by OCVCD (2010)

Including:

- Agnique MMFG
- Agnique MMF
- Altosid Briquets
- Altosid XR Briquets
- Altosid Pellets
- Altosid Liquid Larvicide
- BVA-2
- GB-1111
- VectoBac CG
- VectoBac G
- VectoBac 12AS
- VectoLex WDG
- VectoLex CG
- Natular 2EC
- Natular T30
- Natular XRT
- Natular XRG
- Aqua Anvil
- Distance
- Amdro Pro
- Advion
- Extinguish
- Extinguish Plus
- Prescription Treatment brand 565 Plus XLO
- Suspend SC
- M-Pede
- Contrac – All Weather Cake
- Roundup Pro

Cognis Corporation

Material Safety Data Sheet

SDS no. : 292753

AGNIQUE MMF G

Revision: 03/19/2009
printing date: 03/19/2009

1. Chemical product and company identification

Product name:
AGNIQUE MMF G

Supplier
Cognis Corporation
5051 Estecreek Drive
Cincinnati, OH 45232-1446
Phone: +1 (866) 910-0598
Fax-no.: +1 (513) 482-3576

Emergency Information Chemtrec:
+1-800-424-9300

2. Composition / information on ingredients

General chemical description:
Mosquito Larvicide & Pupicide in Pellet Form

COMPONENT:	CAS-No.	CONCENTRATION (Wt. %):
Proprietary component(s)		68
Poly(oxy-1,2-ethanediyl), .alpha.-(C16-20 branched and linear alkyl)-.omega.-hydroxy	881022-11-3	32

3. Hazards identification

EMERGENCY OVERVIEW

Low hazard for usual industrial or commercial handling.

Delivery state:
pellets

State:
solid

Odor:
almost odourless

Color(s):
light brown

Routes of entry:
Skin contact, Eye contact

Potential Health Acute Effects:
Inhalation:
May cause respiratory irritation.

Skin contact:
not irritating

Eye contact:
May cause eye irritation.

Ingestion:
May be harmful if swallowed in large quantities.

Potential Chronic Health Effects:
None known

4. First aid measures

After inhalation:
Remove person from dust-contaminated zone, seek medical advice if necessary.

After skin contact:
Wash thoroughly with soap and water.

After eye contact:
Rinse immediately with plenty of running water (for 10 minutes). Seek medical attention if necessary.

After ingestion:
Do not induce vomiting.
Seek medical advice immediately and show this container or label.

5. Fire fighting measures

Flash point:
365 °F (185.00 °C)

Autoignition temperature:

Not determined

Flammable/Explosive limits:
Lower limits:
No data available.
Upper limits:
No data available.

Suitable extinguishing media:
water spray jet
Carbon dioxide.
Foam.

Special protection equipment for firefighters:
Wear self-contained breathing apparatus.
Wear full protective clothing.

Unusual fire or explosion hazards:
Avoid creating explosive concentrations of dust.

Hazardous combustion products:
Carbon dioxide., Sulphur oxides

6. Accidental release measures

General information:
Avoid open flames and sources of ignition.
Clean up spills immediately.

Personal precautions:
dust mask
Avoid dust formation.

Process for cleaning and take-up:
Pick up spilled material and containerize for recovery or disposal.
Vacuum or sweep area to remove residues.

7. Handling and storage

Handling:
Handling advice:
Avoid dust formation.
Ensure adequate ventilation.
Avoid naked flames, sparking and sources of ignition.

Storage:

General storage advice:

Avoid container damage while handling and storing.
Store only in the original container.

8. Exposure controls / personal protection

Indication for system design:

Ensure adequate ventilation.

Components with specific control parameters for workplace:

Valid for USA

Name on list	Basis	Type	Value	Category	Remarks
PARTICLES (INSOLUBLE OR POORLY SOLUBLE) NOT OTHERWISE SPECIFIED, INHALABLE PARTICLES	ACGIH	Time Weighted Average (TWA).	10 mg/m^3		
PARTICLES (INSOLUBLE OR POORLY SOLUBLE) NOT OTHERWISE SPECIFIED, RESPIRABLE PARTICLES	ACGIH	Time Weighted Average (TWA).	3 mg/m^3		
PARTICULATES NOT OTHERWISE REGULATED RESPIRABLE FRACTION	OSHA Z1	Permissible Exposure Limit (PEL)	5 mg/m^3		All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.
PARTICULATES NOT OTHERWISE REGULATED TOTAL DUST	OSHA Z1	Permissible Exposure Limit (PEL)	15 mg/m^3		All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by the Particulates Not Otherwise Regulated (PNOR) limit which is the same as the inert or nuisance dust limit of Table Z-3.

PARTICULATES NOT OTHERWISE REGULATED RESPIRABLE FRACTION	OSHA Z1A	Time Weighted Average (TWA).	5 mg/m^3		
PARTICULATES NOT OTHERWISE REGULATED TOTAL DUST	OSHA Z1A	Time Weighted Average (TWA).	15 mg/m^3		
INERT OR NUISANCE DUST, RESPIRABLE FRACTION	Z3	Time Weighted Average (TWA).	15 others	millions of particles per cubic foot of air.	
INERT OR NUISANCE DUST, TOTAL DUST	Z3	Time Weighted Average (TWA).	50 others	millions of particles per cubic foot of air.	
INERT OR NUISANCE DUST, RESPIRABLE FRACTION	Z3	Time Weighted Average (TWA).	5 mg/m^3		
INERT OR NUISANCE DUST, TOTAL DUST	Z3	Time Weighted Average (TWA).	15 mg/m^3		
PARTICULATES NOT OTHERWISE REGULATED, RESPIRABLE FRACTION	US CA OEL	Time Weighted Average (TWA) Permissible Exposure Limit (PEL):	5 mg/m^3		
PARTICULATES NOT OTHERWISE REGULATED, TOTAL DUST	US CA OEL	Time Weighted Average (TWA) Permissible Exposure Limit (PEL):	10 mg/m^3		

Personal protection measures:

Respiratory protection:

Nuisance dust mask if use causes dusting.

Hand protection:

Appropriate chemical resistant gloves.

Eye protection:

Safety glasses with side shields.

Skin protection:

Wear suitable protective clothing.

9. Physical and chemical properties

General description:

Delivery state:	pellets
State:	solid
Odor:	almost odourless
Color(s):	light brown

Designation	Value	Method
Solubility in Water	Soluble	no information

10. Stability and reactivity

Stability:

Conditions to avoid:

Keep away from sources of ignition and naked flames.

Dangerous decomposition products:

Carbon dioxide.
Sulphur oxides

Decomposition advices:

No decomposition if used according to specifications.

Reactivity:

Materials to avoid:

Strong Acids
Strong Alkalies
Strong Oxidizers

Hazardous polymerization:

Will not occur

11. Toxicological information

General toxicological information:

No toxicity information available or testing conducted on this product.

12. Ecological information

General ecological information:

no data available

13. Disposal considerations

Waste disposal of product:
All recovered material should be packaged, labeled, transported, and disposed or reclaimed in conformance with applicable laws and regulations and in conformance with good engineering practices.
Reclaim where possible.

14. Transport information

General information:
Not hazardous according to RID, ADR, ADNR, IMDG, IATA-DGR, CFR and TDG.

The transport information provided represents the regulatory transport classification of the product without consideration to packaging, quantity, or modal restrictions and exceptions. It is the user's responsibility to determine the appropriate packaging and modal requirements and/or limitations for the product quantity being shipped.

15. Regulatory information

TSCA Inventory Status:	This product is excluded pursuant to Section 3(2)(B)(ii) of the Toxic Substances Control Act [FIFRA Exclusion].		
SARA 311/312 Hazard Categories:	None		
TSCA 12(b) Components:	none		
SARA 313 Toxic Chemicals:	none		
SARA 302 Extremely Hazardous Substances:	US. EPA Emergency Planning and Community Right-To-Know Act (EPCRA) SARA Title III Section 302 Extremely Hazardous Substance (40 CFR 355, Appendix A)		
	ETHYLENE OXIDE	CAS: 75-21-8	3PPM
CERCLA Hazardous Chemicals:	US. EPA CERCLA Hazardous Substances (40 CFR 302)		
	ETHYLENE OXIDE	CAS: 75-21-8	3PPM
	1,4-DIETHYLENEOXIDE	CAS: 123-91-1	33PPM

California Proposition 65: This product contains the following chemical/s known to the State of California to cause cancer and/or birth defects or other reproductive harm.

ETHYLENE OXIDE	CAS: 75-21-8	3PPM
1,4-DIOXANE	CAS: 123-91-1	33PPM

16. Other information

NFPA Rating (US)	Value
Health	1
Fire	1
Reactivity	0
Special Hazard	

HMIS Rating (US)	Value
Health	1
Flammability	1
Reactivity	0

All information, recommendations, and suggestions appearing herein concerning our product are based upon tests and data believed to be reliable. However, it is the user's responsibility to determine the safety, toxicity, and suitability for his own use of the product described herein. Since the actual use by others is beyond our control, no guarantee, express or implied, is being made as to the effects of such use, the results obtained, or the safety and toxicity of the product nor is their any assumed liability arising out of use, by others, of the product referred to herein. The information herein is not to be construed as absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations.

MSDS by MSDS Number

/TD>

Our database contains over 10,000 MSDS representing over 80,000 unique product codes. Your search will be more successful if you fill in as much information as possible.

Univar USA
6100 Carillon Point
Kirkland WA 98033
425−889−3400

For Emergency Assistance involving chemicals call − CHEMTREC (800) 424−9300

MSDS Number:P21046VS MSDS Version:006

006 09/26/02 AGNIQUE MMF MOSQUITO LARVICIDE & PUPICIDE

****
PRODUCT IDENTIFICATION
****

PRODUCT NAME: AGNIQUE MMF MOSQUITO LARVICIDE & PUPICIDE

MSDS#: P21046vs

DATE ISSUED: 09/04/02

SUPERSEDES: 01/02/00

ISSUED BY: 005326

SECTION 1: CHEMICAL PRODUCT and COMPANY IDENTIFICATION

PRODUCT NAME: AGNIQUE MMF MOSQUITO LARVICIDE & PUPICIDE
PRODUCT DESCRIPTION: ETHOXYLATED ALCOHOL
SYNONYMS: HENKEL 5996
CASRN: 52292−17−8
MANUFACTURER: Cognis Corporation
5051 Estecreek Drive
Cincinnati,OH 45232
Phone: 800−543−7370 Fax: 513−482−5515
EMERGENCY NUMBERS:
CHEMTREC: 800−424−9300

EPA NO. 2302−14

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL	CONCENTRATION(Wt.%)	EXPOSURE LIMITS
POE (2) Isostearyl Alcohol		
CASRN 52292−17−8	100.0	None Established
1,4−Dioxane		
CASRN 123−91−1	< 0.0010	PEL:25 ppm (TWA) PEL Skin designation TLV:20 ppm (TWA) PEL Skin designation

---

SECTION 3: HAZARDS IDENTIFICATION

Emergency Overview
WARNING!
May cause minor eye irritation on prolonged or repeated contact.

Clear, Viscous, Light Straw Colored Liquid

SKIN CONTACT:

This material is not classified as a skin irritant.

EYE CONTACT:
May cause minor eye irritation on prolonged or repeated contact.

INHALATION:
Considered to be non−toxic by animal tests.

INGESTION:
Considered to be non−toxic by animal tests.

CHRONIC EFFECTS:
None known.

OTHER HEALTH EFFECTS:
None known.

PRIMARY ROUTES of EXPOSURE: Inhalation, Skin

SECTION 4: FIRST AID MEASURES

SKIN CONTACT:
Wash affected area with soap and water.

EYE CONTACT:
Immediately flush eyes with plenty of cool water for at least 15 minutes. Do not let victim rub eyes. Get medical attention if irritation develops.

INHALATION:
If overexposure to vapor or mist occurs, immediately remove victim to fresh air. If victim has stopped breathing give artificial respiration, preferably mouth to mouth. Get medical attention immediately

INGESTION:
If swallowed, get medical assistance. Do not induce vomiting.

SECTION 5: FIRE FIGHTING MEASURES

Flash Point: >500 Deg F (Cleveland Open Cup)
LFL: Not Determined UFL: Not Determined
AUTOIGNITION TEMP: Not Determined

RECOMMENDED EXTINGUISHING MEDIA:
Carbon dioxide, Dry chemical, Foam, Water spray

SPECIAL FIRE FIGHTING PROCEDURES:
Use water spray, dry chemical, foam or carbon dioxide. Water may be ineffective but should be used to keep fire exposed containers cool. If a spill or leak has not ignited, use water spray to disperse the vapors. Water spray may be used to flush spills away from fire.

UNUSUAL FIRE OR EXPLOSION HAZARDS:
Perform only those fire fighting procedures for which you have been trained. Firefighters should wear self contained breathing apparatus in the positive pressure mode with a full facepiece when there is a possibility of exposure to smoke, fumes or hazardous decomposition products.

HAZARDOUS COMBUSTION PRODUCTS:
Decomposition may produce carbon monoxide and carbon dioxide.

SECTION 6: ACCIDENTAL RELEASE MEASURES

STEPS TO TAKE IN CASE OF SPILL OR LEAK:
Add dry material to absorb spill (if large spill, dike to contain). Using recommended protective equipment, pick up bulk of spill and containerize for recovery or disposal. Flush area with water to remove residues.

SECTION 7: HANDLING AND STORAGE

Container disposal: Triple rinse then offer for recycling or reconditioning, or puncture and dispose in a sanitary landfill or by other procedures approved by state or local authorities.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

EYE PROTECTION:
Safety glasses with side shields

SKIN PROTECTION:
Rubber gloves

RESPIRATORY PROTECTION:
Not applicable with adequate ventilation.

ENGINEERING CONTROLS:
General ventilation.

SECTION 9: PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE: Liquid
APPEARANCE: Clear, Viscous, Light Straw Colored Liquid
ODOR: Mild
ODOR THRESHOLD: Not Determined
pH: N/D
MELTING POINT: −7 to −3 Deg C
BOILING POINT: 320 Deg C
SPECIFIC GRAVITY: 0.906
SOLUBILITY IN WATER: Insoluble
PERCENT VOLATILES(by Wt.): Not Determined
VAPOR DENSITY: Heavier than Air
VAPOR PRESSURE: Not Determined
EVAPORATION RATE(N−BUTYL ACETATE=1): Not determined
VOC CONTENT(EPA Method 24): 0.0 %

SECTION 10: STABILITY AND REACTIVITY

STABILITY: Normally Stable

HAZARDOUS POLYMERIZATION: Will not occur.

INCOMPATIBLE MATERIALS:
Strong acids, bases and oxidizing agents.

CONDITIONS TO AVOID:
Avoid contact with heat, sparks, flame and all sources of ignition.

HAZARDOUS DECOMPOSITION PRODUCTS:
Decomposition produces carbon monoxide and carbon dioxide.

SECTION 11: TOXICOLOGICAL INFORMATION

TYPE OF STUDY	RESULTS	SPECIES
ORAL LD(50)	>20 g/kg	Rat
INHALATION LC(50)	>29 mg/l	Rabbit
DERMAL LD(50)	>2 g/kg	Rabbit

This material was found to be non−irritating to human skin in a human patch test.

This material was mildly irritating to rabbit eyes, and the effects were reversible in 7 days.

SECTION 12: ECOLOGICAL INFORMATION

ECOLOGICAL TOXICITY:
Avian acute oral LD50 (Mallard Duck): >2,000 mg/kg

Avian dietary LC50 (Bobwhite Quail): >5,000 mg/kg
Fish acute LC50 (Bluegill): 290 mg/kg
Rainbow Trout: 98 mg/kg
Aquatic invertebrate LC50 (Daphnia): 1.9 mg/L

ENVIRONMENTAL FATE:

Average persistence in the environment under standard use conditions is 5−14 days at recommended dosage rates.

SECTION 13: DISPOSAL CONSIDERATIONS

All recovered material should be packaged, labeled, transported, and disposed or reclaimed in conformance with applicable laws and regulations and in conformance with Good Engineering Practices. Avoid landfilling of liquids. Reclaim where possible.

SECTION 14: TRANSPORTATION INFORMATION

INSECTICIDES, FUNGICIDES, INSECT/ANIMAL
REPELLENTS, NOI
NMFC: 102120

The information provided is for domestic highway transportation only. This product may be regulated differently when shipped in other types of containers or by modes other than that addressed by this section of the MSDS. For information, please contact Regulatory Affairs at 513/482−5022.

For RQ applicability, please see Section XV.

SECTION 15: REGULATORY INFORMATION

TSCA INVENTORY STATUS:
This product and/or all of its components are included on the TSCA Inventory of Chemical Substances.

TSCA 12(b) COMPONENTS:
None

SARA 311/312 HAZARD CATEGORIES: Acute

SARA 313 TOXIC CHEMICALS: None

SARA 302 EXTREMELY HAZARDOUS SUBSTANCES: None

CERCLA HAZARDOUS SUBSTANCES:
1,4−Dioxane(123−91−1) < 0.0020%

CALIFORNIA PROPOSITION 65 COMPONENTS:
WARNING This product contains a chemical (or chemicals) known to the State of California to cause cancer, birth defects and/or other reproductive harm.
1,4−Dioxane(123−91−1) < 0.0010%

SECTION 16: OTHER INFORMATION

HMIS RATINGS: HEALTH: 1 FLAMMABILITY: 1 REACTIVITY: 0

NFPA RATINGS: HEALTH: FLAMMABILITY: REACTIVITY: OTHER: None

THE FOLLOWING WARNING INFORMATION IS PROVIDED ON THE LABEL FOR THIS PRODUCT:

WARNING!
May cause minor eye irritation on prolonged or repeated contact.
FIRST AID − INHALATION:
If overexposure to vapor or mist occurs, immediately remove victim to fresh air. If victim has stopped breathing give artificial respiration, preferably mouth to mouth. Get medical attention immediately
FIRST AID − SKIN CONTACT:
Wash affected area with soap and water.
FIRST AID − EYE CONTACT:
Immediately flush eyes with plenty of cool water for at least 15 minutes. Do not let victim rub eyes. Get medical attention if

irritation develops.
FIRST AID − INGESTION:
If swallowed, get medical assistance. Do not induce vomiting.
HANDLING AND STORAGE:
Container disposal: Triple rinse then offer for recycling or reconditioning, or puncture and dispose in a sanitary landfill or by other procedures approved by state or local authorities.

ABBREVIATIONS USED:

ND or N/D = Not Determined
NA or N/A = Not Applicable or Not Available
NE or N/E = Not Established
N/AP = Not Applicable

For Additional Information:
Contact: MSDS Coordinator − Univar USA
During business hours, Pacific Time − (425) 889−3400

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Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar USA Sales Office.

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END OF MSDS

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for (i=0;i 0) { document.images[i].border = 0; document.images[i].width = 0; document.images[i].height = 0; break; } }

MSDS Safety Information

TOP

FSC: 6850

MSDS Date: 08/01/1990

MSDS Num: BZPWF

Submitter: N EN

LIIN: 00N024224

Tech Review: 02/16/1996

Status CD: C

Product ID: ALTOSID BRIQUETS

MFN: 02

Article: N

Kit Part: N

Cage: 6P098

Responsible Party

Name: ZOECON CORP

Address: 12200 DENTON DR

City: DALLAS

State: TX

Zip: 75234

Country: US

Info Phone Number: 214−243−2321

Emergency Phone Number: 214−243−2321

Preparer's Name: N/P

Proprietary Ind: N

Review Ind: N

Published: Y

Special Project CD: N

Contractor Summary

TOP

Cage: 51112

Name: ZOECON CORP

Address: 12200 DENTON DR

City: DALLAS

State: TX

Zip: 75234

Country: US

Phone: 214−243−2321

Cage: 6P098

Name: ZOECON CORP

Address: 975 CALIFORNIA AVE

Box: N/K

City:

State:

Zip:

PALO ALTO CA 94304−1104

Country: **Phone:**

US UNKNOWN

Ingredients

TOP

Cas: 40596−69−8 M JR1685000 M

Code: RTECS #: Code:

Name: **2,4−DODECADIENOIC ACID, 11−METHOXY−3,7,11−TRIMETHYL−, 1−METHYLETHYL ESTER; (R−S)METHOPRENE: (ING 2)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

N/K (FP N)

Code: M OSHA STEL: Code:

ACGIH TLV: N/K (FP N)

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

N

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 1: ISOPROPYL(E,E)−11−METHOXY−3,7,11−TRIMETHYL−2,4−DODECADIENOATE)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: 7778−18−9 M WS6920000 M

Code: RTECS #: Code:

Name: **CALCIUM SULFATE**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

15 MG/M3 TDUST

Code: M

OSHA STEL:

Code:

ACGIH TLV: 10 MG/M3 TDUST

Code: M

ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

N

========== **Health Hazards Data** ==========

TOP

LD50 LC50 Mixture

LD50 (ORAL RAT): > 34600 MG/KG.

Route Of Entry Inds − Inhalation:YES

Skin:YES

Ingestion:YES

Carcinogenicity Inds − NTP:NO

IARC:NO

OSHA:NO

Health Hazards Acute And Chronic

ACUTE: NO ADVERSE REACTIONS HAVE RESULTED FROM HUMAN EXPOSURE DURING RESEARCH OR MANUFACTURE. NOTIFY MANUFACTURER OF ANY SYMPTOMS WHICH MAY BE RELATED TO EXPOSURE. METABOLISM: ANIMAL STUDIES INDICATE SLOW AND COMPLETE ABSORPTION FOLLOWING INGESTION. METHOPRENE IS SLOWLY ELIMINATED IN URINE, FECES, & (EFTS OF OVEREXP)

Explanation Of Carcinogenicity

NOT RELEVANT.

Signs And Symptions Of Overexposure

HLTH HAZ: EXPIRED AIR (CA. 82.8% @ 5 DAYS IN RAT). PLASMA LEVELS WERE LOW, PEAKING AT 6 HOURS. TISSUE LEVELS WERE ALSO LOW. METHOPRENE IS EXTENSIVELY METABOLIZED. ENTEROHEPATIC CIRCULATION OF METHOPRE NE METABOLITES EXCRETED IN THE BILE MAYOCCUR.

Medical Cond Aggravated By Exposure

NONE SPECIFIED BY MANUFACTURER.

First Aid

EYES: IMMED FLUSH W/GENTLY RUNNING WATER FOR AT LEAST 15 MIN. SEE MD IF IRRIT PERSISTS. SKIN: REMOVE CONTAM CLTHG. WASH THORO W/WATER & SOAP. SEE MD IF SYMP DEVELOP. INGEST: GIVE 1−2 GLASSES OF WATER TO DRINK & INDUCE VOMIT. REFER VICTIM TO MED PERS. IN CASE OF UNCON, DO NOT INDUCE VOMIT/GIVE ANYTHING BY MOUTH. INHAL: REMOVE VICTIM TO FRESH AIR. SEEK MED ATTN

AS NEEDED.

Spill Release Procedures

SWEEP UP MATERIAL. PLACE IN CONTAINER FOR DISPOSAL. DO NOT ALLOW SPILL TO ENTER WATERWAYS INHABITED BY AQUATIC ORGANISMS.

Neutralizing Agent

NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods

CONSULT STATE, FEDERAL AND LOCAL REGULATIONS FOR PROPER DISPOSAL PROCEDURES. DO NOT CONTAMINATE WATER, FOOD OR FEED BY DISPOSAL. EMPTY CONTAINERS MAY BE DISPOSED OF IN SANITARY LANDFILL.

Handling And Storage Precautions

STORE IN A COOL, DRY PLACE. DO NOT CONTAMINATE FOOD, FEED OR WATER BY STORAGE.

Other Precautions

AVOID CONTACT WITH SKIN AND EYES.

========== Fire and Explosion Hazard Information ==========

TOP

Flash Point Method:

N/P

Flash Point:

Flash Point Text: N/A

Autoignition Temp:

Autoignition Temp Text: N/A

Lower Limits: N/A

Upper Limits: N/A

Extinguishing Media

USE WATER, DRY CHEMICAL, FOAM.

Fire Fighting Procedures

WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N). DO NOT ALLOW RUNOFF TO ENTER WATERWAYS INHABITED BY AQUATIC ORGANISMS.

Unusual Fire/Explosion Hazard

NONE.

========== Control Measures ==========

TOP

Respiratory Protection

AVOID INHALATION OF DUST. IF PROLONGED OR EXCESSIVE EXPOSURE IS EXPECTED, WEAR NIOSH/MSHA APPROVED DUST RESPIRATOR.

Ventilation

LOCAL EXHAUST.

Protective Gloves

IMPERVIOUS GLOVES.

Eye Protection

ANSI APPRVD CHEM WORKERS GOGGS (FP N).

Other Protective Equipment

WEAR APPROPRIATE CLOTHING TO PREVENT SKIN CONTACT. EMERGENCY EYEWASH DELUGE SHOWER MEETING ANSI DESIGN CRITERIA (FP N)

Work Hygienic Practices

AVOID CONTACT WITH EYES OR SKIN. AVOID BREATHING DUST. WASH THOROUGHLY WITH SOAP AND WATER AFTER HANDLING.

Supplemental Safety and Health

NONE SPECIFIED BY MANUFACTURER.

========== Physical/Chemical Properties ==========

TOP

HCC:

NRC/State LIC No:

Net Prop WT For Ammo:

Boiling Point: B.P. Text: N/A

Melt/Freeze Pt: M.P/F.P Text: N/K

Decomp Temp: Decomp Text: N/K

Vapor Pres:	N/A	Vapor Density:	N/A
Volatile Org Content %:		Spec Gravity:	1.04 (H*2O=1)
VOC Pounds/Gallon:			
		PH:	N/K
VOC Grams/Liter:		Viscosity:	N/P
Evaporation Rate & Reference:	N/A		
Solubility in Water:	1 PPM		
Appearance and Odor:	GREY TO BLACK SOLID, WITH A SLIGHT HYDROCARBON ODOR		
Percent Volatiles by Volume:	NONE	Corrosion Rate:	N/K

========== **Reactivity Data** ========== TOP

Stability Indicator:

YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: NONE.

Hazardous Decomposition Products: NONE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization NOT RELEVANT.

:

========== **Toxicological Information** ========== TOP

Toxicological Information:

N/P

========== **Ecological Information** ========== TOP

Ecological:

N/P

========== **MSDS Transport Information** ========== TOP

Transport Information:

N/P

========== **Regulatory Information** ========== TOP

Sara Title III Information:

N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

========== **Other Information** ========== TOP

Other Information:

N/P

==========

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Date Issued: May, 2001
Supersedes: November,2000

MATERIAL SAFETY DATA SHEET
ALTOSID® XR EXTENDED RESIDUAL BRIQUETS

Manufacturer: Wellmark International

Address: 1100 East Woodfield Road, Suite 500 Schaumburg, IL 60173

Emergency Phone: 1-800-248-7763

Transportation Emergency Phone: CHEMTREC: 1-800-424-9300

1. CHEMICAL PRODUCT INFORMATION

Product Name: Altosid® XR Extended Residual Briquets

Chemical Name/Synonym: (S)-Methoprene; isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate

Chemical Family: Terpenoid

Formula: C19 H34 O3

EPA Registration No.: 2724-421

RF Number: 292A

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component (chemical, common name)	CAS Number	Weight	Tolerance
(S)- Methoprene: Isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate	65733-16-6	2.1%	Not established
Inert ingredients (non-hazardous and/or trade secret)		97.9%	

3. HAZARD INFORMATION

PRECAUTIONARY STATEMENT

Caution: Keep out of the reach of children.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

No adverse reactions have resulted from normal human exposure during research and testing. Adverse animal reactions to this product have not been shown.

PRIMARY ROUTE OF ENTRY **Dermal/Eye:** Yes **Oral:** Yes **Inhalation** No

ACUTE TOXICITY

Oral: LD50 (rat): >34,000 mg/kg (highest dose level tested)(Based on (S)-Methoprene)

Dermal: LD50 (rabbit): >2,000 mg/kg (Hot) (highest dose level tested) (Based on (S)-Methoprene)

Inhalation: LC50 (rat): Not applicable to this product form

OTHER TOXICOLOGICAL INFORMATION

Skin Irritation: Non-irritating (rabbit) (Based on (S) Methoprene)

Eye Irritation: Mild/moderate irritation, corneal opacity at 1 hour - all animals clear by 72 hours (rabbit) (Based on (S) Methoprene)

Sensitizer: Not a sensitizer (guinea pig) (Based on (RS) Methoprene)

4. FIRST AID MEASURES

Eye: Immediately flush with plenty of water.. See a physician if irritation persists.

Skin: Wash material off with soap and water. Remove contaminated clothing and footwear. See a physician if symptoms persist.

Ingestion: Drink 1-2 glasses of water and try to induce vomiting. Seek medical attention. Never give anything by mouth to an unconscious person.

Inhalation: Although this is not a primary route of entry, remove victim to fresh air. See a physician if cough or other respiratory symptoms develop

Note to Physician: Treat symptomatically

5. FIRE FIGHTING MEASURES

NFPA Rating: **Health: 0** **Fire: 0** **Reactivity: 0**

Flammability Class: N/A

Flash Point: Does not flash

Explosive Limits (% of Volume): N/A

Extinguishing Media: Water, foam, dry chemical

Special Protective Equipment: Firefighters should wear protective clothing, eye protection, and self contained breathing apparatus.

Fire Fighting Procedures: Normal procedures. Do not allow run-off to enter waterways inhabited by aquatic organisms

Combustion Products: None known

Unusual Fire/Explosion Hazards: None

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken: Sweep up material and place in a container for disposal. Do not allow spill to enter waterways inhabited by aquatic organisms

Absorbents: Not necessary due to product form and packaging

Incompatibles: None

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes or clothing. Do not remove briquets from container except for immediate use. Avoid breathing dust. Wash thoroughly with soap and water after handling.

Storage: Store in a cool, dry place. Do not contaminate food or feed by storage or disposal. Keep away from children.

8. EXPOSURE CONTROL / PERSONAL MEASURES

Exposure Limits: Not Applicable

Ventilation: Use with adequate ventilation.

Personal Protective Equipment: Under ordinary use conditions, no special protection is required. If prolonged exposure is expected, it is recommended to wear a MSHA/NIOSH approved organic vapor/pesticide respirator, impervious gloves, chemical goggles or safety glasses with side shields.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor:	Grey to black solid with slight hydrocarbon odor.
Boiling Point:	N/A
Melting Point:	N/A
Vapor Pressure (mm Hg):	N/A
Vapor Density (Air = 1):	N/A
Specific Gravity:	1.04 g/cc
Bulk Density:	N/A
Solubility:	1 ppm
Evaporation Rate:	N/A
pH:	N/A

10. STABILITY AND REACTIVITY

Stability:	Stable
Reactivity:	Non-reactive
Incompatibility w/ Other Materials:	None
Decomposition Products:	None
Hazardous Polymerization:	Will not occur

11. TOXICOLOGICAL INFORMATION

CHRONIC TOXICITY [Specific to Active Ingredient(s)]
Methoprene is not considered as an oncogenic compound. The NOEL for non-carcinogen effects in an 18-month mouse study was 250ppm.

DEVELOPMENTAL/REPRODUCTIVE TOXICITY [Specific to Active Ingredient(s)]
Methoprene is not a teratogenic compound. The NOEL for maternal and embryo toxicity in rabbits was 200/mg/kg/day. The NOEL for reproductive effects in rats was 500 ppm.

MUTAGENICITY [Specific to Active Ingredient(s)]
Methoprene is not a mutagenic compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE [Based on (RS)-Methoprene]

Hydrolysis:	T1/2 > 4 weeks
Photolysis:	T1/2 < 10 hours
Soil half life:	~ 10 days
Water solubility:	< 2 ppm

ECOTOXICITY [Based on (S)-Methoprene]

Acute Toxicity:	fish:LC50 (trout): 760 ppb, (bluegill): > 370 ppb ((S)-Methoprene); aquatic invertebrates:LC50 (Daphnia): 360 ppb ((S)-Methoprene This product is toxic to aquatic dipteran.)

13. DISPOSAL CONSIDERATIONS

Dispose of empty bag in sanitary landfill or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORT INFORMATION

DOT49CFR Description: Not regulated as hazardous by D.O.T.

Freight Classification: Insecticides, NOI other than poison in boxes or drums. NMFC 102120

15. REGULATORY INFORMATION

CERCLA (Superfund): Not regulated

RCRA: Not regulated as hazardous

SARA 311/312 HAZARD CATEGORIES

Immediate Health: Yes (irritation)

Delayed Health: No

Fire: No

Sudden Pressure: No

Reactivity: No

The information presented herein, while not guaranteed, was prepared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all inclusive and the manner and conditions of use and handling may involve other or additional considerations.

MSDS by MSDS Number

/TD>

Our database contains over 10,000 MSDS representing over 80,000 unique product codes. Your search will be more successful if you fill in as much information as possible.

Univar USA
6100 Carillon Point
Kirkland WA 98033
425−889−3400

For Emergency Assistance involving chemicals call − CHEMTREC (800) 424−9300

MSDS Number:34490 MSDS Version:001

001 04/19/00 ZOECON ALTOSID PELLETS

****
PRODUCT IDENTIFICATION
****

PRODUCT NAME: ZOECON ALTOSID PELLETS

MSDS#: 34490

DATE ISSUED: 7/99

SUPERSEDES: NEW

ISSUED BY: 009966

Date Issued: July, 1999
Supersedes:November, 1997

MATERIAL SAFETY DATA SHEET − ZOECON ALTOSID PELLETS

Manufacturer: Wellmark International
Address: 1000 Tower Lane, Suite 245, Bensenville, Illinois 60106
Emergency Phone: 1−800−248−7763
Transportation Emergency Phone: CHEMTREC: 1−800−424−9300

Product Name: Zoecon Altosid Pellets
Chemical Name/Synonym: (S)−Methoprene; isopropyl (2E,4E,7S)−11−methoxy−3,7,11−trimethyl−2,4−dodecadienoate
Chemical Family: Terpenoid
Formula: C19 H34 O3
EPA Registration No.:2724−448
RF Number: 330

PRIVATE Component
(chemical, common name)
CAS Number
Weight Tolerance
(S)−Methoprene; isopropyl (2E,4E,7S)−11−Methoxy− 3,7,11−trimethyl−2,4−dodecadienoate
65733−16−6
4.25%
Not established
Inert ingredients
(nonhazardous and/or trade secret)

95.75
%

Calcium Sulfate
7778−18−9

15 mg/m3

PRIVATE PRECAUTIONARY STATEMENT −

KEEP OUT OF THE REACH OF CHILDREN
CAUTION
SIGNS AND SYMPTOMS OF OVEREXPOSURE: No adverse reactions have resulted from normal human exposure during research and testing. Adverse animal reactions to this product have not been shown.

PRIMARY ROUTE OF ENTRY Dermal/Eye: Yes Oral: No Inhalation: Yes
ACUTE TOXICITY
Oral: LD50 (rat): >5,000 mg/kg (HDT) (Based on (S)−Methoprene)
Dermal: LD50 (rabbit): >2,000 mg/kg (HDT) (Based on (S)−Methoprene)
Inhalation: LC50 (rat): >210 mg/l air (Based on (RS)−Methoprene)
OTHER TOXICOLOGICAL INFORMATION
Skin Irritation: Non−irritating (rabbit) (Based on (S)−Methoprene)
Eye Irritation: Practically non−irritating (rabbit) (Based on (S)−Methoprene)
Sensitizer: Not a sensitizer (guinea pig) (Based on (RS)−Methoprene)

Eye: Immediately flush with copious amounts of water for at least 15 minutes. See a physician if irritation persists.
Skin: Wash material off with copious amounts of water and soap. Remove contaminated clothing and footwear. See a physician if symptoms persist.
Ingestion: Drink 1−2 glasses of water and try to induce vomiting. Seek medical attention. Never give anything by mouth to an unconscious person.
Inhalation: Remove victim to fresh air. See a physician if cough or other respiratory symptoms develop.
Note to Physician: Treat symptomatically

NFPA Rating: Health: 0 Fire: 0 Reactivity: 0
Flammability Class: N/A
Flash Point: Does not flash
Explosive Limits (% of Volume): N/A
Extinguishing Media: Water, Foam, Dry Chemical
Special Protective Equipment: Firefighters should wear protective clothing, eye protection, and self contained breathing apparatus.
Fire Fighting Procedures: Normal procedures. Do not allow run−off to enter waterways inhabited by aquatic organisms.
Combustion Products: None known
Unusual Fire/Explosion Hazards: None

Steps to be Taken: Sweep up material and place in a container for disposal. Do not allow spill to enter waterways inhabited by aquatic organisms
Incompatibles: None

Handling: Avoid contact with eyes or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling.
Storage: Store closed containers of Altosid pellets in a cool, dry place. Do not contaminate water, food or feed by storage or by disposal.

Exposure Limits: Calcium Sulfate = 15 mg/m3 (OSHA PEL & ACGIH TLV)
Ventilation: Use with adequate ventilation.
Personal Protective Equipment: Under ordinary use conditions, no special protection is required. If prolonged exposure is expected, it is recommended to wear a MSHA/NIOSH approved organic vapor/pesticide respirator, impervious gloves, chemical goggles or safety glasses with side shields.

Appearance and Odor: Dark grey to black pellets with slight hydrocarbon odor.
Boiling Point: N/A
Melting Point: N/A
Vapor Pressure (mm Hg): N/A
Vapor Density (Air = 1): N/A
Specific Gravity: 1.04 g/cc
Bulk Density: N/A
Solubility: 1 ppm
Evaporation Rate: N/A
pH: N/A

Stability: Stable
Reactivity: Non−reactive
Incompatibility with Other Materials: None
Decomposition Products: None
Hazardous Polymerization: Will not occur

CHRONIC TOXICITY (Based on (RS)−Methoprene)
Methoprene is not considered as an oncogenic compound. The NOEL for non−carcinogen effects in an 18−month mouse study was

250ppm.
DEVELOPMENTAL/REPAODUCTIVE TOXICITY (Based on (RS)−Methoprene)
Methoprene is not a teratogenic compound. The NOEL for maternal and embryo toxicity in rabbits was 200/mg/kg/day. The NOEL for reproductive effects in rats was 500 ppm.
MUTAGENICITY (Based on (RS)−Methoprene)
Methoprene is not a mutagenic compound.

ENVIRONMENTAL FATE (Based on (RS)−Methoprene)
Hydrolysis: T1/2 > 4 weeks ((S)−Methoprene)
Photolysis: T1/2 <10 hours ((S)−Methoprene)
Soil half life: 10 days ((S)−Methoprene)
Water solubility: < 2 ppm ((S)−Methoprene)
ECOTOXICITY (Based on (S)−Methoprene)
Acute Toxicity: fish: LC50 (trout): 760 ppb, (bluegill): >370 ppb ((S)−Methoprene)
aquatic invertebrates: LC50 (Daphnia): 360 ppb ((S)−Methoprene)

Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

DOT49CFR Description: Not regulated as hazardous by D.O.T.
Freight Classification: Insecticides, NOI other than poison in boxes or drums. NMFC 102120

CERCLA (Superfund): Not regulated
RCRA: Not regulated as hazardous
SARA 311/312 HAZARD CATEGORIES
Immediate Health: Yes (irritant)
Delayed Health: No
Fire: No
Sudden Pressure: No
Reactivity: No

For Additional Information:
Contact: MSDS Coordinator − Univar USA
During business hours, Pacific Time − (425) 889−3400

NOTICE
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Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar USA Sales Office.

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END OF MSDS

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for (i=0;i 0) { document.images[i].border = 0; document.images[i].width = 0; document.images[i].height = 0; break; } }

Date Issued: November, 2004
Supersedes: November, 2003

MATERIAL SAFETY DATA SHEET
ZOECON® ALTOSID® LIQUID LARVICIDE CONCENTRATE

Manufacturer: Wellmark International

Address: 1501 E. Woodfield Rd., Suite 200 West, Schaumburg, IL 60173

Emergency Phone: 1-800-248-7763

Transportation Emergency Phone: CHEMTREC: 1-800-424-9300

1. CHEMICAL PRODUCT INFORMATION

Product Name: Zoecon Altosid® Liquid Larvicide Concentrate

Chemical Name/Synonym: (S)-Methoprene; isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate

Chemical Family: Terpenoid

Formula: C19 H34 O3

EPA Registration No.: 2724-446

RF Number: 437

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component (chemical, common name)	CAS Number	Weight	Tolerance
(S)- Methoprene: Isopropyl (2E,4E,7S)-11-Methoxy-3,7,11-trimethyl-2,4-dodecadienoate	65733-16-6	20.0%	Not established
Inert ingredients (non-hazardous and/or trade secret)		80%.0	N/A

3. HAZARD INFORMATION

PRECAUTIONARY STATEMENT

Caution: Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling..Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

No adverse reactions have resulted from normal human exposure during research and testing.

PRIMARY ROUTE OF ENTRY **Dermal/Eye:** Yes **Oral:** No **Inhalation:** No

ACUTE TOXICITY

Oral: LD50 (rat): >34,000 mg/kg (highest dose tested) (HDT) (Based on (S) Methoprene)

Dermal: LD50 (rabbit): >2000 mg/kg (highest dose tested) (HDT) (Based on (S) Methoprene)

Inhalation: LC50 (rat): >5.19 mg/L air (Based on (S) Methoprene)

OTHER TOXICOLOGICAL INFORMATION

Skin Irritation: Non-irritating (rabbit) (Based on (S) Methoprene)

Eye Irritation: Practically non-irritating (rabbit) (Based on (S) Methoprene)

Sensitizer: Not a sensitizer (guinea pig) (Based on (S) Methoprene)

4. FIRST AID MEASURES

Eye: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.

Skin: Take off contaminated clothing. Rinse skin immediately with soap and water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Ingestion: Drink 1-2 glasses of water and try to induce vomiting. Seek medical attention. Never give anything by mouth to an unconscious person.

Inhalation: Remove victim to fresh air. See a physician if cough or other respiratory symptoms develop.

Note to Physician: Treat symptomatically

5. FIRE FIGHTING MEASURES

NFPA Rating: **Health: 0** **Fire: 0** **Reactivity: 0**

Flammability Class: N/A

Flash Point: Does not flash

Explosive Limits (% of Volume): None

Extinguishing Media: Water, foam, CO2

Special Protective Equipment: Firefighters should wear protective clothing and self contained breathing apparatus.

Fire Fighting Procedures: Normal procedures. Do not allow fire fighting water to escape into waterways or sewers.

Combustion Products: Carbon monoxide, carbon dioxide

Unusual Fire/Explosion Hazards: None

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken: In case of leakage or spill, soak up with absorbent material. Place in a container for disposal.

Absorbents: Clay granules, sawdust, dirt or equivalent.

Incompatibles: None

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

Storage: Store in a cool, dry place, away from other pesticides, food and feed.

8. EXPOSURE CONTROL / PERSONAL MEASURES

Exposure Limits:	Not established
Ventilation:	Use with adequate ventilation.
Personal Protective Equipment:	Under ordinary use conditions, no special protection is required. If prolonged exposure is expected, it is recommended to wear a MSHA/NIOSH approved organic vapor/pesticide respirator, impervious gloves, chemical goggles or safety glasses with side shields.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor:	Creamy, yellow liquid with slight odor.
Boiling Point:	100 C
Melting Point:	Not applicable
Vapor Pressure (mm Hg):	17.5 mm Hg
Vapor Density (Air = 1):	0.6 (water phase)
Specific Gravity:	1.04 - 1.06
Bulk Density:	8.3 lbs/gal
Solubility:	Disperses in water
Evaporation Rate:	Approximately 0.8
pH:	6.3 - 6.8

10. STABILITY AND REACTIVITY

Stability:	Stable
Reactivity:	Non-reactive
Incompatibility w/ Other Materials:	Bleach, oxidizing/alkaline materials
Decomposition Products:	None
Hazardous Polymerization:	Will not occur

11. TOXICOLOGICAL INFORMATION

CHRONIC TOXICITY [Based on (RS)-Methoprene]
Methoprene is not considered as an oncogenic compound. The NOEL for non-carcinogen effects in an 18-month mouse study was 250ppm.

DEVELOPMENTAL/REPRODUCTIVE TOXICITY [Based on (RS)-Methoprene]
Methoprene is not a teratogenic compound. The NOEL for maternal and embryo toxicity in rabbits was 200/mg/kg/day. The NOEL for reproductive effects in rats was 500 ppm.

MUTAGENICITY [Based on (RS)-Methoprene]
Methoprene is not a mutagenic compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE [Based on (RS)-Methoprene]

Hydrolysis: T1/2 > 4 weeks

Photolysis: T1/2 < 10 hours

Soil half life: ~ 10 days

Water solubility: < 2 ppm

ECOTOXICITY [Based on (S)-Methoprene]

Acute Toxicity: fish:LC50 (trout): 760 ppb, (bluegill): > 370 ppb ;
aquatic invertebrates:LC50 (Daphnia): 360 ppb

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food, or feed by disposal. **Pesticide Disposal:** Wastes resulting from this product may be disposed of on site or at an approved waste management facility. **Container Disposal:** Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORT INFORMATION

DOT49CFR Description: Not regulated as hazardous by D.O.T., I.A.T.A. or I.M.D.G.

Freight Classification: Insecticides, NOI other than poison in boxes or drums. NMFC 102120

15. REGULATORY INFORMATION

CERCLA (Superfund): Not regulated

RCRA: Not regulated as hazardous

SARA 311/312 HAZARD CATEGORIES

Immediate Health: Yes (irritation)

Delayed Health: No

Fire: No

Sudden Pressure: No

Reactivity: No

The information presented herein, while not guaranteed, was prepared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all inclusive and the manner and conditions of use and handling may involve other or additional considerations.

25 24 042

MATERIAL SAFETY DATA SHEET

BVA TRANS II

SECTION 1: General Information		
Manufacturer/Supplier Name:	Phone :	248-348-4920
BVA OILS	**Emergency :**	**CHEMTRAC**
48845 West Road		**1-800-424-9300**
Wixom, MI 48393-0301	Date prepared:	6/13/00

SECTION II: COMPOSITION / INFORMATION ON INGREDIENTS			
Chemical Name	CAS NUMBER	EXPOSURE LIMITS	Concentration % by volume
Severely hydrotreated Light Naphthenic Petroleum Oil	#RN 64742-53-6	Exposure Limits: OIL MIST OSHA PEL MIST 5 MG/M3 8 hrs. ACGIH TLV MIST 5 MG/M3 8 hrs.	99.9
Hindered phenol type inhibitor	#RN 128-39-2		0.1

SECTION III: POTENTIAL HEALTH EFFECTS FROM OVEREXPOSURE	
EMERGENCY OVERVIEW **Not expected to cause a severe emergency hazard.** **Material has a NFPA rating of 0 - 1 - 0.** **There are no chemicals in reportable quantities under SARA Section 313** **Use of adequate ventilation will prevent aspiration of oil mists.** **Wash skin after contact, prolonged contact with any oils can cause irritation in some individuals.**	
PRIMARY ROUTES OF ENTRY	Skin
EYES :	Tests on similar materials suggest that no eye effect be expected.
SKIN :	Tests on similar materials indicate that no significant adverse health effects are expected to occur upon short-term exposure.
INGESTION :	Tests on similar materials indicate no significant adverse effects expected. Practically non-toxic.
INHALATION :	Tests on similar material indicate no acute effects are expected.
CHRONIC (CANCER INFORMATION)	Prolonged and/or repeated contact with this material may produce skin irritation and inflammation. Carcinogen listed by : National Toxicology Program (NO) I .A .R .C. (NO) OSHA (NO) ACGIH (NO) This product does not require a cancer hazard warning in accordance with the OSHA Hazard Communication Standard.
MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE	Personnel with pre-existing skin disorders should avoid contact with this product.

SECTIONI IV : FIRST AID PROCEDURES	
EYE :	Flush eyes immediately with water for at least 15 minutes or until irritation subsides. If irritation persists, consult a physician.
SKIN:	Wash thoroughly with soap and water. Remove contaminated clothing and wash before reuse. If irritation or rash develops, obtain medical assistance. Immediately remove soaked clothing.
INHALATION :	Not likely to occur except a mist. Remove patient to fresh air and consult a physician. If breathing is difficult, give oxygen. If not breathing give artificial respiration.
INGESTION :	Product is practically non-toxic. Do not induce vomiting. Obtain emergency medical attention.

SECTION V : FIRE FIGHTING PROCEDURES	
This product is: Combustible	
FLASH POINT TAG CC AUTOIGNITION : FLAMMABILITGY CLASS : LOWER EXPLOSIVE LIMIT (%) UPPER EXPLOSIVE LIMIT (%)	>293°F > 145°C COC ASTM D92 > 650°F > 343°C IIIB Not determined Not determined
FIRE AND EXPLOSION HAZARDS	Slightly combustible. OSHA/NFPA Class IIIB Combustible Liquid. If heated above its flash point will release flammable vapors which can burn in the open or be explosive in confined spaces if exposed to ignition source. Mists or sprays may be flammable below oil's normal flash point. Keep away from extreme heat or open flame.
EXTINGUISHING MEDIA :	Dry chemical, carbon dioxide, water fog and foam. NOTE: Water, fog and foam may cause frothing and spattering.
FIREFIGHTING PROCEDURES :	Use water to cool containers exposed to flames. Do not enter enclosed or a confined work space without proper protective equipment. Firefighting personnel should wear respiratory protection (Positive pressure if available).
Products of combustion include fumes, smoke and carbon monoxide.	

SECTION VI : SPILL OR LEAK HANDLING PROCEDURES
Shut off ignition source. Contain spill and keep from entering waterways or sewers. Use personal protective equipment. Advise EPA; state agency if required. Absorb on inert material. Shovel, sweep or vacuum spill.

SECTION VII : HANDLING AND STORAGE	
HANDLING AND STORAGE PRECAUTIONS	Keep away from flames, sparks or hot surfaces. Never use a torch to cut or weld on or near container. Empty oil containers can contain explosive vapors. NFPA Class IIIB storage. Wash thoroughly after handling.
STORAGE TEMPERATURE :	ambient
STORAGE PRESSURE :	ATMOSPHERIC
WORK / HYGIENIC PRACTICES	Wash hands with soap and water before eating, drinking smoking or use of toilet facilities. Do not use gasoline, solvents, kerosene, or harsh abrasive skin cleaners for washing exposed skin areas. Take a shower after work if general contact occurs. Remove oil-soaked clothing and launder before reuse. Launder or discard contaminated shoes and leather gloves.

SECTION VIII : EXPOSURE CONTROLS / PERSONAL PROTECTION	
ENGINEERING CONTROLS	Use adequate ventilation to keep oil mists of this material below applicable standard(s). See Section on occupational exposure limits.
EYE / FACE PROTECTION	Safety glasses or splash goggles. Have suitable eye wash water available.
SKIN PROTECTION	.Avoid prolonged and/or repeated skin contact. If prolonged contact cannot be avoided, wear protective impervious gloves and clothing. Acceptable materials for gloves are polyvinyl chloride; neoprene; nitrile; polyvinyl alcohol; viton.
RESPIRATORY PROTECTION	Normally not required if adequate ventilation. If occupational exposure limits are exceeded wear NIOSH/MSHA approved apparatus.
OTHER/ GENERAL PROTECTION	If there is a likelihood of splashing, an oil resistant clothing should be worn. Never wear oil soaked clothing. Launder or dry clean before wearing. Discard oil soaked shoes. Affix warning labels on containers in accordance with 29 CFR 1910.1200 (Hazard Communication Standard).

SECTION IX : PHYSICAL & CHEMICAL PROPERTIES			
APPEARANCE :	Clear, pale straw to water white, viscous liquid	BOILING POINT :	IBP > 520 (D86) °F IBP > 271 (D86) °C
PHYSICAL STATE :	LIQUID	MELTING POINT :	-80 (D97) °F -62 (D97) °C
ODOR :	Light bland petroleum	SOLUBILITY IN WATER :	negligible
ODOR THRESHOLD	N.D.	VAPOR PRESSURE :	< 0.01 mm Hg @ 20°C
SPECIFIC GRAVITY :	0.89 Water = 1	VAPOR DENSITY (AIR = 1) :	> 5
PACKING DENSITY :	N.A	MOLECULAR WEIGHT :	280.00

SECTION IX : PHYSICAL & CHEMICAL PROPERTIES (Continued)			
EVAPORATION RATE	100X slower than ethyl ether	VOLATILE ORGANIC COMPOUNDS (VOC) CONTENT	40.0%
% VOLATILES :	nil	Ph :	essentially neutral
VISCOSITY	12 cSt / 66 SUS @ 100°F		
Physical data may vary slightly to meet specifications			

SECTION X : STABILITY & REACTIVITY	
STABILITY:	Stable
CONDITIONS TO AVOID:	Sources of ignition
INCOMPATIBLE MATERIALS	Strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS	Combustion may produce carbon monoxide and other asphyxiants.
HAZARDOUS POLYMERIZATION:	Will not occur.

SECTION XI: TOXICOLOGICAL INFORMATION	
Acute Studies	Tests on similar materials show a low order of acute oral and dermal toxicity.
Skin Effects	Practically non-toxic if absorbed. May cause mild irritation with prolonged and repeated contact.
Eye Effects	Minimal irritation on contact..
Acute Oral Effects	Tests onsimilar materials indicate low order of acute oral toxicity.
Acute Inhalation Effects	Low acute toxicity expected on inhalation.
Medical Conditions Aggravated By Overexposure	Dermatitis and Sensitive skin.
This product is severely hydrotreated. Severely hydrotreated naphthenic petroleum oil has not been found to be carcinogenic or a potential carcinogen. This product is not listed as carcinogenic or a potential carcinogen by the National Toxicology Program, by the I.A.R.C. monographs or by OSHA. Nevertheless, good industrial hygienic practices are recommended.	

SECTION XII : ECOLOGICAL INFORMATION
No specific ecological data are available for this product. Please refer to section 6 for information regarding accidental releases and section 15 for regulator reporting requirements.

SECTION XIII : DISPOSAL CONSIDERATIONS
Follow federal, state and local regulations. Not a RCRA hazardous waste if uncontaminated. If "used", RCRA criteria must be determined. Do not flush to drain/storm sewer. Contract to authorized disposal service. If permitted, incineration may be practical. Recommend recycling.
Not a RCRA hazardous waste if uncontaminated.

SECTION XIV : TRANSPORT INFORMATION	
Proper Shipping Name :	Not regulated by DOT
Hazard Class :	Not applicable
DOT Identification Number	N/A
DOT Shipping Label	Not regulated by DOT

SECTION XV : REGULATORY INFORMATION	
SARA 302 Threshold Planning Quantity :	NOT APPLICABLE
SARA 304 Reportable Quantity :	NOT APPLICABLE
EPA / TSCA Inventory :	The components of this product are listed on the EPA / TSCA inventory of chemicals.
EPA / Hazard Classification Code :	NOT APPLICABLE
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) :	No chemicals in this product are subject to the reporting requirements of CERCLA.
SARA TITLE III - HAZARD CLASSES :	Acute Health Hazard
SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION :	No chemicals in this product exceed the De Minimus reporting level established by SARA Title III, Section 313 and 40 CFR 372.
CANADIAN REGULATORY INFORMATION	The components of this product are listed on the Canadian (DSL) Domestic Substances List.
WHMIS Classification :	not controlled.

SECTION XIV: OTHER INFORMATION		
NFPA HAZARD RATING	HEALTH : FIRE : REACTIVITY :	0 Negligible 1 Slight 0 Negligible

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET SHOULD BE PROVIDED TO ALL WHO USE, HANDLE, STORE, TRANSPORT OR ARE OTHERWISE EXPOSED TO THIS PRODUCT. WE BELIEVE THE INFORMATION IN THIS DOCUMENT TO BE RELIABLE AND UP TO DATE AS OF THE DATE OF PUBLICATION, BUT MAKE NO GUARANTEE THAT IT IS.

Material Safety Data Sheet

Date last revised: 13 January 2009

I. General Information

Chemical Name and Synonyms Aliphatic Solvent	**Trade Name & Synonyms** Mosquito Larvicide GB 1111 Golden Bear 1111 Mosquito Larvicide
Chemical Family Petroleum Hydrocarbon	**EPA Registration Number** 8329-72
Proper DOT Shipping Name Agricultural Insecticide, N.O.I., Non-hazardous	**DOT Hazard Classification** Not regulated by the US DOT as a hazardous material
Manufacturer Clarke Mosquito Control Products Inc.	**Manufacturer's Phone Number** (630) 894-2000
Manufacturer's Address 159 North Garden Avenue Roselle, Illinois 60172	**INFOTRAC** (Transportation/Spill Emergency) 1-800-535-5053 **Poison Control Center** (Medical Emergency) 1-800-214-7753

II. Ingredients

Principal Hazardous Components	CAS #	OSHA –PEL-TWA	Percent
White Mineral Oil	8042-47-5	5 mg/m3 (Oil Mist)	98.7%

III. Physical Data

Boiling Point (°F): Not Available	**Density @ 20 °C:** 0.853 g/mL	**Lbs./gallon:** 7.11
Vapor Pressure (mm Hg.): < 0.1 @ 20 °C	**Vapor Density (Air = 1):** >1	
Solubility in Water: Negligible	**pH:** 5.14 (1% w/w solution)	
Appearance: colorless, clear oily liquid	**Odor:** odorless	
Viscosity cSt @ 40 °C: 14.213	**Evaporation Rate** (water=1): Less than 0.1	

IV. Fire & Explosion Hazard Data

Flash Point (Test Method: 166 °C (331 °F) (Cleveland)

Extinguishing Media: Foam, carbon dioxide, or dry chemical. Water may cause frothing. Water may be ineffective.

Special Properties: Material can burn but will not ignite. This material will release vapors when heated above the flash point temperature that can ignite when exposed to a source of ignition. In enclosed spaces, heated vapor can ignite with explosive force. Mists or sprays may burnt at temperatures below the flash point.

Special Protection: Dense smoke. Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies. Cool fire exposed areas and equipment. Avoid the use of water.

V. Health Hazard Data

Primary Route of Entry: Ingestion and, if a mist is generated, inhalation	**Toxicity:** Oral LD50 > 5,000 mg/kg Dermal LD50 > 5,000 mg/kg

VI. EMERGENCY FIRST AID

Skin Contact: Remove contaminated clothing and wash affected areas of skin with soap and water. Launder contaminated clothing before reuse.

Eye: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.

Inhalation: Remove affected person to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.

Ingestion: Call a physician or Poison Control Center immediately. **Do not induce vomiting**. Vomiting may cause aspiration resulting in chemical pneumonia. Do not give anything by mouth to an unconscious person.

Note to Physician: Product contains petroleum distillate. Gastric lavage is indicated if material was taken internally. Vomiting may cause aspiration pneumonia.

VII. Reactivity Data

Stability:	Stable
Incompatibility	Strong oxidizers such a hydrogen peroxide, and chromic acid.
Hazardous Decomposition Products	Carbon monoxide & carbon dioxide, smoke, fumes, and unburned hydrocaroons from burning/combustion.

VIII. Environmental Protection Procedures

Spill Response: Do not touch damaged containers or spilled material unless wearing appropriate PPE. Slipping hazard; do not walk through spilled material. Stop leak if you can do so without risk. For small spills, sbsorb or cover with dry earth, sand, or other inert non-combustible absorbent material and place into waste containers for later disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban areas, clean up spill as soon as possible. In natural environments, seek cleanup advice from specialists to minimize physical habitat damage. This material will float on water. Absorbent pads and similar materials can be used. Comply with all laws and regulations.

Storage: Store tightly sealed and upright in its original labeled container, in a dry locked place out of reach of children. Avoid exposure to extreme temperatures. Avoid strong oxidizers. Eliminate all sources of ignition, such as flames and sparks.

Waste Disposal: Do not contaminate water, food, or feed by storage or disposal. Pesticide Disposal: Pesticide, spray mixture or rinse water that cannot be used according to label instructions must be disposed of at or by an approved waste disposal facility. Container Disposal: Triple rinse (or equivalent), following product label instruction. Then offer for recycling or reconditioning, or dispose of in a landfill or by other approved State and local procedures. For guidance, contact your State Water Board or Regional Office of the EPA.

Other Precautions: Do not contaminate water by cleaning of equipment or disposal or wastes.

IX. Special Protection Information

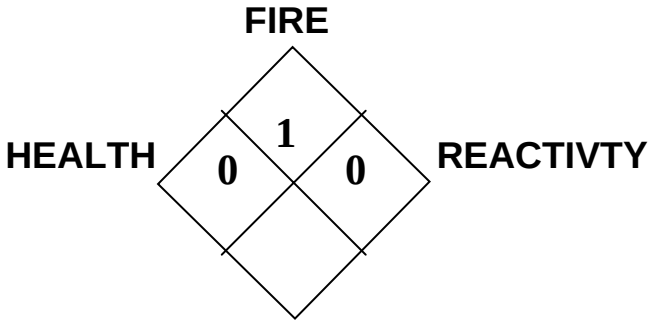
Eye Protection: OSHA-approved safety glasses, goggles or face shield suggested when mixing or loading tank.	**Skin Protection:** Handlers should wear protective clothing and chemical resistant gloves when mixing or loading tank. Avoid prolonged or repeated contact with skin or breathing of vapors, mist or fumes.
Respiratory Protection: Not likely to be needed	**Ventilation:** Local if necessary to maintain allowable PEL

Other: IMPORTANT. Read and observe all precautions and instructions on the label.

X. Additional Regulatory Information

Section 313: This chemical does not contain any chemical subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

NFPA Rating Information:



NFPA Code Key
4 = Severe
3 = Serious
2 = Moderate
1 = Slight
0 = Minimal

The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information or products referred to herein. NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS MADE.

VectoBac® CG
MSDS# BIO-0044 Rev. 5 **ISSUED 01/13/10**

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL NAME: **VectoBac® CG**
EPA Reg.No.: 73049-19
Code Number: 05094
List Number: 05094

MANUFACTURER: Valent BioSciences Corporation
870 Technology Way, Suite 100
Libertyville, Illinois 60048

EMERGENCY TELEPHONE NUMBERS
Emergency Health or Spill:
Outside the United States: 651-632-6184
Within the United States: 877-315-9819

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME: Bacillus thuringiensis, subsp. israelensis, strain AM65-52
CONCENTRATION: 4.95 %
CAS NUMBER: 68038-71-1

OSHA-PEL	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
ACGIH-TLV	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
OTHER LIMITS	8HR TWA:	N/A
	STEL:	N/A
	CEILING:	N/A

INGREDIENT NAME: Inert Ingredients - identity withheld as a Trade Secret
CONCENTRATION: 95.05 %
CAS NUMBER: N/A

OSHA-PEL	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
ACGIH-TLV	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
OTHER LIMITS	8HR TWA:	N/A
	STEL:	N/A
	CEILING:	N/A

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW: Product is non-toxic by ingestion, skin contact, or inhalation. Direct contact with eyes or skin may cause mild irritation.

ROUTE(S) OF ENTRY:
Skin: No
Inhalation: No
Ingestion: No

SKIN CONTACT: Non-irritant

SKIN SENSITIZATION: N/D

EYE CONTACT: Non-irritant

TARGET ORGANS: N/D

CARCINOGENICITY RATING: NTP: N/L IARC: N/L OSHA: N/L ACGIH: N/L
None

SIGNS AND SYMPTOMS: Direct contact with eyes or skin may cause mild irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D.

4. FIRST AID MEASURES

EYES: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

SKIN: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INGESTION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INHALATION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

5. FIRE FIGHTING PROCEDURES

FLASH POINT: N/A
FLASH POINT METHOD: N/A
LOWER EXPLOSIVE LIMIT(%): N/A
UPPER EXPLOSIVE LIMIT(%): N/A
AUTOIGNITION TEMPERATURE: N/D

FIRE & EXPLOSION HAZARDS: Non-flammable and no explosive properties.

EXTINGUISHING MEDIA: Use appropriate medium for underlying cause of fire.

FIRE FIGHTING INSTRUCTIONS: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

SPILL OR RELEASE PROCEDURES: Recover product. Place into appropriate container for disposal. Avoid dust. Ventilate and wash spill area.

7. HANDLING AND STORAGE

HANDLING: N/D.

STORAGE: Store in a cool, dry place.

SPECIAL PRECAUTIONS: N/A

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use local exhaust.

RESPIRATORY PROTECTION: Not usually required. However, mixers/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist respirator meeting NIOSH standards of at least N-95, R-95 or P-95.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION, continued

SKIN PROTECTION: Impervious gloves, clothing to minimize skin contact.

EYE PROTECTION: Not usually required. If necessary, use safety glasses or goggles.

OTHER PROTECTION: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Granular solid.
ODOR: Mild
BOILING POINT: N/A
MELTING/FREEZING POINT: N/A
VAPOR PRESSURE (mm Hg): N/A
VAPOR DENSITY (Air=1): N/A
EVAPORATION RATE: N/D
BULK DENSITY: 32 ± 3 lb/cu.ft.
SPECIFIC GRAVITY: N/D
SOLUBILITY: N/A
pH: N/D
VISCOSITY: N/A

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable

INCOMPATIBILITIES: Alkalinity inactivates product.

HAZARDOUS DECOMPOSITION PRODUCTS: N/D.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

ORAL LD50:LD50 (rat) > 5,000 mg/kg

DERMAL LD50: LD50 (rabbit) > 5,000 mg/kg

INHALATION LC50: N/D. No lethality was observed in rats after a 4 hour exposure at the highest obtainable inhalation exposure chamber concentration (2.84 mg/l) to VectoBac® Technical Powder.

CORROSIVENESS: N/D. Not expected to have any corrosive properties.

DERMAL IRRITATION: N/D. Transient, slight or mild irritation noted in a dermal toxicity study with VectoBac® Technical Powder.

OCULAR IRRITATION: N/D. VectoBac® Technical Powder was mildly irritating in an eye irritation test in rabbits.

DERMAL SENSITIZATION: N/D

SPECIAL TARGET ORGAN EFFECTS: N/D

CARCINOGENICITY INFORMATION: N/D. None of the components are classified as carcinogens.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: Technical Powder has not presented pathogenicity to birds, fish or bees.

13. DISPOSAL CONSIDERATIONS

Do not contaminate potable water, food or feed by storage or disposal. Dispose of product in accordance with federal, state, and local regulations.

WASTE DISPOSAL METHODS:

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

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13. DISPOSAL CONSIDERATIONS, continued

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORTATION INFORMATION

DOT STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IATA/ICA0 STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IMO STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A
FLASH POINT: N/A

15. REGULATORY INFORMATION

TSCA STATUS: Exempt RCRA STATUS: N/D

CERCLA STATUS: N/D PROP 65 (CA): N/D

SARA STATUS: N/D

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16. OTHER INFORMATION

REASON FOR ISSUE: Strain identity.
APPROVAL DATE: 01/13/10
SUPERSEDES DATE: 01/31/07

LEGEND: N/A = Not Applicable
N/D = Not Determined
N/L = Not Listed
L = Listed
C = Ceiling
S = Short-term
(R) = Registered Trademark of Valent BioSciences
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VectoBac® G
MSDS# BIO-0057 Rev. 1 ISSUED 06/19/03

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL NAME: **VectoBac® G**
EPA Registration No. 73049-10

MANUFACTURER: Valent BioSciences Corporation
870 Technology Way, Suite 100
Libertyville, Illinois 60048

EMERGENCY TELEPHONE NUMBERS
Emergency Health or Spill:
Outside the United States: 651-632-6184
Within the United States: 877-315-9819

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME: Bacillus thuringiensis, subsp. israelensis
CONCENTRATION: 2.80 %
CAS/RTECS NUMBERS: 68038-71-1 / N/A
OSHA-PEL 8HR TWA: N/L
STEL: N/L
CEILING: N/L
ACGIH-TLV 8HR TWA: N/L
STEL: N/L
CEILING: N/L
OTHER 8HR TWA: N/A
LIMITS STEL: N/A
CEILING: N/A

INGREDIENT NAME: Inert Ingredients - identity withheld as a Trade Secret
CONCENTRATION: 97.20 %
CAS/RTECS NUMBERS: N/A / N/A
OSHA-PEL 8HR TWA: N/L
STEL: N/L
CEILING: N/L
ACGIH-TLV 8HR TWA: N/L
STEL: N/L
CEILING: N/L
OTHER 8HR TWA: N/A
LIMITS STEL: N/A
CEILING: N/A

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2. COMPOSITION/INFORMATION ON INGREDIENTS, continued

EEC (European Community): N/A
Symbol Designation: N/A
Risk Phrases: N/A
Safety Phrases: N/A

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW: Product is non-toxic by ingestion, skin contact, or inhalation. Direct contact with eyes or skin may cause mild irritation.

ROUTE(S) OF ENTRY: Skin: No
Inhalation: No
Ingestion: No

SKIN CONTACT: Non-irritant

SKIN SENSITIZATION: N/D

EYE CONTACT: Non-irritant

TARGET ORGANS: N/D

CARCINOGENICITY RATING: NTP: N/L IARC: N/L OSHA: N/L ACGIH: N/L
None

SIGNS AND SYMPTOMS: Direct contact with eyes or skin may cause mild irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D.

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4. FIRST AID MEASURES

EYES: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

SKIN: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INGESTION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INHALATION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

5. FIRE FIGHTING PROCEDURES

FLASH POINT: N/A
FLASH POINT METHOD: N/D
LOWER EXPLOSIVE LIMIT(%): N/D
UPPER EXPLOSIVE LIMIT(%): N/D
AUTOIGNITION TEMPERATURE: N/D

FIRE & EXPLOSION HAZARDS: Non-flammable and no explosive properties.

EXTINGUISHING MEDIA: Use appropriate medium for underlying cause of fire.

FIRE FIGHTING INSTRUCTIONS: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

SPILL OR RELEASE PROCEDURES: Recover product. Place into appropriate container for disposal. Avoid dust. Ventilate and wash spill area.

7. HANDLING AND STORAGE

HANDLING: N/D.

STORAGE: Store in a cool, dry place.

SPECIAL PRECAUTIONS: N/A

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use local exhaust.

RESPIRATORY PROTECTION: Not usually required. However, mixers/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist respirator meeting NIOSH standards of at least N-95, R-95 or P-95.

SKIN PROTECTION: Impervious gloves, clothing to minimize skin contact.

EYE PROTECTION: Not usually required. If necessary, use safety glasses or goggles.

OTHER PROTECTION: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Granular solid.
ODOR: Mild
BOILING POINT: N/A
MELTING/FREEZING POINT: N/A
VAPOR PRESSURE (mm Hg): N/A
VAPOR DENSITY (Air=1): N/A
EVAPORATION RATE: N/D
BULK DENSITY: 27 ± 4 lb/cu.ft.
SPECIFIC GRAVITY: N/D
SOLUBILITY: N/A
pH: 5.4 ± 1.0 (10% slurry)
VISCOSITY: N/A

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable

INCOMPATIBILITIES: Alkalinity inactivates product.

HAZARDOUS DECOMPOSITION PRODUCTS: N/D.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

ORAL LD50: LD50 (rat) > 5,000 mg/kg

DERMAL LD50: LD50 (rabbit) > 5,000 mg/kg

INHALATION LC50: N/D. No lethality was observed in rats after a 4 hour exposure at the highest obtainable inhalation exposure chamber concentration (2.84 mg/l) to VectoBac® Technical Powder.

CORROSIVENESS: N/D. Not expected to have any corrosive properties.

DERMAL IRRITATION: N/D. Transient, slight or mild irritation noted in a dermal toxicity study with VectoBac® Technical Powder.

OCULAR IRRITATION: N/D. VectoBac® Technical Powder was mildly irritating in an eye irritation test in rabbits.

DERMAL SENSITIZATION: N/D

SPECIAL TARGET ORGAN EFFECTS: N/D

CARCINOGENICITY INFORMATION: N/D. None of the components are classified as carcinogens.

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12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: N/D

13. DISPOSAL CONSIDERATIONS

Do not contaminate potable water, food or feed by storage or disposal. Dispose of product in accordance with federal, state, and local regulations.

WASTE DISPOSAL METHODS:

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

14. TRANSPORTATION INFORMATION

DOT STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IATA/ICA0 STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IMO STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A
FLASH POINT: N/A

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15. REGULATORY INFORMATION

TSCA STATUS: Exempt

CERCLA STATUS: N/D

SARA STATUS: N/D

RCRA STATUS: N/D

PROP 65 (CA): N/D

16. OTHER INFORMATION

REASON FOR ISSUE: Updated Hazard Information (Section 3) and Toxicological Information (Section 11).
APPROVAL DATE: 06/19/03
SUPERSEDES DATE: 06/12/01

LEGEND: N/A = Not Applicable
N/D = Not Determined
N/L = Not Listed
L = Listed
C = Ceiling
S = Short-term
(R) = Registered Trademark of Valent BioSciences
(TM) = Registered Trademark of Valent BioSciences

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MSDS by MSDS Number

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Univar USA
6100 Carillon Point
Kirkland WA 98033
425−889−3400

For Emergency Assistance involving chemicals call − CHEMTREC (800) 424−9300

MSDS Number:P14497V MSDS Version:001

001 04/08/93 VECTOBAC 12AS

****
SECTION I PRODUCT IDENTIFICATION
****

PRODUCT NAME: VECTOBAC 12AS

MSDS #: P14497V

DATE ISSUED: 04/29/89

ISSUED BY: 006175

TSCA STATUS: Exempt

CHEMICAL NAME: Bacillus thuringiensis, Serotype H−14

DOT CLASS: Not Regulated

****
SECTION II HAZARDOUS INGREDIENTS/IDENTITY INFO
****

NAME(CAS NO)	OSHA PEL	ACGIH TLV	ABBOT LIMIT
Bacillus thuringiensis, Serotype H−14	NL	NL	N/D

*Hazardous per OSHA criteria

****
SECTION III PHYSICAL PROPERTIES
****

APPEARANCE; Suspension Light brown in color. Potency is 1200ITU/mg (4.84 billion ITU per gallon)

SOLUBILITY: Dispenses well in water
BOILING POINT: N/D

MELTING POINT: N/D
pH: 4.6−5.0
VAPOR DENSITY: N/D
VISCOSITY: 250−1000 cps 25 DEG C
VAPOR PRESSURE: N/D
DENSITY: 1.06−1.1g/ml

****
SECTION IV FIRE AND EXPLOSION DATA
****

FLASH POINT: N/D
EXTINGUISHING MEDIA: Use appropriate media for underlying cause of fire
SPECIAL FIRE FIGHTING PROCEDURES: Wear protective clothing and self−contaminated breathing apparatus

UNUSUAL FIRE/EXPLOSION HAZARDS: N/D

SECTION V REACTIVITY

INCOMPATIBILITY: N/D

HAZARDOUS DECOMPOSITION OR BY PRODUCTS: N/D

CONDITIONS TO AVOID: Avoid exposure to heat.

SECTION VI HEALTH HAZARD DATA

ROUTES OF ENTRY; Inhalation − N/D SKin−No Ingestion−No

ORAL TOXICITY: N/D, LD50>5000 mg/kg in rats for a similar formulation

DERMAL TOXICITY: N/D, LD50 >2000 mg/kg in rabbits for a similar formulation

INHALATION TOXICITY; N/D, LCLa=3.9 mg/L/4H for a similar formulation 9one of ten animals died when exposed to the maximum attainable concentration)

CORROSIVENESS: No

DERMAL IRRITATION: N/D, Slightly irritating with some sloughing found in a skin irritation test (4 hour application) in rabbits. Redness, swelling and sloughing of the skin were also noted in a dermal toxicity study in rabbits with a similar formulation

OCULAR IRRITATION: Non−irritating in an eye irritation test in rabbits

DERMAL SENSITIZATION: Sensitizer, Eight of ten animals positive in a dermal sensitization study in guinea pigs with a similar formulation
SPECIAL TARGET ORGAN EFFECTS: N/D

CARCINOGENICITY: NTP−NL IARC−NL OSHA−NL ACGIH−NL

SIGNS/SYMPTOMS OF EXPOSURE: N/D

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D, Data suggest pre−existing skin or eye lesions and hypersensitivity to VectoBac formulations

EMERGENCY/FIRST AID PROCEDURES: Remove from source of exposure. If skin or eye contact occurs flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. no known antidote. Provide symptomatic/supportive care as necessary.

SECTION VII SPECIAL PROTECTION INFORMATION

VENTILATION: Use local ventilation to control vapors
RESPIRATOR: Approved respirator for dusts/mists
GLOVES: impervious
EYE PROTECTION: Safety glasses
OTHER PRECAUTION: N/D

SECTION VIII SPECIAL HANDLING AND STORAGE

SPECIAL PRECAUTIONS: Avoid excessive storage temperatures and direct sunlight

SPILL OR RELEASED PROCEDURES: REcover product and place in appropriate container for disposal. Ventilate and wash area.

WASTE DISPOSAL: Dispose of product in accordance with federal, state, and local regulations

OTHER HANDLING: N/D

LEGEND

N/A= Not Applicable
N/D= Not Determined
NL= Not Listed
L= Listed
C= Ceiling
S= Short Term

For Additional Information:
Contact: MSDS Coordinator − Univar USA

During business hours, Pacific Time − (425) 889−3400

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END OF MSDS

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for (i=0;i 0) { document.images[i].border = 0; document.images[i].width = 0; document.images[i].height = 0; break; } }

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL NAME: VectoLex WDG
EPA Registration No. 73049-57
Drug Code: 82835 * 38504

MANUFACTURER: Valent BioSciences Corporation
870 Technology Way, Suite 100
Libertyville, Illinois 60048

EMERGENCY TELEPHONE NUMBERS
Emergency Health or Spill:
Outside the United States: 651-632-6184
Within the United States: 877-315-9819

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME: Bacillus sphaericus Serotype H5a5b, Strain 2362 dried concentrate
CONCENTRATION: 51.2000 %
CAS/RTECS NUMBERS: N/A, N/A

OSHA-PEL	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
ACGIH-TLV	8HR TWA:	N/L
	STEL:	N/L
	CEILING:	N/L
OTHER LIMITS	8HR TWA:	N/A
	STEL:	N/A
	CEILING:	N/A

2. COMPOSITION/INFORMATION ON INGREDIENTS, continued

INGREDIENT NAME: Inert Ingredients - identity withheld as a Trade Secret
CONCENTRATION: 48.8000 %
CAS/RTECS NUMBERS: N/A / N/A
OSHA-PEL 8HR TWA: N/L
STEL: N/L
CEILING: N/L
ACGIH-TLV 8HR TWA: N/L
STEL: N/L
CEILING: N/L
OTHER LIMITS 8HR TWA: N/A
STEL: N/A
CEILING: N/A

EEC (European Community): N/A
Symbol Designation: N/A
Risk Phrases: N/A
Safety Phrases: N/A

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW: This material may cause eye irritation.

ROUTE(S) OF ENTRY: Skin: No
Inhalation: No
Ingestion: No

INGESTION RATING: None

SKIN ABSORPTION RATING: None

INHALATION RATING: None

CORROSIVENESS RATING: None

SKIN CONTACT RATING: None

SKIN SENSITIZATION RATING: N/D

3. HAZARDS INFORMATION, continued

EYE CONTACT RATING: None

TARGET ORGANS: N/D

CARCINOGENICITY RATING: NTP: N/L IARC: N/L OSHA: N/L
ACGIH: N/L
None

SIGNS AND SYMPTOMS: N/D. Direct contact could cause mild skin and eye irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D. Data suggest possibly pre-existing eye or skin ailments.

4. FIRST AID MEASURES

EYES: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

SKIN: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INGESTION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INHALATION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

5. FIRE FIGHTING PROCEDURES

FLASH POINT: N/D
FLASH POINT METHOD: N/D
LOWER EXPLOSIVE LIMIT(%): N/D

5. FIRE FIGHTING PROCEDURES, continued

UPPER EXPLOSIVE LIMIT(%): N/D
AUTOIGNITION TEMPERATURE: N/D

FIRE & EXPLOSION HAZARDS: N/D.

EXTINGUISHING MEDIA: Use appropriate medium for the underlying cause of the fire.

FIRE FIGHTING INSTRUCTIONS: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

SPILL OR RELEASE PROCEDURES: Recover product and place in an appropriate container for disposal. Ventilate and wash the spill area.

7. HANDLING AND STORAGE

HANDLING: N/D.

STORAGE: Store in a cool (59-86 F or 15-30 C), dry place.

SPECIAL PRECAUTIONS: Wash thoroughly with soap and water after handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use local exhaust.

RESPIRATORY PROTECTION: Air purifying respirator with dust/mist filter (N95), if needed.

SKIN PROTECTION: Impervious.

EYE PROTECTION: Goggles.

OTHER PROTECTION: Wear tyvek coveralls during dusty operations.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Granule
ODOR: N/D
BOILING POINT: N/D
MELTING/FREEZING POINT: N/D
VAPOR PRESSURE (mm Hg): N/D
VAPOR DENSITY (Air=1): N/D
EVAPORATION RATE: N/D
BULK DENSITY: 0.4 g/mL
SPECIFIC GRAVITY: N/D
SOLUBILITY: Suspends readily in water.
pH: 4-6 as an aqueous solution.
VISCOSITY: N/D

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: N/D

INCOMPATIBILITIES: N/D

HAZARDOUS DECOMPOSITION PRODUCTS: N/D.

HAZARDOUS POLYMERIZATION: N/D

11. TOXICOLOGICAL INFORMATION

ORAL TOXICITY: LD50 > 5050 mg/kg in rats.

DERMAL TOXICITY: LD50 > 5050 mg/kg in rabbits.

INHALATION TOXICITY: Not lethal in an inhalation study with rats at the maximum achievable airborne concentration of 0.435 mg/L/4 hours (22.9 mg/l nominal concentration).

CORROSIVENESS: N/D

DERMAL IRRITATION: Produced mild transient redness with recovery by 48 hours in a skin irritation test in rabbits (Primary Irritation Index = 0.3 on a scale of 0-8).

11. TOXICOLOGICAL INFORMATION, continued

OCULAR IRRITATION: Produced mild transient conjunctival redness with recovery by 48 hours in an eye irritation test in rabbits.

DERMAL SENSITIZATION: N/D

SPECIAL TARGET ORGAN EFFECTS: N/D

CARCINOGENICITY INFORMATION: N/D

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: N/D

13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHODS: Dispose of product in accordance with federal, state and local regulations.

14. TRANSPORTATION INFORMATION

DOT STATUS: Not Regulated
PROPER SHIPPING NAME: N/D
HAZARD CLASS: N/D
UN NUMBER: N/D
PACKING GROUP: N/D
REPORTABLE QUANTITY: N/D

IATA/ICA0 STATUS: Not Regulated
PROPER SHIPPING NAME: N/D
HAZARD CLASS: N/D
UN NUMBER: N/D
PACKING GROUP: N/D
REPORTABLE QUANTITY: N/D

14. TRANSPORTATION INFORMATION, continued

IMO STATUS: Not Regulated
PROPER SHIPPING NAME: N/D
HAZARD CLASS: N/D
UN NUMBER: N/D
PACKING GROUP: N/D
REPORTABLE QUANTITY: N/D
FLASH POINT: N/D

15. REGULATORY INFORMATION

TSCA STATUS: Exempt

CERCLA STATUS: N/D

SARA STATUS: N/D

RCRA STATUS: N/D

PROP 65 (CA): N/D

16. OTHER INFORMATION

LEGEND: N/A = Not Applicable
N/D = Not Determined
N/L = Not Listed
L = Listed
C = Ceiling
S = Short-term
(R) = Registered Trademark of Valent BioSciences
(TM) = Registered Trademark of Valent BioSciences

16. OTHER INFORMATION, continued

The information and recommendations contained herein are based upon tests believed to be reliable. However, Valent BioSciences does not guarantee their accuracy or completeness nor shall any of this information constitute a warranty, whether expressed or implied, as to the safety of the goods, the merchantability of the goods, or the fitness of the goods for a particular purpose. Adjustment to conform with actual conditions of usage may be required. Valent BioSciences assumes no responsibility for results obtained or for incidental or consequential damages arising from the use of these data. No freedom from infringement of any patent, copyright or trademark is to be inferred.

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VectoLexâ CG
MSDS# BIO-0042 Rev. 1 ISSUED 08/15/03

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATERIAL NAME: VectoLex® CG
VectoLex® G
VectoLex® WSP
EPA Registration No. 73049-20
List Number: 5722

MANUFACTURER: Valent BioSciences Corporation
870 Technology Way, Suite 100
Libertyville, Illinois 60048

EMERGENCY TELEPHONE NUMBERS
Emergency Health or Spill:
Outside the United States: 651-632-6184
Within the United States: 877-315-9819

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME: Bacillus sphaericus Serotype H-5a5b, strain 2362
CONCENTRATION: 7.50 %
CAS/RTECS NUMBERS: N/A / N/A
OSHA-PEL 8HR TWA: N/L
STEL: N/L
CEILING: N/L
ACGIH-TLV 8HR TWA: N/L
STEL: N/L
CEILING: N/L
OTHER 8HR TWA: N/A
LIMITS STEL: N/A
CEILING: N/A

INGREDIENT NAME: Inert Ingredients - identity withheld as Trade Secret
CONCENTRATION: 92.50 %
CAS/RTECS NUMBERS: N/A / N/A
OSHA-PEL 8HR TWA: N/L
STEL: N/L
CEILING: N/L
ACGIH-TLV 8HR TWA: N/L
STEL: N/L
CEILING: N/L
OTHER 8HR TWA: N/A
LIMITS STEL: N/A
CEILING: N/A

2. COMPOSITION/INFORMATION ON INGREDIENTS, continued

EEC (European Community): N/A
Symbol Designation: N/A
Risk Phrases: N/A
Safety Phrases: N/A

3. HAZARDS INFORMATION

EMERGENCY OVERVIEW: Product is non-toxic by ingestion, skin contact, or inhalation. Direct contact with eyes or skin may cause mild irritation.

ROUTE(S) OF ENTRY: Skin: No
Inhalation: No
Ingestion: No

SKIN CONTACT: Non-irritant

SKIN SENSITIZATION: Non-sensitizer

EYE CONTACT: Non-irritant

TARGET ORGANS: N/D

CARCINOGENICITY RATING: NTP: N/L IARC: N/L OSHA: N/L ACGIH: N/L
None

SIGNS AND SYMPTOMS: Direct contact with eyes or skin may cause mild irritation.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D. Data suggest pre-existing skin or eye lesions.

4. FIRST AID MEASURES

EYES: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

SKIN: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INGESTION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

INHALATION: Remove from source of exposure. If signs of toxicity occur, seek medical attention. Provide symptomatic/supportive care as necessary.

5. FIRE FIGHTING PROCEDURES

FLASH POINT: N/A
FLASH POINT METHOD: N/D
LOWER EXPLOSIVE LIMIT(%): N/D
UPPER EXPLOSIVE LIMIT(%): N/D

AUTOIGNITION TEMPERATURE: N/D

FIRE & EXPLOSION HAZARDS: Non-flammable and no explosive properties.

EXTINGUISHING MEDIA: Use appropriate medium for underlying cause of fire.

FIRE FIGHTING INSTRUCTIONS: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

SPILL OR RELEASE PROCEDURES: Recover product. Place into appropriate container for disposal. Avoid dust. Ventilate and wash spill area.

7. HANDLING AND STORAGE

HANDLING: N/D.

STORAGE: Store in a cool, dry place.

SPECIAL PRECAUTIONS: Wash thoroughly with soap and water after handling.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS: Use local exhaust.

RESPIRATORY PROTECTION: Not usually required. However, mixers/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist respirator meeting NIOSH standards of at least N-95, R-95 or P-95.

SKIN PROTECTION: Impervious gloves, clothing to minimize skin contact.

EYE PROTECTION: Not usually required. If necessary, use safety glasses or goggles.

OTHER PROTECTION: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE: Granules
ODOR: Characteristic odor
BOILING POINT: N/A
MELTING/FREEZING POINT: N/A
VAPOR PRESSURE (mm Hg): N/A
VAPOR DENSITY (Air=1): N/A
EVAPORATION RATE: N/A
BULK DENSITY: 35 ± 3 lb/cu.ft.
SPECIFIC GRAVITY: N/D
SOLUBILITY: Partially suspends/soluble in water
pH: N/A
VISCOSITY: N/A

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.

INCOMPATIBILITIES: Alkalinity inactivates product.

HAZARDOUS DECOMPOSITION PRODUCTS: N/D.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

ORAL LD50: N/D. LD50 (rat) > 5,000 mg/kg for Technical Powder.

DERMAL LD50: N/D. LD50 (rabbit) > 2,000 mg/kg for Technical Powder.

INHALATION LC50: N/D. No lethality in rats after a 4-hour exposure at the maximum obtainable inhalation exposure chamber concentration (0.09 mg/l) to VectoLex® Technical Powder.

CORROSIVENESS: N/D. Not expected to have any corrosive properties.

DERMAL IRRITATION: N/D. Transient, slight to mild irritation noted in a dermal toxicity study with VectoLex® Technical Powder.

OCULAR IRRITATION: N/D. VectoLex® Technical Powder caused mild to moderate eye irritation in tests with rabbits.

DERMAL SENSITIZATION: N/D. Results from tests with a similar formulated material were negative.

SPECIAL TARGET ORGAN EFFECTS: N/D

CARCINOGENICITY INFORMATION: N/D. None of the components are classified as carcinogens.

12. ECOLOGICAL INFORMATION

ECOLOGICAL INFORMATION: N/D

13. DISPOSAL CONSIDERATIONS

Do not contaminate potable water, food or feed by storage or disposal. Dispose of product in accordance with federal, state, and local regulations.

WASTE DISPOSAL METHODS:

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

For Water Soluble Pouches, dispose of empty outer foil bag in trash.

14. TRANSPORTATION INFORMATION

DOT STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IATA/ICA0 STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A

IMO STATUS: Not Regulated
PROPER SHIPPING NAME: N/A
HAZARD CLASS: N/A
UN NUMBER: N/A
PACKING GROUP: N/A
REPORTABLE QUANTITY: N/A
FLASH POINT: N/A

15. REGULATORY INFORMATION

TSCA STATUS: Exempt RCRA STATUS: N/D

CERCLA STATUS: N/D PROP 65 (CA): N/D

SARA STATUS: N/D

16. OTHER INFORMATION

REASON FOR ISSUE: Updated Hazard Information (Section 3), Disposal Information (Section 13) and added VectoLex® WSP trade name.
APPROVAL DATE: 08/15/03
SUPERSEDES DATE: 06/12/01

LEGEND: N/A = Not Applicable
N/D = Not Determined
N/L = Not Listed
L = Listed
C = Ceiling
S = Short-term
® = Registered Trademark of Valent BioSciences
(TM) = Registered Trademark of Valent BioSciences

The information and recommendations contained herein are based upon tests believed to be reliable. However, Valent BioSciences does not guarantee their accuracy or completeness nor shall any of this information constitute a warranty, whether expressed or implied, as to the safety of the goods, the merchantability of the goods, or the fitness of the goods for a particular purpose. Adjustment to conform with actual conditions of usage may be required. Valent BioSciences assumes no responsibility for results obtained or for incidental or consequential damages arising from the use of these data. No freedom from infringement of any patent, copyright or trademark is to be inferred.

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MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994

PRODUCT: NATULAR™ 2EC

Effective Date: 3/18/2009
US EPA Registration No.: 8329-82
Development Code: GF-1592

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: NATULAR™ 2EC

COMPANY IDENTIFICATION:
Clarke Mosquito Control Products, Inc.
159 North Garden Avenue
Roselle, IL 60172
U.S.A.

1-800-323-5727

2. INFORMATION ON INGREDIENTS:

Spinosad:	Factor A CAS# 131929-60-7 Factor D CAS# 131929-63-0	20.62%
Other Ingredients*, proprietary		79.38%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

3. HAZARDS IDENTIFICATION:

POTENTIAL HEALTH EFFECTS: This section includes possible adverse effects, which could occur if this material is not handled in the recommended manner.

EYE: May cause transient (temporary) eye irritation. Vapors from product may be irritating to mucous membranes, including the eyes.

SKIN: Short term exposure may cause temporary irritation. Can be absorbed through the skin. The LD50 for skin absorption in rats is >5000 mg/kg. A single prolonged exposure is not likely to result in the material being absorbed in harmful amounts. Did not cause allergic skin irritation or reactions when tested in guinea pigs.

INGESTION: Harmful if swallowed. The oral LD50 for rats is 2,000 mg/kg. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Symptoms of poisoning include nausea, vomiting, acidosis, pulmonary edema, pneumonia, and convulsions.

INHALATION: Short term exposure may result in respiratory tract irritation. The inhalation LC50 for the formulation is greater than 2.01 mg/L. Acute exposure to concentrate mist is not likely to cause adverse effects.

CANCER INFORMATION: Spinosad did not cause cancer in laboratory animals.

REPRODUCTIVE EFFECTS: Spinosad effects on reproduction, in laboratory animal studies, have been seen only at doses that produced significant toxicity to the parent animals.

4. FIRST AID:

EYE: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

INGESTION: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: 99° C (210.2 °F)
METHOD USED: Closed cup (ASTM D93)

FLAMMABLE LIMITS:
LFL: Not established
UFL: Not established

FIRE AND EXPLOSION HAZARDS: Material is not pyrophoric.

EXTINGUISHING MEDIA: Regular dry chemical, carbon dioxide, water, regular foam. Large fires: Use regular foam or flood with fine water spray.

FIRE-FIGHTING PRECAUTIONS: Move container from fire area if it can be done without risk. Do not scatter spilled material with high-pressure water streams. Dike for later disposal. Use extinguishing agents appropriate for surrounding fire. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FIRE AND EXPLOSION HAZARDS: Keep people away. Isolate fire area and deny unnecessary entry. Under fire conditions some components may decompose. Combustion products may include CO and NOx typical of wood smoke.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS/LEAKS: Stop leak if possible without personal risk. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Keep unnecessary people away, isolate hazard area and deny entry.

7. HANDLING AND STORAGE:

HANDLING: Keep out of reach of children. Avoid eye contact. Do not take internally. Wash thoroughly after handling and before eating, drinking, or smoking. Store product in original container. See product label for additional instructions.

STORAGE: Product should be stored in compliance with local regulations. Store in a cool, dry, well-ventilated place in the original container. Protect from excessive heat and cold. Do not store near food, drink, animal feed, pharmaceuticals, cosmetics or fertilizers. Keep out of reach of children.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: Spinosad: Dow AgroSciences Industrial Hygiene Guide is 0.3 mg/M^3, TWA.

OSHA PEL/STEL: Not established.

ENGINEERING CONTROLS: Good general ventilation should be sufficient for most conditions.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

EYE/FACE PROTECTION: Use of protective eyewear is recommended.

CLOTHING: No precautions other than clean body-covering clothing and chemical resistant gloves should be needed. See product label for additional instructions.

APPLICATORS AND ALL OTHER HANDLERS: Wear protective eyewear.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: light tan to golden liquid, oily
ODOR: characteristic of wintergreen (mint)
DENSITY: 1.16 g/ml
VAPOR PRESSURE: 1 mmHg @ 20 C
VAPOR DENSITY (air=1): 5
SOLUBILITY IN WATER: slightly soluble
pH: 7.71
VISCOSITY: 17.32 (20C), 8.59 (40C)

10. STABILITY AND REACTIVITY:

STABILITY (CONDITIONS TO AVOID): Thermally stable at typical use and storage temperatures and pressure. Avoid heat, flames, sparks and other sources of ignition. Avoid contact with incompatible materials.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID): Reactive with oxidizing agents, acids, alkalis.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition products: forms carbon monoxide and/or dioxide upon burning.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

MUTAGENICITY: For spinosad, in-vitro and animal mutagenicity studies were negative.

TOXICITY DATA: > 5000 mg/kg oral rat LD50
~ 2000 mg/kg dermal rat LD50
> 2.01 mg/L inhalation rat LC50

LOCAL EFFECTS: Mild irritant: inhalation, skin, eye
ACUTE TOXICITY LEVEL: Slightly toxic, ingestion

Additional information provided in Section 3.

12. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: Improper disposal of excess product or rinsate is a violation of the Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA regional office for guidance.

Follow product label instructions for container disposal.

14. TRANSPORT INFORMATION:

This product is not regulated by DOT when shipped domestically by land.

15. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Immediate (acute) hazard

STATE RIGHT-TO-KNOW: The following product components are cited on certain state lists as mentioned. Non-listed components may be shown in the composition section of the MSDS.

None

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): This product contains no chemical subject to reporting under CERCLA.

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

The information herein is given in good faith, but no warranty, express or implied, is made. Consult Clarke Mosquito Control Products, Inc. for further Information.

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994

PRODUCT: NATULAR™ T30

Effective Date: 3/18/2009
US EPA Registration No.: 8329-85
Development Code: GF-1934

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: NATULAR™ T30

COMPANY IDENTIFICATION:
Clarke Mosquito Control Products, Inc.
110 E. Irving Park Road, 4th Floor
Roselle, IL 60172
U.S.A.

1-800-323-5727

2. INFORMATION ON INGREDIENTS:

Spinosad:	Factor A CAS# 131929-60-7 Factor D CAS# 131929-63-0	8.33%
Other Ingredients*, Proprietary blend		91.67%

* Product may contain up to 3.8% by weight Crystalline Silica (CAS# 14808-60-7).

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

3. HAZARDS IDENTIFICATION:

POTENTIAL HEALTH EFFECTS: This section includes possible adverse effects, which could occur if this material is not handled in the recommended manner.

EYE: This product may release nuisance dust in handling or use. Dust may cause slight transient (temporary) eye irritation.

SKIN: Essentially non-irritating to skin. The LD50 for skin absorption in rats is > 5000 mg/kg. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Single dose oral toxicity is extremely low. The oral LD50 in rats is > 5000 mg/kg.

INHALATION: Inhalation of dusts from this product may irritate the nose, throat, lungs, and upper respiratory tract. Acute exposure to dust is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGANS) EFFECTS: In animals, spinosad has been shown to cause vacuolation of cells in various tissues. Dose levels producing these effects were many times higher than any dose levels expected from exposure due to use.

CANCER INFORMATION: Spinosad did not cause cancer in laboratory animals. Respirable crystalline silica is classified by IARC as a Group 1 carcinogen. The weight percent of crystalline silica given represents total quartz and not the respirable fraction. Testing of dust from source products has not detected respirable crystalline silica.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: Spinosad, in laboratory animal studies, effects on reproduction have been seen only at doses that produced significant toxicity to the parent animals.

4. FIRST AID:

EYE: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

INGESTION: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: Not determined
METHOD USED: Not determined

FLAMMABLE LIMITS:
LFL: Not determined
UFL: Not determined

EXTINGUISHING MEDIA: To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam.

FIRE AND EXPLOSION HAZARDS: Keep people away. Isolate fire area and deny unnecessary entry. Under fire conditions some components may decompose. Combustion products may include CO and NOx typical of wood smoke.

FIRE-FIGHTING EQUIPMENT: Wear positive pressure, self-contained breathing apparatus (SCBA) and protective fire-fighting clothing (includes fire-fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS/LEAKS: Collect all waste material and place in closable marked containers. Use non-reactive absorbent to absorb small spills of rinsate and collect for disposal.

7. HANDLING AND STORAGE:

HANDLING: Keep out of reach of children. Do not take internally. Wash thoroughly after handling and before eating, drinking, or smoking. Store product in original container. See product label for additional instructions.

STORAGE: Product should be stored in compliance with local regulations. Store in a cool, dry, well-ventilated place in the original container. Protect from excessive heat and cold. Do not store near food, drink, animal feeding stuffs, pharmaceuticals, cosmetics or fertilizers. Keep out of reach of children.

CONTAINER HANDLING: Non-refillable container. Do not reuse or refill this container. Offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: Spinosad: Dow AgroSciences Industrial Hygiene Guide is 0.3 mg/M^3, TWA.

Crystalline silica TLV 0.05 mg/M^3, TLV-Respirable fraction

ENGINEERING CONTROLS: Good ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed. See product label for additional instructions.

APPLICATORS AND ALL OTHER HANDLERS: Refer to the product label for personal protective clothing and equipment.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: White to light tan briquet/tablet
ODOR: earthy scent
BOILING POINT: Not applicable (solid formulation)
LOOSE BULK DENSITY: 1.9075 g/ml
SOLUBILITY IN WATER: Not applicable
pH: 5.49

10. STABILITY AND REACTIVITY:

STABILITY (CONDITIONS TO AVOID): Thermally stable at typical use and storage temperatures.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID): None Known.

HAZARDOUS DECOMPOSITION PRODUCTS: None known under normal conditions of storage and use.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

MUTAGENICITY: For spinosad, in-vitro and animal mutagenicity studies were negative.

Additional information provided in Section 3.

12. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: Improper disposal of excess product or rinsate is a violation of the Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA regional office for guidance.

13. TRANSPORT INFORMATION:

This product is not regulated by DOT when shipped domestically by land.

14. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given.

Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Respirable dusts of crystalline silica are classified as a Delayed (Chronic) Health Hazard

STATE RIGHT-TO-KNOW: National, state, provincial or local emergency planning, community right-to-know or other laws, regulations or ordinances may be applicable--consult applicable national, state, provincial or local laws.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): This product contains no chemical subject to reporting under CERCLA.

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

The information herein is given in good faith, but no warranty, express or implied, is made. Consult Clarke Mosquito Control Products, Inc. for further Information.

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994

PRODUCT: NATULAR™ XRT

Effective Date: 3/18/2009
US EPA Registration No.: 8329-84
Development Code: GF-1935

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: NATULAR™ XRT

COMPANY IDENTIFICATION:
Clarke Mosquito Control Products, Inc.
110 E. Irving Park Rd., 4th Floor
Roselle, IL 60172
U.S.A.

1-800-323-5727

2. INFORMATION ON INGREDIENTS:

Spinosad:	Factor A CAS# 131929-60-7 Factor D CAS# 131929-63-0	6.25%
Other Ingredients*, Proprietary blend		93.75%

* Product may contain up to 3.6% by weight Crystalline Silica (CAS# 14808-60-7)

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

3. HAZARDS IDENTIFICATION:

POTENTIAL HEALTH EFFECTS: This section includes possible adverse effects, which could occur if this material is not handled in the recommended manner.

EYE: This product may release nuisance dust in handling or use. Dust may cause slight transient (temporary) eye irritation.

SKIN: Essentially non-irritating to skin. The LD50 for skin absorption in rats is > 5000 mg/kg. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Single dose oral toxicity is extremely low. The oral LD50 in rats is > 5000 mg/kg.

INHALATION: Inhalation of dusts from this product may irritate the nose, throat, lungs, and upper respiratory tract. Acute exposure to dust is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGANS) EFFECTS: In animals, spinosad has been shown to cause vacuolation of cells in various tissues. Dose levels producing these effects were many times higher than any dose levels expected from exposure due to use.

CANCER INFORMATION: Spinosad did not cause cancer in laboratory animals. Respirable crystalline silica is classified by IARC as a Group 1 carcinogen. The weight percent of crystalline silica given represents total quartz and not the respirable fraction. Testing of dust from source products has not detected respirable crystalline silica.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: Spinosad effects on reproduction, in laboratory animal studies, have been seen only at doses that produced significant toxicity to the parent animals.

4. FIRST AID:

EYE: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

INGESTION: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: Not determined
METHOD USED: Not applicable
FLAMMABLE LIMITS:
LFL: Not determined
UFL: Not determined

EXTINGUISHING MEDIA: To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam.

FIRE AND EXPLOSION HAZARDS: Keep people away. Isolate fire area and deny unnecessary entry. Under fire conditions some components may decompose. Combustion products may include CO and NOx typical of wood smoke.

FIRE-FIGHTING EQUIPMENT: Wear positive pressure, self-contained breathing apparatus (SCBA) and protective fire-

fighting clothing (includes fire-fighting helmet, coat, pants, boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS/LEAKS: Collect all waste material and place in closable marked containers. Use non-reactive absorbent to absorb small spills of rinsate and collect for disposal.

7. HANDLING AND STORAGE:

HANDLING: Keep out of reach of children. Do not take internally. Wash thoroughly after handling and before eating, drinking, or smoking. Store product in original container. See product label for additional instructions.

STORAGE: Product should be stored in compliance with local regulations. Store in a cool, dry, well-ventilated place in the original container. Protect from excessive heat and cold. Do not store near food, drink, animal feeding stuffs, pharmaceuticals, cosmetics or fertilizers. Keep out of reach of children.

CONTAINER HANDLING: Non-refillable container. Do not reuse or refill this container. Offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: Spinosad: Dow AgroSciences Industrial Hygiene Guide is 0.3 mg/M^3, TWA.

Crystalline silica TLV 0.05 mg/M^3, TLV-Respirable fraction

ENGINEERING CONTROLS: Good ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed. See product label for additional instructions.

APPLICATORS AND ALL OTHER HANDLERS: Wear protective eyewear to avoid eye contact with dust.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: White to light tan briquet/tablet
ODOR: earthy scent
BOILING POINT: Not applicable (solid formulation)
LOOSE BULK DENSITY: 1.766 g/mL
SOLUBILITY IN WATER: Not applicable
pH: 5.49

10. STABILITY AND REACTIVITY:

STABILITY (CONDITIONS TO AVOID): Thermally stable at typical use and storage temperatures.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID): None Known.

HAZARDOUS DECOMPOSITION PRODUCTS: None known under normal conditions of storage and use.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

MUTAGENICITY: For spinosad, in-vitro and animal mutagenicity studies were negative.

Additional information provided in Section 3.

12. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: Improper disposal of excess product or rinsate is a violation of the Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA regional office for guidance.

13. TRANSPORT INFORMATION:

This product is not regulated by DOT when shipped domestically by land.

14. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's

responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Respirable dusts of crystalline silica are classified as a Delayed (Chronic) Health Hazard

STATE RIGHT-TO-KNOW: National, state, provincial or local emergency planning, community right-to-know or other laws, regulations or ordinances may be applicable – consult applicable national, state, provincial or local laws.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): This product contains no chemical subject to reporting under CERCLA.

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

The information herein is given in good faith, but no warranty, express or implied, is made. Consult Clarke Mosquito Control Products, Inc. for further Information.

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994

PRODUCT: NATULAR™ XRG

Effective Date: 3/18/2009
US EPA Registration No.: 8329-83
Development Codes: GF-1983, F-15C

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT: NATULAR XRG

COMPANY IDENTIFICATION:
Clarke Mosquito Control Products, Inc.
110 E. Irving Park Road, 4th Floor
Roselle, IL 60172

1-800-323-5727

2. INFORMATION ON INGREDIENTS:

Spinosad:	Factor A CAS# 131929-60-7 Factor D CAS# 131929-63-0	2.5%
Other Ingredients*, Proprietary blend		97.5%

* Product may contain up to 69% by weight crystalline silica (CAS# 14808-60-7)

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

3. HAZARDS IDENTIFICATION:

POTENTIAL HEALTH EFFECTS: This section includes possible adverse effects which could occur if this material is not handled in the recommended manner.

EYE: May cause slight transient (temporary) eye irritation.

SKIN: Essentially non-irritating to skin. The LD50 for skin absorption in rats is > 5000 mg/kg. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Single dose oral toxicity is low. The oral LD50 in rats is > 5000 mg/kg.

INHALATION: Inhalation of dusts from this product may irritate the nose, throat, lungs, and upper respiratory tract. Acute exposure to dust is not likely to be hazardous.

SYSTEMIC (OTHER TARGET ORGANS) EFFECTS: In animals, spinosad has been shown to cause vacuolation of cells in various tissues. Dose levels producing these effects were many times higher than any dose levels expected from exposure due to use.

CANCER INFORMATION: Spinosad did not cause cancer in laboratory animals. Respirable crystalline silica is classified by IARC as a Group 1 carcinogen. The weight percent of crystalline silica given represents total quartz and not the respirable fraction. As formulated, NATULAR XRG is not expected to form appreciable respirable dust from use or attrition.

TERATOLOGY (BIRTH DEFECTS): Birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effect on the fetus.

REPRODUCTIVE EFFECTS: Spinosad effects on reproduction, in laboratory animal studies, have been seen only at doses that produced significant toxicity to the parent animals.

4. FIRST AID:

EYE: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

INGESTION: If swallowed, seek medical attention. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: Not applicable (granular formulation)
METHOD USED: Not applicable

FLAMMABLE LIMITS:
LFL: Not applicable (granular formulation)
UFL: Not applicable (granular formulation)

EXTINGUISHING MEDIA: To extinguish combustible residues of this product use water fog, carbon dioxide, dry chemical or foam.

FIRE AND EXPLOSION HAZARDS: Keep people away. Isolate fire area and deny unnecessary entry. Under fire conditions some components may decompose. Combustion products may include CO and NOx typical of wood smoke.

FIRE-FIGHTING EQUIPMENT: Wear positive pressure, self-contained breathing apparatus (SCBA) and protective fire-fighting clothing (includes fire-fighting helmet, coat, pants,

boots, and gloves). If protective equipment is not available or not used, fight fire from a protected location or safe distance.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS/LEAKS: Collect all waste material and place in closable marked containers. Use non-reactive absorbent to absorb small spills of rinsate and collect for disposal.

7. HANDLING AND STORAGE:

HANDLING: Keep out of reach of children. Avoid eye contact. Do not take internally. Wash thoroughly after handling and before eating, drinking, or smoking. Store product in original container. See product label for additional instructions.

STORAGE: Product should be stored in compliance with local regulations. Store in a cool, dry, well-ventilated place in the original container. Protect from excessive heat and cold. Do not store near food, drink, animal feeding stuffs, pharmaceuticals, cosmetics or fertilizers. Keep out of reach of children.

CONTAINER HANDLING: Non-refillable container. Do not reuseor refill this container. Offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: Spinosad: Dow AgroSciences Industrial Hygiene Guide is 0.3 mg/M^3, TWA.

Crystalline silica TLV 0.05 mg/M^3, TLV-Respirable fraction

ENGINEERING CONTROLS: Good ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

EYE/FACE PROTECTION: Use of safety glasses is recommended.

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed. See product label for additional instructions.

RESPIRATORY PROTECTION: Atmospheric levels should be maintained below the exposure guideline.

APPLICATORS AND ALL OTHER HANDLERS: Wear protective eyewear to avoid eye contact with granules.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: solid tan granule
ODOR: faint
BOILING POINT: Not applicable (granular formulation)
POUR DENSITY: 1.284 +/- 0.010 g/ml
TAP DENSITY: 1.343 +/- 0.011 g/ml
SOLUBILITY IN WATER: Not applicable

10. STABILITY AND REACTIVITY:

STABILITY (CONDITIONS TO AVOID): Thermally stable at typical use and storage temperatures.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID): None Known.

HAZARDOUS DECOMPOSITION PRODUCTS: None known under normal conditions of storage and use.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

MUTAGENICITY: For spinosad, in-vitro and animal mutagenicity studies were negative.

Additional information provided in Section 3.

12. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: Improper disposal of excess product or rinsate is a violation of the Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA regional office for guidance.

13. TRANSPORT INFORMATION:

This product is not regulated by DOT when shipped domestically by land.

14. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: This product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Respirable dusts of crystalline silica are classified as a Delayed (Chronic) Health Hazard. The weight percent of crystalline silica given represents total quartz and not the respirable fraction. As formulated, NATULAR XRG is not expected to form appreciable respirable dust from use or attrition.

STATE RIGHT-TO-KNOW: National, state, provincial or local emergency planning, community right-to-know or other laws, regulations or ordinances may be applicable – consult applicable national, state, provincial or local laws.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): This product contains no chemical subject to reporting under CERCLA.

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

The information herein is given in good faith, but no warranty, express or implied, is made. Consult Clarke Mosquito Control Products, Inc. for further Information.

Material Safety Data Sheet

Date last revised: 17 August 2006

I. General Information

Chemical Name and Synonyms	Trade Name & Synonyms
Sumithrin Piperonyl Butoxide	**Aqua Anvil Water-based Adulticide**
Chemical Family Synergized Synthetic Pyrethroid Emulsifiable Insecticide Concentrate	**EPA Registration Number** 1021-1807-8329
Proper DOT and ICAO/IATA Shipping Name Insecticides, Insect or Animal Repellent, Liquid N.O.S	**DOT and ICAO/IATA Hazard Classification** Non-Hazardous when shipped in quantities of less 119 gal.
Registrant Clarke Mosquito Control	**Registrant's Phone Number** (630) 894-2000
Registrant's Address 159 N. Garden Ave. Roselle, Il 60172	**EMERGENCY PHONE**: (888) 740-8712 or (952) 852-9509 **CHEMTREC U.S. and Canada**: (800) 424-9300 **CHEMTREC All Other Areas:** (703) 527-3887

II. Ingredients

Principal Hazardous Components	CAS #	Percent
d-Phenothrin (SUMITHRIN)	026002-80-2	10 %
Piperonyl Butoxide	000051-03-6	10 %

Ingredients not identified are proprietary or non-hazardous. Values are not specifications.

III. Physical Data

(VOC): < 4.000%	**Specific Gravity (H_2O = 1):** 1.016 at 20 C (68 F)
Viscosity: 16 CPS at 24 C (75.2 F) Brookfield	**Vapor Density (Air = 1):** Heavier than air
Solubility in Water: Partially miscible in water	**pH:** 4.1
Appearance: Milky opaque white liquid	**Odor:** Sweet surfactant odor

IV. Fire & Explosion Hazard Data

Flash Point (Test Method : > 93.3 C (200 F) TAG Closed Cup

Extinguishing Media: Use water spray, foam, carbon dioxide, or dry chemical

Special Fire Fighting Procedures: Under fire conditions this product may support combustion and may decompose to give off toxic gasses such as carbon monoxide and nitrogen oxides. Use full faced self-contained breathing apparatus along with full protective gear. Keep nearby containers and equipment cool with water stream.

Flammable Class: This product is NOT classified as flammable or combustible by OSHA

V. Health Hazard Data

Toxicity:

Oral LD_{50}: Albino rat	>5000 mg/kg
Dermal LD_{50}: Albino rat	> 5000 mg/kg
Acute Inhalation LC50	EPA Toxicity Category IV

Primary Route of Entry: Inhalation, Dermal, Oral

Eyes: Causes mild to moderate eye irritation. Irritation clearing within 48 hours.

Skin: Can cause skin irritation. Can cause a burning or prickling sensation on more sensitive areas (face, eyes, mouth). May be harmful if absorbed through the skin. Not considered to be a dermal sensitizer.

Ingestion: May be harmful if swallowed.

Inhalation: Excessive inhalation can cause nasal and respiratory irritation.

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as being carcinogenic.

VI. EMERGENCY FIRST AID

Eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing the eye. Call a poison control center or doctor for treatment advice.

Skin: Remove contaminated clothing and wash affected areas of skin with soap and water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Ingestion: If swallowed, IMMEDIATELY call a poison control center or doctor for treatment advice. DO NOT give any liquid to the person. Do not induce vomiting unless told to do so by a poison control center or a doctor. Never give anything by mouth to an unconscious person.

Inhalation: Remove affected person to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Call a poison control center or doctor for further treatment advice.

Note to Physician: For skin effects, a highly efficient therapeutic agent for pyrethroid exposure is topical application of tocopherol acetate (Vitamin E).

VII. Reactivity Data

Stable:	YES
Conditions to Avoid	Not compatible with strong acids or bases. Not compatible with strong oxidizers.
Hazardous Polymerization	No

VIII. Environmental Protection Procedures

Spill Response: Stop release, if possible without risk. Dike or contain release, if possible and if immediate response can prevent further damage or danger. Isolate and control access to the release area. Take actions to reduce vapors. **Small spills**: Absorb with appropriate absorbent such as sand, or vermiculite. Clean spill area of residues and absorbent. **Large Spill:** Collect products into drums, storage tanks, etc., via drains, pumps, etc. Absorb with appropriate absorbent such as sand or vermiculite. Clean spill area of residues and absorbent. **Water Spill**: Contains pyrethroids, which are toxic to fish and other aquatic invertebrates. Contaminated absorbent and washwater should be disposed of according to local, state, and federal regulations.

Storage: Store in a cool, dry place. Keep container closed. KEEP OUT OF REACH OF CHILDREN.

Waste Disposal: Do not contaminate water, food, or feed by storage or disposal. Pesticide Disposal: Pesticide, spray mixture or rinse water that cannot be used according to label instructions must be disposed of at or by an approved waste disposal facility. Container Disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or dispose of in a landfill or by other approved State and local procedures. None of the ingredients in this product appear on the RCRA lists (40 CFR 261.24, 40 CFR 251.33) or CERCLA Hazardous Substance list (40 CFR Part 302 Table 302.4).

Work Hygienic Practices: DO NOT SMOKE, EAT, DRINK OR APPLY COSMETICS IN WORK AREA! Wash promptly if skin becomes contaminated. Wash at the end of each work shift and before eating, smoking, or using the toilet.

Ecotoxicological Information: This product is toxic to aquatic organisms, including fish and aquatic invertebrates. Do not contaminate bodies of water when disposing of equipment rinsate or washwaters.

IX . Special Protection Information

Eye Protection: Handlers and Applicators should take prudent precautions to avoid contact with eyes.	**Skin Protection:** Handlers and Applicators should wear long-sleeved shirt and long pants, socks and shoes.
Respiratory Protection: A respirator is not normally required when handling this product. Use in well ventilated areas.	**Ventilation:** Mechanical ventilation should be used when handling in enclosed spaces.

Other: OSHA, ACGIH and Supplier exposure limits have not been defined for the principle components of this product. IMPORTANT. Read and observe all precautions and instructions on the label.

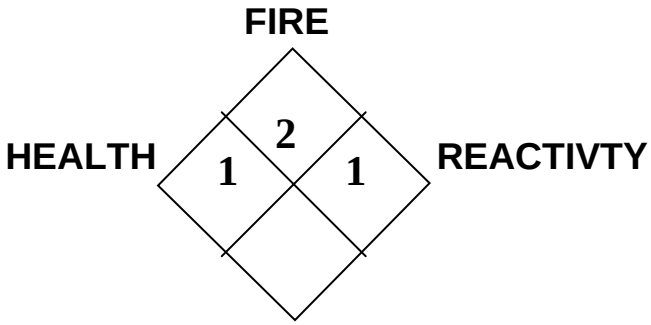
X. Additional Regulatory Information

SARA Title III
311/312 Hazard Categories
Fire: No **Pressure Generating:** No
Reactivity: No **Acute:** Yes

Section 313 Reportable Ingredinets:

Ingredient	CAS #	% weight
Piperonyl Butoxide	000051-06-6	10.0 %
d-Phenothrin	02002-80-2	10.0 %

Section 302/304 Emergency Planning: There are no SARA Title III Section 302 extremely hazardous substances present in this formulation (40 CFR 355). There are no components that are subject to emergency requirements under CERCLA Section 103(1) (40 CFR 302.4) in this formulation.



NFPA Code Key
4 = Severe
3 = Serious
2 = Moderate
1 = Slight
0 = Minimal

The information and statements herein are believed to be reliable but are not to be construed as a warranty or representation for which we assume legal responsibility. Users should undertake sufficient verification and testing to determine the suitability for their own particular purpose of any information or products referred to herein. NO WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE IS MADE.

Our database contains over 10,000 MSDS representing over 80,000 unique product codes. Your search will be more successful if you fill in as much information as possible.

Univar USA
6100 Carillon Point
Kirkland WA 98033
425−889−3400

For Emergency Assistance involving chemicals call − CHEMTREC (800) 424−9300

MSDS Number:47338 MSDS Version:001

001 04/17/02 DISTANCE FIRE ANT BAIT

****
PRODUCT IDENTIFICATION
****

PRODUCT NAME: DISTANCE FIRE ANT BAIT

MSDS#: 47338

DATE ISSUED: 8/15/01

SUPERSEDES: New

ISSUED BY: 006075

Material Safety Data Sheet

DISTANCE FIRE ANT BAIT

This Material Safety Data Sheet (MSDS)
serves different purposes than and
DOES NOT REPLACE
OR MODIFY THE EPA−APPROVED PRODUCT LABELING
(attached to and accompanying
the
product container). This MSDS provides
important health, safety, and
environmental information for
employers, employees, emergency responders
and others handling large
quantities of the product in
activities generally other than product use,
while the labeling provides
that information specifically for
product use in the ordinary course.

Use, storage and disposal of pesticide products is regulated by the EPA
under the authority of the Federal Insecticide, Fungicide, and Rodenticide
Act (FIFRA) through the product labeling. All
necessary and appropriate precautionary, use, storage, and disposal
information is set forth on that labeling. It is a violation of federal law to
use a pesticide product in any manner not prescribed on
the EPA−approved label.

SECTION, 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: DISTANCED Fire Ant Bait
EPA REGISTRATION NUMBER: 1021−1728−59639
SYNONYM(S): NYLAR Fire Ant Bait

MANUFACTURER EMERGENCY TELEPHONE NUMBERS
VALENT USA CORPORATION HEALTH EMERGENCY OR SPILL (24 hr):
P.O. Box 8025 (800) 892−0099
1333 N. California Blvd., Suite 600 TRANSPORTATION (24 hr.): CHEMTREC

Walnut Creek, CA 94596−8025 800 424−9300 or 202 483−7616

PRODUCT INFORMATION
AGRICULTURAL PRODUCTS: (800) 6VALENT
PROFESSIONAL PRODUCTS: (800) 89VALENT

COMPOSITION / INFORMATION ON INGREDIENTS

Ingredient Name CAS #) (Chemical Name,	Weight Percent	Exposure Limit	Ref.
Pyriproxyfen* (95737−68−1)	0.5	None	–––
2− 1−meth 1−2− 4− phenoxphenoxy ethox pyridine			
Other Ingredients"	99.5	None	–––

EMERGENCY TELEPHONE #: (800) 892−0099 NDA−No Data Available NA−Not Applicable

* Active Ingredient

** Other ingredients, which are maintained as trade secrets, are any substances other than an active ingredient contained in this product. Some of these may be hazardous, but their identity is withheld because they are considered trade secrets. The hazards associated with the other ingredients are addressed in this document. Specific information on other ingredients for the management of exposures, spills, or safety assessments can be obtained by a treating physician or nurse by calling 1−800−892−0099 at any time.

SECTION 3 HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION:
- HARMFUL IF SWALLOWED
- AVOID CONTACT WITH EYES OR SKIN
- AVOID BREATHING DUST
- KEEP OUT OF REACH OF CHILDREN

POTENTIAL HEALTH EFFECTS

Acute Toxicity (Primary Routes of Exposure)

Signs and Symptoms of Systemic Effects:
The acute toxicity of this product is relatively low; transient, minimal signs of toxicity were observed in rats at high oral doses.

Eye: This product is expected to cause brief and/or minor eye irritation. The degree of injury will depend on the amount and duration of contact and the speed and thoroughness of the first aid treatment. The expected adverse effects resulting from an exposure may include redness and possibly some minor swelling.

Skin: This product has been shown to produce brief and/or minor skin irritation. The degree of injury will depend on the amount and duration of the contact and the speed and thoroughness of the first aid treatment. The expected adverse health effects resulting from an exposure may include redness and possibly some minor swelling.

This product is not expected to cause allergic skin reactions.

This product has been shown to be slightly toxic when absorbed through the skin. The degree of injury will depend on the amount of material absorbed and the speed and thoroughness of the first aid treatment. The expected adverse systemic health effects are described above.

Ingestion: This product has been shown to be minimally toxic when ingested. The degree of injury will depend on the amount of material ingested and the speed and thoroughness of the first aid treatment. The expected adverse health effects resulting from an exposure are described above.

Inhalation: Based on an evaluation of the ingredients and/or similar products, this product is expected to be minimally toxic when inhaled. The degree of injury will depend on the amount of material inhaled and the speed and thoroughness of the first aid treatment. The expected adverse systemic health effects are described above.

Exposure to very high concentrations in the air may result in respiratory irritation. Signs and symptoms may include, but not be limited to, nasal discharge, sore throat, coughing and difficulty in breathing.

Chronic Toxicity (Including Cancer): Studies with pyriproxyfen technical indicated that repeated high exposures produced changes in the liver, kidney and red blood cells but did not product cancer in test animals.

Overall, this product is not expected to be a chronic hazard when used according to label directions.

Teratology (Birth Defects) Information: No developmental toxicity was produced in animals exposed to pyriproxyfen technical, even at doses that were toxic to the pregnant animal. This product is not expected to be a developmental hazard when used according to label directions.

Reproduction Information: Pyriproxyfen Technical did not produce reproductive toxicity in animal studies. This product is not expected to be a reproductive hazard when used according to label directions.

Potentially Aggravated Condition: Individuals with preexisting diseases of the liver, kidney, red blood cell or central nervous system may have increased susceptibility to the toxicity of excessive exposures.

For complete discussion of the toxicology data from which this evaluation was made, refer to Section 11. For Regulatory Information, refer to Section 15.

SECTION 4: FIRST AID MEASURES EMERGENCY NUMBER (800) 892−0099

EYES: Flush eyes with plenty of water. Remove contact lenses if worn. Call a physician if irritation persists.

SKIN: Wash with plenty of soap and water. Remove and wash contaminated Clothing separately. Get medical attention if irritation persists.

INGESTION: If swallowed, drink 1 or 2 glasses of water (or milk) and induce vomiting by touching the back of the throat with finger. If possible, contact a physician or Poison Control Center before inducing vomiting. Do not induce vomiting or give anything by mouth to an unconscious person. Take person and product container to the nearest emergency treatment center.

INHALATION: If respiratory irritation or any signs or symptoms as described in this document occur, remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth−to−
mouth. Get medical attention.

NOTES TO PHYSICIAN: None.

SECTION 5: FIRE FIGHTING MEASURES

FLASH POINT: NA METHOD: NA
AUTOIGNITION: NA

EXTINGUISHING MEDIA: Foam, carbon dioxide or dry chemical.
FLAMMABLE LIMITS (% by volume in air): Lower: NA Upper: NA

NFPA RATINGS: Health −1; Flammability− 2; Reactivity−0; Special −None

(Least−0, Slight−1, Moderate−2, High−3, Extreme−4).
These values are obtained using professional judgment. Values were not available in the guidelines or published evaluations
prepared by the National Fire Protection Association, NFPA.

FIRE FIGHTING INSTRUCTIONS: Products of combustion from fires involving this material may be toxic. Avoid breathing smoke and mists. Avoid personnel and equipment contact with fallout and runoff. Minimize the amount of water used for fire fighting. Do not enter enclosed areas
without full protective equipment, including self−contained breathing equipment. Contain and isolate runoff and debris for proper disposal. Decontaminate personal protective equipment and
fire fighting equipment before reuse. Read the entire document.

HAZARDOUS COMBUSTION PRODUCTS: Normal combustion forms carbon dioxide, water vapor and may produce oxides of nitrogen. Incomplete combustion can produce carbon monoxide.

SECTION 6 ACCIDENTAL RELEASE MEASURES

VALENT EMERGENCY PHONE NUMBER: (800) 892−0099
CHEMTREC EMERGENCY PHONE NUMBER: (800) 424−9300

OBSERVE PRECAUTIONS IN SECTION 8: PERSONAL PROTECTION
Stop the source of the spill if safe to do so. Contain the spill to prevent

further contamination of the soil, surface water, or ground water.

FOR SPILLS ON LAND:
CONTAINMENT: Reduce airborne dust. Avoid runoff into storm sewers or other Bodies of water.

CLEANUP: Clean up spill immediately. Vacuum or sweep up material in a Disposable container. Wash area with soap and water. Pick up wash liquid with Additional absorbent and place in disposable container.

FOR SPILLS IN WATER:
CONTAINMENT: This material will dissolve in water. Stop the source of the release.
Contain and isolate to prevent further release into soil, surface water and groundwater.
Notify and consult with appropriate authorities.
CLEANUP: Remove contaminated water for removal or treatment.

SECTION 7: HANDLING AND STOWAGE

END USER MUST READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

Do not store or transport near food or feed. Store in a cool, dry place, out of direct sunlight.

EMERGENCY TELEPHONE #: (800) 892−0099 NDA−No Data Available NA−Not Applicable

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

END USER MUST READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

EYE PROTECTION: Do not get this material in your eyes. Eye contact can be avoided by wearing protective eyewear.

RESPIRATION/VENTILATION: If operating conditions result in airborne concentrations of this material, the use of an approved respirator is recommended.

SKIN PROTECTION: Avoid contact with skin or clothing. Skin contact should be minimized by wearing protective clothing including gloves.

SECTION 9. PHYS/CHEM PROPERTIES

APPEARANCE: Small golden flakes. Appearance of corn grits.
ODOR: Mild soybean oil odor.
MELTING POINT: NA
BOILING POINT: NA
DENSITY: 0.31 g/cm3 at 20 C
SOLUBILITY: NA
VAPOR PRESSURE: NA
PERCENT VOLATILE: Less than 1 %.
DISSOCIATION CONSTANT: NA
OCTANOL/WATER PARTITION
COEFFICIENT: NA
pH: NA
VISCOSITY: NA

SECTION 10, STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable
INCOMPATIBILITY: Not compatible with strong acids or bases. Not compatible with strong oxidizers.
HAZARDOUS DECOMPOSITION PRODUCTS: See section 5 combustion products.
IMPACT EXPLODABILITY: NDA
OXIDATION/REDUCTION PROPERTIES: NDA

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE (Product Specific Information):

Eye Irritation: This product produced eye irritation in rabbits which cleared within 72
hours after treatment (Toxicity Category III).

Skin Irritation: This product did not produce skin irritation in rabbits (Toxicity Category IV).

Dermal Toxicity: The dermal LD50 in rabbits is greater than 2 g/kg (Toxicity Category III).

Oral Toxicity: The oral LD50 greater than 5000 mg/kg (Toxicity Category IV).

Inhalation Toxicity: No product specific data available. Based on information on the ingredients it is expected to be minimally toxic by the inhalation route (Category IV).

Skin Sensitization: This product did not produce a positive skin sensitization reaction in a skin sensitization test.

SUBCHRONIC: Subchronic oral toxicity studies conducted with pyriproxyfen technical in the rat, mouse and dog indicate a low level of toxicity. Effects observed at high dose levels consisted primarily of decreased body weight; increased liver weights; histopathological changes in the liver and kidney; decreased red blood cell counts, hemoglobin and hematocrit; altered blood chemistry parameters; and, at 5000 and 10000 ppm in mice, a decreased in survival rates. The NOELs from these studies were 1000 ppm (149.4 mg/kg/day) in mice, 100 mg/kg/day in dogs and 400 ppm (23.5 mg/kg/day) in rats.

In a 4 week inhalation study of pyriproxyfen technical in rats, decreased body weight and increased water consumption was observed at 1000 mg/m3, The NOEL in this study was 482 mg/m3.

A 21−day dermal toxicity study in rats with pyriproxyfen technical did not produce any signs of dermal or systemic toxicity at 1000 mg/kg/day.

CHRONIC/CARCINOGENICITY: Pyriproxyfen technical has been tested in chronic studies with dogs, rats and mice. Dogs exposed to dose levels of 300 mg/kg/day or higher for 52 weeks showed overt clinical signs of toxicity, elevated levels of blood enzymes and liver damage. The NOEL in this study was 100 mg/kg/day. In a 78 week study in mice, dietary levels of 3000 ppm or greater produced gross and histopathological changes in the kidney. The NOEL in this study was 600 ppm. In a 2−year study in rats, dietary levels of 3000 ppm or greater produced decreased body weights in female rats. The NOEL in the rat study was 600 ppm. No oncogenic response was produced in mice or rats.

TERATOLOGY/DEVELOPMENTAL TOXICITY:
Tests for developmental toxicity in rats and rabbits were conducted with pyriproxyfen technical. In the study conducted with rats, maternal toxicity (mortality, decreased body weight gain and food consumption and clinical signs of toxicity) was observed at doses of 300 mg/kg/day and greater. The maternal NOEL was 100 mg/kg/day.
A transient increase in skeletal developmental toxicity was 100 mg/kg/day. An increased incidence of visceral and skeletal variations was observed postnatally at 1000 mg/kg/day. The NOEL for postnatal developmental toxicity was 300 mg/kg/day. In the study conducted with rabbits, maternal toxicity (clinical signs of toxicity including one death, decreased body weight gain and food consumption, and abortions or premature deliveries) was observed at oral doses of 300 mg/kg/day or higher. The maternal NOEL was 100 mg/kg/day. No developmental effects were observed in the rabbit fetuses. The NOEL for developmental toxicity in rabbits was 1000 mg/kg/day.

REPRODUCTION: A dietary rat reproduction study was conducted with pyriproxyfen technical.
Systemic toxicity (reduced body weights, histopathological changes in the liver and kidney, and increased liver weight) was produced at 5000 ppm. The systemic NOEL was 1000 ppm. No effects on reproduction were produced even at 5000 ppm, the highest dose tested.

MUTAGENICITY: Pyriproxyfen technical was negative in the following tests for mutagenicity:
Ames Assay with and without S9, unscheduled DNA synthesis in HeLa S3 cells, in vitro gene mutation in V79 Chinese hamster cells, and in vitro chromosomal aberration in Chinese hamster ovary cells.

For a summary of the potential for adverse health effects from exposure to this product, refer to Section 3. For information regarding regulations pertaining to this product, refer to Section 15.

SECTION 12 ECOLOGICAL TOXICITY

AVIAN TOXICITY: Pyriproxyfen technical is practically non−toxic to avian species. Test results include:

Oral LD50 mallard duck: greater than 2000 mg/kg
Oral LD50 bobwhite quail: greater than 2000 mg/kg
Dietary LD50 mallard duck: greater than 5200 ppm
Dietary LD50 bobwhite quail: greater than 5200 ppm

Reproduction bobwhite quail: NOEC = 600 ppm
Reproduction mallard duck: NOEC = 600 ppm

AQUATIC ORGANISM TOXICITY: Pyriproxyfen technical is moderately to highly toxic to fish and moderately to very highly toxic to aquatic invertebrate species. Test results include:

Freshwater species:

LC50 (96 hr) Bluegill Sunfish: greater than 270 ug/I
LC50 (96 hr) Rainbow Trout: greater than 325 ug/I
LC50 (21 day) Rainbow Trout: 90 ug/l
LC50 (96 hr) Carp: 450 ug/l
LC50 (96 hr) Killifish: 2660 ug/l
ECM (48 hr) Daphnia magna: 400 ug/I
MATC (21 day) Daphnia magna: 20 ppt
MATC (Early Life Cycle) Rainbow Trout: 5.4 ug/I

Estuarine species:

LD50 (96 hr) Sheepshead Minnow: greater than 1.02 ppm
LD50 (96 hr) Mysid Shrimp: 65 ug/l
EC50 (96 hr) Oyster Shell Deposition: greater than 92 ug/I

OTHER NON−TARGET ORGANISM TOXICITY: Pyriproxyfen technical is practically non−toxic to bees. The acute contact LC50 in bees was greater than 100 ug/bee.

SECTION 13 DISPOSAL CONSIDERATIONS

END USERS MUST DISPOSE OF ANY UNUSED PRODUCT AS PER THE LABEL RECOMMENDATIONS.

DISPOSAL METHODS: Check governmental regulations and local authorities for Approved disposal of this material. Dispose in accordance with applicable laws and regulations.

SECTION 14. TRANSPORT INFORMATION

D.O.T. SHIPPING NAME: Insecticide, solid, non−regulated
TECHNICAL SHIPPING NAME: Pyriproxyfen 0.5 % solid
D.O.T. HAZARD CLASS: NA
U.N./N.A. NUMBER: NA
RQ: None

SECTION 15 REGULATORY INFORMATION

REGULATIONS UNDER FIFRA: All pesticides are governed under FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act). Therefore, the regulations presented below are pertinent only when handled outside of the normal use and applications of pesticides. This includes waste streams resulting from manufacturing/formulation facilities, spills or misuse of products, and storage of large quantities of products containing hazardous or extremely hazardous substances.

OTHER U.S. FEDERAL REGULATIONS:

CERCLA RQ*: None
RCRA**: None
SARA TITLE III: SARA 313 − None
SARA 311/312 − Immediate Health − Yes
Delayed Health − Yes
Fire − No

Neither this product nor any of its components have been listed as a carcinogen by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or the Occupational Safety and Health Administration (OSHA).

STATE REGULATIONS: Each state may promulgate standards more stringent than the federal government. This section cannot encompass an inclusive list of all state regulations. Therefore, the user should consult state or local authorities.

PROPOSITION 65: Not Listed
NEW JERSEY HAZARDOUS SUBSTANCE LIST: Not Listed

RQ: Reportable Quantity
RCRA waste codes must be determined on a case−by−case basis (i.e., spill, Processing waste, etc.). The waste code presented is based on available product characteristics only.

For information regarding potential adverse health effects from exposure to this product, refer to Sections 3 and 11.

EMERGENCY TELEPHONE #: (800) 892−0099 NDA−No Data Available NA−Not Applicable

For Additional Information:
Contact: MSDS Coordinator − Univar USA
During business hours, Pacific Time − (425) 889−3400

NOTICE
Univar USA, expressly disclaims all express or implied warranties of merchantibility and fitness for a particular purpose, with respect to the product or information provided herein, and shall under no circumstances be liable for incidental or consequential damages.

Do not use ingredient information and/or ingredient percentages in this MSDS as a product specification. For product specification information refer to a Product Specification Sheet and/or a Certificate of Analysis. These can be obtained from your local Univar USA Sales Office.

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END OF MSDS

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for (i=0;i 0) { document.images[i].border = 0; document.images[i].width = 0; document.images[i].height = 0; break; } }

AMBRANDS®

AMDRO PRO FIRE ANT KILLER

MATERIAL SAFETY DATA SHEET
AMDRO PRO Fire Ant Bait

2030 Powers Ferry Road,
Suite 500
Atlanta, GA 30339

EMERGENCY TELEPHONE: 800-265-0761 (U.S.A.)
800-424-9300 (CHEMTREC)

MSDS No.
CAS NO. 067485-29-4
DATE: December 9, 2005
REVISED:
EPA REG NO. 241-322-73342

SECTION I

Trade Name: AMDRO® PRO Fire Ant Bait

Chemical Name: Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone [3-4-(trifluoromethyl) phenyl]- 1-[2-[4-(trifluoromethyl)phenyl]ethenyl]-2- propenylidene] hydrazone

Synonyms: Hydramethylnon, AC 217,300 Formula: C25 H24 F6 N4

Chemical Family: Amidinohydrazone Mol Wt: 494.5

SECTION II - INGREDIENTS

COMPONENT	CAS NO.	%	PEL/TLV – SOURCE
Hydramethylnon*	67485-29-4	0.73	1.4 mg/m3 TWA manufacturer recommended
Inerts	N/A	99.27	None established

SARA Title III Section 313: * Listed

SECTION III – PHYSICAL DATA

BOILING/MELTING POINT @ 760mm Hg: 185 - 190°C pH: N/D

VAPOR PRESSURE mmHg @ 20° C: 6 X 10 (-8) @ 25°C

SPECIFIC GRAVITY OR BULK DENSITY: 15 – 24 lb/cu. ft.

SOLUBILITY IN WATER: 0.88 ppm @ 25°C (technical)

APPEARANCE: Mustard color granules ODOR: Vegetable oil INTENSITY: Mild

SECTION IV – FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD): >220° F AUTOIGNITION TEMP: About 404°C

FLAMMABILITY LIMITS IN AIR (% BY VOL): LOWER: N/D UPPER: N/D

NFPA 704 HAZARD CODES
HEALTH: N/R FLAMMABLE: N/R INSTABILITY: N/R OTHER: N/R
NFPA 30 STORAGE CLASSIFICATION: N/R

EXTINGUISHING MEDIUM	**Use water fog, foam, CO(2), or dry chemical extinguishing media.**
SPECIAL FIREFIGHTING PROCEDURES	**Firefighters should be equipped with self-contained breathing apparatus and turnout gear.**
UNUSUAL FIRE EXPLOSION HAZARDS	**None known.** **Organic dusts may form an explosive dust/air mixture. Class St-1 explosive dust.**

SELECT ACRONYM KEY

N/A – Not available; N/D – Not determined; N/R - Not rated; N/E – Not established

AMBRANDS®

AMDRO PRO FIRE ANT KILLER

SECTION V – HEALTH DATA

TOXICOLOGICAL TEST DATA:

Data for the formulated product:
Rat, Oral LD50 (combined sexes) > 5000 mg/kg
Rabbit, Dermal LD50 (combined sexes) > 2000 mg/kg
Rat, Inhalation LC50 (4 hr) Not available
Rat, Inhalation LC50 (1 hr, calculated) Not available
Rabbit, Eye Irritation – Not irritating
Rabbit, Skin Irritation – Mildly irritating.
Guinea pig, Dermal Sensitizer – Not a sensitizer
Data for the technical material:
In a two generation rat reproduction study, male reproductive fertility was depressed at 75 ppm due to degenerative testicular changes but this effect was not seen at 50 ppm.

OSHA, NTP, OR IARC Carcinogen: Not Listed.

EFFECTS OF OVEREXPOSURE:

See Product Label and Directions For Use for additional precautionary statements.
PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION: KEEP OUT OF REACH OF CHILDREN
MAY BE HARMFUL IF SWALLOWED. Avoid contact with skin, eyes, and clothing.

Existing medical conditions aggravated by this product: None known.

FIRST AID PROCEDURES:

If swallowed:	Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. If person is unconscious, do not give anything by mouth and do not induce vomiting.
If on skin:	Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice,
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.
Note to physician:	There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition.
Note:	Have the product container or label with you when calling a poison control center or doctor or going for treatment.

SECTION VI – REACTIVITY DATA

STABILITY: Stable. See Section X – Additional Information
CONDITIONS TO AVOID: Store in original container in cool, dry, well ventilated place away from ignition sources, heat or flame.

CHEMICAL INCOMPATIBILITY: Oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxides of carbon and nitrogen, HF

HAZARDOUS POLYMERIZATION: Does not occur.
CONDITIONS TO AVOID: Does not polymerize.

CORROSIVE TO METAL: No **OXIDIZER**: No

AMBRANDS®

AMDRO PRO FIRE ANT KILLER

SECTION VII – PERSONAL PROTECTION

PESTICIDE APPLICATORS & WORKERS must refer to the Product Label and Directions For Use attached to the product for Agricultural Use Requirements in accordance with the EPA Worker Protection Standard 40 CFR part 170.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

Respiratory Protection:
Wear a NIOSH approved cartridge respirator approved for pesticides if the TWA of 1.4 mg/m3 is exceeded.

Respiratory Protection:
Supplied air respirators should be worn if large quantities of mist/dust (10 x the TWA) are generated or prolonged exposure possible.

Eye Protection:
Chemical goggles when respirator does not provide eye protection.

Protective Clothing:
Gloves and protective clothing as necessary to prevent skin contact.

Ventilation:
Whenever possible, engineering controls should be used to minimize the need for personal protective equipment.

SECTION VIII – ENVIRONMENTAL DATA

ENVIRONMENTAL TOXICITY DATA
Hydramethylnon, the active ingredient, is very toxic to fish and aquatic invertebrates.

SARA 311/312 REPORTING
FIRE: N PRESSURE: N REACTIVITY: N ACUTE: Y CHRONIC: Y TPQ(lbs): N/R

SPILL AND LEAK PROCEDURES:
In case of large scale spillage of this product, avoid contact, isolate area and keep out animals and unprotected persons. Call CHEMTREC (800-424-9300) or AMDRO (800-265-0761). For a small spill, wear personal protective equipment as specified on the label.
FOR A SOLID SPILL: Sweep solid into a drum for re-use or disposal. Remove personal protective equipment and decontaminate it prior to re-use.
HAZARDOUS SUBSTANCE SUPERFUND: No RQ (lbs): None

WASTE DISPOSAL METHOD:
Pesticide wastes are acutely hazardous. Wastes resulting from this product may be disposed of on site or at an approved waste disposal facility. Improper disposal of excess pesticide, spray mix or rinsate is a violation of federal law. If these wastes cannot be disposed of according to label instructions, contact the state agency responsible for pesticide regulation or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

HAZARDOUS WASTE 40CFR261: No HAZARDOUS WASTE NUMBER: None

CONTAINER DISPOSAL:
See above "WASTE DISPOSAL METHOD".

SECTION IX – SHIPPING DATA – PACKAGE AND BULK

D.O.T. PROPER SHIPPING NAME (49CFR172.101-102):
None

HAZARDOUS SUBSTANCE (49CFR CERCLA LIST): None
RQ(lbs): None

D.O.T. HAZARD CLASSIFICATION (CFR 172.101-102):
PRIMARY
None

SECONDARY

D.O.T. LABELS REQUIRED (49CFR 172.101-102):	D.O.T. PLACARDS REQUIRED (CFR172.504):	POISON CONSTITUENT (49CFR172.203(K):
None	None	None

BILL OF LADING DESCRIPTION
Insecticides, agricultural, NOIBN
This product is not regulated by the Department of Transportation.

CC NO.: Not Applicable **UN/NA CODE:**

AMBRANDS®

AMDRO PRO FIRE ANT KILLER

SECTION X – ADDITIONAL INFORMATION

Amdro® Pro Fire Ant Bait

HANDLING AND STORAGE INFORMATION

Store in a cool, dry, secure place and KEEP THE CONTAINER TIGHTLY CLOSED.
Amdro® Pro Fire Ant Bait is formulated in an oil bait that functions as an attractant to ants.
Prolonged exposure to air may turn the oil rancid and reduce the attractiveness to ants.
USE PRODUCT WITHIN 3 MONTHS OF OPENING CONTAINER.
This product may be an attractant to pets and rodents.
Keep pets away from treated areas for at least 24 hours after application.

EPA Reg. No. 241-322-73342

KEEP OUT OF REACH OF CHILDREN.

CAUTION

Complete Label and Directions For Use are attached to the product.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to supplemental labeling under "Agricultural Use Requirements" in the Directions for Use section for information about this standard.

AMBRANDS
2030 Powers Ferry Road, Suite 500
Atlanta, GA 30339
770-333-8999

DISCLAIMER

IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION FURNISHED BY AMBRANDS HEREUNDER ARE GIVEN GRATIS AND AMBRANDS ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

"DuPont" "ADVION" FIRE ANT BAIT
M0000496 Revised 16-SEP-2005

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

"DuPont", "ADVION" are trademarks of DuPont.

CAS Number : 173584-44-6
CAS Name : (DPX-KN128 Active Ingredient)

Tradenames and Synonyms

INDOXACARB
Indoxacarb 0.045% Fire Ant Bait

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont
1007 Market Street
Wilmington, DE 19898

PHONE NUMBERS
Product Information : 1-800-441-7515 (outside the U.S. 302-774-1000)
Transport Emergency : CHEMTREC 1-800-424-9300(outside U.S. 703-527-3887)
Medical Emergency : 1-800-441-3637 (outside the U.S. 302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
INDOXACARB	173584-44-6	0.045
OTHER INGREDIENTS		99.955

HAZARDS IDENTIFICATION

Potential Health Effects

Based on animal testing, no biologically significant effects are expected from skin or eye contact or by ingestion.

(HAZARDS IDENTIFICATION - Continued)

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

IF INHALED: No specific intervention is indicated as the compound is not likely to be hazardous by inhalation. Consult a physician if necessary.

IF ON SKIN OR CLOTHING: No specific intervention is indicated as the compound is not likely to be hazardous to the skin. Consult a physician if necessary.

IF IN EYES: No specific intervention is indicated as the compound is not likely to be hazardous to the eyes. Consult a physician if necessary.

IF SWALLOWED: No specific intervention is indicated as the compound is not likely to be hazardous by ingestion. Consult a physician if necessary.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

You may contact 1-800-441-3637 for emergency medical treatment.

FIRE FIGHTING MEASURES

Flammable Properties

Not a fire or explosion hazard.

Extinguishing Media

Water, Water Spray, Foam, Dry Chemical, CO2.

Fire Fighting Instructions

Keep personnel removed and upwind of fire. Wear self-contained breathing apparatus. Wear full protective equipment. Runoff from fire control may be a pollution hazard.

(FIRE FIGHTING MEASURES - Continued)

If area is exposed to fire and conditions permit, let fire burn itself out. Burning chemicals may produce by-products more toxic than the original material. If product is on fire, wear self-contained breathing apparatus and full protective equipment. Use water spray. Control runoff.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus.

Emergency Response - Chemical resistant coveralls, waterproof gloves, waterproof boots and face/eye protection. If dusting occurs, use NIOSH approved respirator protection.

Initial Containment

Follow applicable Federal, State/Provincial and Local laws/ regulations. Prevent material from entering sewers, waterways, or low areas.

Spill Clean Up

Shovel or sweep up. Avoid causing dust. Dispose of in an approved container.

HANDLING AND STORAGE

Handling (Personnel)

USERS SHOULD: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

Storage

Do not contaminate water, food, or feed by storage.

Store product in original container only in a location inaccessible to children and pets. Do not contaminate water, other pesticides, fertilizer, food or feed in storage.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Use only with adequate ventilation. Keep container tightly closed.

Do not generate dust.

Personal Protective Equipment

Applicators and other handlers must wear:
Long-sleeved shirt and long pants.
Shoes plus socks.
Gloves.

Follow manufacturer's instructions for cleaning/ maintaining personal protective equipment (PPE). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Exposure Guidelines

Exposure Limits
"DuPont" "ADVION" FIRE ANT BAIT

PEL (OSHA)	: Particulates (Not Otherwise Regulated) 15 mg/m3, 8 Hr. TWA, total dust 5 mg/m3, 8 Hr. TWA, respirable dust
AEL * (DuPont)	: 1 mg/m3 8 & 12 Hr. TWA, Respirable

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Odor	: Slight vegetable oil
Form	: Granular-like
Color	: Light yellow
Density	: 0.29-0.35 g/cc
Vapor Pressure	: 2.5 x 10(-8) Pa (a.i.)
Solubility in Water	: 0.2 ppm (a.i)

STABILITY AND REACTIVITY

Incompatibility with Other Materials

None reasonably foreseeable.

TOXICOLOGICAL INFORMATION

Animal Data

DuPont Advion Fire Ant Bait
Oral LD50: > 5000 mg/kg in rats
Dermal LD50: > 5000 mg/kg in rabbits

DuPont Advion Fire Ant Bait is not a skin or eye irritant, and is not a skin sensitizer in animal tests.

ECOLOGICAL INFORMATION

Ecotoxicological Information

DuPont Advion Fire Ant Bait contains 0.045% active ingredient (calculated as the active isomer DPX-KN128) and is labeled for a maximum single application rate of 1.5 lbs of Advion fire ant bait per acre (equivalent to 0.0007 lbs active ingredient per acre). Based on the Advion Fire Ant Bait application rate, and the laboratory test results conducted with a higher concentration technical material, the ecological toxicity risk potential is extremely low for aquatic and avian species when the product is applied according to label directions to control red imported fire ants.

Note that the following results are based on tests conducted under laboratory conditions using DPX-MP062 Technical as the test substance. The DPX-MP062 Technical used in the tests contained 94.5% active ingredient in the form of the insecticidally active isomer DPX-KN128 and inactive isomer IN-KN127 in an approximately 75:25 ratio.

(94.5% DPX-MP062)
AQUATIC TOXICITY:
96 hour LC50 - Bluegill sunfish: 0.90 mg/L.
96 hour LC50 - Rainbow trout : 0.65 mg/L.
48 hour EC50 - Daphnia magna : 0.60 mg/L.

Based on the above results for fish and invertebrates, risk quotients (RQs) were < 0.002 and no levels of concern (LOCs) were exceeded.

AVIAN TOXICITY:
Acute Oral LD50 - Bobwhite Quail : 98 mg/kg.
Acute Dietary LC50 - Bobwhite Quail: 808 ppm

(ECOLOGICAL INFORMATION - Continued)

Acute Dietary LC50 - Mallard Duck : >5620 ppm

Based on the above results for birds, acute RQs were < 0.03 and chronic RQs were < 0.1, and no LOCs were exceeded.

DISPOSAL CONSIDERATIONS

Waste Disposal

Do not contaminate water, food, or feed by storage or disposal. Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Do not apply where/when conditions could favor runoff. Cover, incorporate, or clean up granules that are spilled.

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment rinsewater.

Container Disposal

For Plastic Containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

For Plastic Bags: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

For Fiber Drums with Liners: Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by State and local authorities. If drum is contaminated and cannot be reused, dispose of in the same manner.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO/IATA

Proper Shipping Name : Not Regulated

REGULATORY INFORMATION

U.S. Federal Regulations

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : No
Fire : No
Reactivity : No

In the United States this product is regulated by the US Environmental Protection Agency under the Federal Insecticide, Fungicide and Rodenticide Act. It is a violation of federal law to use this product in a manner inconsistent with its labeling.

EPA Reg. No. 352-627

OTHER INFORMATION

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS: DuPont Crop Protection
Address : Wilmington, DE 19898
Telephone : 1-888-638-7668

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

Date Issued: November 2004
Supersedes:

MATERIAL SAFETY DATA SHEET
EXTINGUISH™ PROFESSIONAL FIRE ANT BAIT

Manufacturer: Wellmark International

Address: 1501 East Woodfield Road, Suite 200W, Schaumburg, IL 60173

Emergency Phone: 1-800-248-7763

Transportation Emergency Phone: CHEMTREC: 1-800-424-9300

1. CHEMICAL PRODUCT INFORMATION

Product Name: Extinguish™ Professional Fire Ant Bait

Chemical Name/Synonym: (S)-Methoprene; isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate

Chemical Family: Terpenoid

Formula: C19 H34 O3

EPA Registration No.: 2724-475

RF Number: 9605

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component (chemical, common name)	CAS Number	Weight	Tolerance
(S)- Methoprene: Isopropyl (2E,4E,7S)-11-Methoxy-3,7,11-trimethyl-2,4-dodecadienoate	65733-16-6	0.50%	Not established
Inert ingredients (nonhazardous) and/or trade secret)		99.50%	

3. HAZARD INFORMATION

PRECAUTIONARY STATEMENT

CAUTION: Keep out of the reach of children. Causes moderate eye irritation. Avoid Contact with eyes or clothing. Wash thoroughly with soap and water after handling.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

No adverse reactions have resulted from normal human exposure during research and testing. Adverse animal reactions to this product have not been shown.

PRIMARY ROUTE OF ENTRY **Dermal/Eye:** Yes **Oral:** No **Inhalation:** Yes

ACUTE TOXICITY

Oral: LD50 (rat): >34,000 mg/kg (HDT) (Based on (S)-Methoprene)

Dermal: LD50 (rabbit): >2,000 mg/kg (HDT) (Based on (S)-Methoprene)

Inhalation: LC50 (rat) >5.19 mg/l air (Based on (S)-Methoprene)

OTHER TOXICOLOGICAL INFORMATION

Skin Irritation: Non-irritating (rabbit) (Based on (S)-Methoprene)

Eye Irritation: Practically non-irritating (rabbit) (Based on (S)-Methoprene)

Sensitizer: Not a sensitizer (guinea pig) (Based on (RS)-Methoprene)

4. FIRST AID MEASURES

Eye: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin: Wash material off with copious amounts of water and soap. Remove contaminated clothing and footwear. See a physician if symptoms persist.

Ingestion: Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by poison control center or doctor. Do not give anything by mouth to an unconscious person.

Inhalation: Remove victim to fresh air. See a physician if cough or other respiratory symptoms develop

Note to Physician: Treat symptomatically

5. FIRE FIGHTING MEASURES

NFPA Rating: **Health: 0** **Fire: 0** **Reactivity: 0**

Flammability Class: Combustible solid

Flash Point: Does not flash

Explosive Limits (% of Volume): N/A

Extinguishing Media: Water, foam, dry chemical

Special Protective Equipment: Firefighters should wear protective clothing, eye protection, and self contained breathing apparatus.

Fire Fighting Procedures: Normal procedures. Do not allow run-off to enter waterways inhabited by aquatic organisms

Combustion Products: None known

Unusual Fire/Explosion Hazards: None

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken: Sweep up material and place in a container for disposal. Do not allow spill to enter waterways inhabited by aquatic organisms

Absorbents: None necessary due to product form and packaging

Incompatibles: None

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling.

Storage: Store closed containers of ant bait ina cool, dry place. Do not contaminate water, food or feed by storage.

8. EXPOSURE CONTROL / PERSONAL MEASURES

Exposure Limits: OSHA PEL Total dust 15mg/ms

Ventilation: Use with adequate ventilation.

Personal Protective Equipment: Under ordinary use conditions, no special protection is required. If prolonged exposure is expected, it is recommended to wear a MSHA/NIOSH approved organic vapor/pesticide respirator, impervious gloves, chemical goggles or safety glasses with side shields.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor:	Pale Yellow, solid granules with earthy, corn-like odor
Boiling Point:	N/A
Melting Point:	N/A
Vapor Pressure (mm Hg):	N/A
Vapor Density (Air = 1):	N/A
Specific Gravity:	N/A
Bulk Density:	0.31 gm/cc (19 lbs. per cubic foot)
Solubility:	Not Soluble
Evaporation Rate:	N/A
pH:	N/A

10. STABILITY AND REACTIVITY

Stability:	Stable
Reactivity:	Non-reactive
Incompatibility w/ Other Materials:	None
Decomposition Products:	None
Hazardous Polymerization:	Will not occur

11. TOXICOLOGICAL INFORMATION

CHRONIC TOXICITY [Based on (RS)-Methoprene]
Methoprene is not considered as an oncogenic compound. The NOEL for non-carcinogen effects in an 18-month mouse study was 250ppm..

DEVELOPMENTAL/REPRODUCTIVE TOXICITY [Based on (RS)-Methoprene]
Methoprene is not a teratogenic compound. The NOEL for maternal and embryotoxicity in rabbits was 200/mg/kg/day. The NOEL for reproductive effects in rats was 500 ppm..

MUTAGENICITY [Based on (RS)-Methoprene]
Methoprene is not a mutagenic compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE [Based on (RS)-Methoprene]

Hydrolysis:	T1/2 > 4 weeks
Photolysis:	T1/2 < 10 hours
Soil half life:	~ 10 days
Water solubility:	< 2 ppm

ECOTOXICITY [Based on (S)-Methoprene]

Acute Toxicity:	fish:LC50 (trout): 760 ppb, (bluegill): > 370 ppb ((S)-Methoprene); **aquatic invertebrates**:LC50 (Daphnia): 360 ppb ((S)-Methoprene)

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food or feed by disposal. **Pesticide Disposal**: Wastes resulting from the use of this product may be disposed of at an approved chemical waste disposal facility in compliance with federal, state, and local requirements. **Container disposal:** Triple rinse (or equivalent), then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned stay out of smoke.

14. TRANSPORT INFORMATION

DOT49CFR Description: Not regulated as hazardous by D.O.T.

Freight Classification: Insecticides, NOI other than poison in boxes or drums. NMFC 102120

15. REGULATORY INFORMATION

CERCLA (Superfund): Not regulated

RCRA: Not regulated as hazardous

SARA 311/312 HAZARD CATEGORIES

Immediate Health: Yes (irritation)

Delayed Health: No

Fire: No

Sudden Pressure: No

Reactivity: No

The information presented herein, while not guaranteed, was prepared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all inclusive and the manner and conditions of use and handling may involve other or additional considerations.

Date Issued: January, 2004
Supersedes: October, 2003

MATERIAL SAFETY DATA SHEET
Extinguish™ Plus

Manufacturer: Wellmark International

Address: 1100 East Woodfield Road, Suite 500 Schaumburg, IL 60173

Emergency Phone: 1-800-248-7763

Transportation Emergency Phone: CHEMTREC: 1-800-424-9300

1. CHEMICAL PRODUCT INFORMATION

Product Name: Extinguish™ Plus

Chemical Name/Synonym: (S)-Methoprene; isopropyl (2E,4E,7S)-11-methoxy-3,7,11-trimethyl-2,4-dodecadienoate

Hydramethylnon; Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone [3-[4(trifluromethyl)phenyl]-1-[2-[4-(trifluromethyl)phenyl]ethenyl]-2-propenylidene]hydrazone

Chemical Family: Terpenoid / Amidinohydrazone

Formula: $C_{19}\ H_{34}\ O_3$ / $C_{25}H_{24}N_4F_6$

EPA Registration No.: 2724-496

RF Number: 2012

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component (chemical, common name)	CAS Number	Weight	Tolerance
Hydramethylnon: Tetrahydro-5,5-dimethyl-2(1H)-pyrimidinone [3-[4(trifluromethyl)phenyl]-1-[2-[4-(trifluromethyl)phenyl]ethenyl]-2-propenylidene]hydrazone	067485-29-4	0.365%	1.4 MG/M^3 (TWA)
(S)- Methoprene: Isopropyl (2E,4E,7S)-11-Methoxy-3,7,11-trimethyl-2,4-dodecadienoate	65733-16-6	0.250%	
Inert Ingredients		99.385%	
Section 313 Toxic Chemical Reference: Hydramethylnon American Cyanamid – 1986			

3. HAZARD INFORMATION

PRECAUTIONARY STATEMENT

CAUTION!

KEEP OUT OF THE REACH OF CHILDREN

Hazards to Humans and Domestic Animals: May be harmful if swallowed. Avoid contact with skin, and clothing. Wash hands thoroughly with soap and water after handling. Prolonged or frequently repeated skin contact may cause allergic reactions in some people.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

PRIMARY ROUTE OF ENTRY **Dermal/Eye:** Yes **Oral:** No **Inhalation** Yes

ACUTE TOXICITY	**Oral:**	LD50 (rat): > 34,600 mg/kg bw (highest dose level tested) (Based on S-Methoprene)
	Dermal:	LD50 (rabbit) >5,000 mg/kg bw (Based on S-Methoprene)
	Inhalation:	4-hour LC50 (rat): 5.19 mg/L air (Based on S-Methoprene) .

OTHER TOXICOLOGICAL INFORMATION

Skin Irritation: Slightly irritating to the skin (based on technical active ingredient)

Eye Irritation: Moderate eye irritant (based on technical active ingredient)

Sensitizer: Hydramethylnon is not a sensitzer.

4. FIRST AID MEASURES

Eye: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

Skin: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15 – 20 minutes. Get medical attention if irritation persists.

Ingestion: Drink two glasses of water, induce vomiting if the person is conscious. Seek medical attention.

Inhalation: Remove to fresh air

Note to Physician: There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition.

5. FIRE FIGHTING MEASURES

NFPA Rating: **Health: 1** **Fire: 1** **Reactivity: 0**

Flammability Class: Combustible solid

Flash Point: Does not flash (not a liquid)

Explosive Limits (% of Volume): N/A

Extinguishing Media: Use water, foam, carbon dioxide, or dry chemical.

Special Protective Equipment: Wear self contained, positive pressure breathing apparatus and full fire fighting protective clothing.

Fire Fighting Procedures: Avoid heavy hose streams; airborne dust may create an explosion hazard. Do not allow run-off to enter waterways.

Combustion Products: Thermal decomposition may produce hydrogen fluoride and oxides of carbon and nitrogen.

Unusual Fire/Explosion Hazards: Class 1 dust exposure hazard.

6. ACCIDENTAL RELEASE MEASURES

Steps to be taken: Shovel or sweep up material and place in a container for disposal. Do not allow spill to enter waterways. Keep all sources of ignition away from the spill, and avoid creating dusty conditions when handling this material. If heavy dusting cannot be avoided, ground all equipment

Absorbents: None necessary due to product form and packaging.

Incompatibles: Not Available

7. HANDLING AND STORAGE

Handling: Avoid contact with eyes or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling. When engineering control is not feasible and employee exposure exceeds 1.4 mg/m,>3< wear a NIOSH approved pesticide respirator. When there is risk of exposure to eyes, wear dust proof goggles, overalls, and gloves.

Storage: Store in a cool, dry, secure place and keep container tightly closed. Store away from pets. Do not contaminate water, food or feed by storage. This product is formulated in oil bait. Prolonged exposure to air may turn oil rancid and reduce the attractiveness of the bait. Use within 3 months after opening.

8. EXPOSURE CONTROL / PERSONAL MEASURES

Exposure Limits: OSHA PEL Total dust 15/ms

Ventilation: Use with adequate ventilation during formulation process.

Personal Protective Equipment: Under ordinary use conditions, no special protection is required. If prolonged exposure is expected or adequate ventilation during formulation process can not be maintained, it is recommended to wear a MSHA/NIOSH approved organic vapor/pesticide respirator, impervious gloves, chemical goggles or safety glasses with side shields.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance and Odor: Yellow-tan, free flowing granules having an odor characteristic of vegetable oil.

Boiling Point: N/A

Melting Point: N/A

Vapor Pressure (mm Hg): N/A

Vapor Density (Air = 1): N/A

Specific Gravity: 0.31 gm/cc (19 lbs. per cubic foot)

Solubility: Insoluble

Evaporation Rate: N/A

pH: N/A

10. STABILITY AND REACTIVITY

Stability: Stable

Reactivity: Non-reactive

Incompatibility w/ Other Materials: Not available

Decomposition Products: Thermal decomposition may produce hydrogen fluoride and oxides of carbon and nitrogen.

Hazardous Polymerization: Will not occur

11. TOXICOLOGICAL INFORMATION

CHRONIC TOXICITY [Specific to Active Ingredient(s)]

A chronic toxicity study in rats with hydramethylnon did not demonstrate any compound-related clinical effects other than organ weight changes. The NOEL was determined to be 50 ppm.

DEVELOPMENTAL/REPRODUCTIVE TOXICITY [Specific to Active Ingredient(s)]
In a 2-generation developmental toxicity study with hydramethylnon in Sprague-Dawley rats, the male rat NOEL was determined to be 75 ppm based on male reproductive effects. No reproductive or developmental effects are expected at exposure levels associated with the use of this product.

MUTAGENICITY [Specific to Active Ingredient(s)]
Hydramethylnon has not been shown to be a mutagenic or carcinogenic compound.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL FATE [Active Ingredients Only]

Hydrolysis: Unknown

Photolysis: Unknown

Soil half life: Unknown

Water solubility: insoluble

ECOTOXICITY [Active Ingredients Only]

Acute Toxicity: Toxic to fish. Do not apply directly to water or areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing equipment wash waters. Do not apply when weather conditions favor drift from target areas.

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food, or feed by disposal. Open dumping is prohibited. Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility. Container Disposal: (Plastic) Triple rinse or (equivalent). Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state or local authorities, by burning. If burned, stay out of smoke. (Paper) Completely empty bag into application equipment. Then dispose of empty bag into a sanitary landfill, or by incineration, or if allowed by state or local authorities, by burning. If burned, stay out of smoke. General: Consult federal, state or local disposal authorities for approved alternative procedure.

14. TRANSPORT INFORMATION

DOT49CFR Description: Not Regulated

Freight Classification: Insecticides, N.O.I. OTHER THAN POISON NMFC I-102120 CL. 60

15. REGULATORY INFORMATION

CERCLA (Superfund): Not Regulated

RCRA: Not Regulated

SARA 311/312 HAZARD CATEGORIES

Immediate Health: Yes (irritation)

Delayed Health: No

Fire: No

Sudden Pressure: NO

Reactivity: NO

The information presented herein, while not guaranteed, was prepared by technically knowledgeable personnel and to the best of our knowledge is true and accurate. It is not intended to be all inclusive and the manner and conditions of use and handling may involve other or additional considerations.

24 74 012

MATERIAL SAFETY DATA SHEET

PRESCRIPTION TREATMENT® brand 565 PLUS XLO® Pressurized Contact Insecticide Formula 1

EMERGENCY PHONE NUMBERS:

MEDICAL: 800-225-3320 (PROSAR) **TRANSPORTATION:** 800-424-9300 (CHEMTREC)

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: PRESCRIPTION TREATMENT® brand 565 PLUS XLO® Pressurized Contact Insecticide Formula 1
EPA Reg. No.: 499-310
Product Code(s): 02-0567-1 (12 x 20 oz.)
EPA Signal Word: CAUTION
Distributed by: Whitmire Micro-Gen Research Laboratories, Inc.
3568 Tree Court Industrial Blvd.
St. Louis MO 63122-6682

SECTION 2. COMPOSITION/INFORMATION ON INGREDIENTS

COMPOSITION INFORMATION

ACTIVE INGREDIENTS (2.5%)	%	CAS NO.
Pyrethrins	0.25%	8003-34-7
Piperonyl Butoxide, Technical	1.00%	51-03-6
n-Octyl Bicycloheptene Dicarboximide	1.00%	113-48-4
d-trans Allethrin	0.25%	28057-48-9
OTHER INGREDIENTS* (97.5%)	**%**	**CAS NO.**
Dimethyl Ether	proprietary	115-10-6
Isoparaffinic Petroleum Solvent	< 10%	64742-48-9
Isopropanol	proprietary	67-63-0

* All ingredients may not be listed. Ingredients not listed do not meet the reporting requirements of the OSHA Hazard Communication Standard (HCS) as specified in 29 CFR 1910.1200.

EXPOSURE INFORMATION

	OSHA PEL		ACGIH TLV	
Material	**STEL**	**TWA**	**STEL**	**TWA**
Pyrethrins	NE	NE	10mg/m	5mg/m
Piperonyl Butoxide, Technical	NE	NE	NE	NE
n-Octyl Bicycloheptene Dicarboximide	NE	NE	NE	NE
d-trans Allethrin	NE	NE	NE	5mg/m
Dimethyl Ether*	NE	NE	NE	NE
Isoparaffinic Petroleum Solvent	500 ppm	NE	NE	NE
Isopropanol	NE	NE	NE	NE

* TWA recommended by ingredient supplier = 1000 ppm

SECTION 3. HAZARDS IDENTIFICATION

SIGNS/SYMPTOMS OF EXPOSURE

Prolonged exposure may cause skin irritation and drying of nose and throat.

ROUTES OF ENTRY

Primary: Skin **Secondary:** Inhalation **Tertiary:** Ingestion

HAZARDOUS DECOMPOSITION PRODUCTS

Thermal decomposition in open flame may result in carbon dioxide and carbon monoxide.

UNUSUAL FIRE, EXPLOSION AND REACTIVITY HAZARDS

Aerosol product - containers may rocket or explode in heat of fire.

SECTION 4. FIRST AID MEASURES

Have the product container or label with you when calling a poison control center or doctor or going for treatment. Describe any symptoms and follow the advice given.

Ingestion: Immediately call a poison control center or doctor. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give ANY liquid to the person. Do not give anything by mouth to an unconscious person.

Inhalation: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

Skin Contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Eye Contact: Hold eyes open and rinse slowly and gently for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. Call a poison control center or doctor for treatment advice.

Medical Conditions Generally Aggravated by Exposure: None known.

Emergency Telephone Number of Prosar: 800-225-3320 (for medical emergencies.)

SECTION 5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION

Flashpoint (TCC): < 20° F
Flame Extension: > 18"
Explodibility Limits in Air (% by volume):
Lower (LEL) = 3.4% Upper (UEL) = 18%
NFPA 30B Flammability: Level 1 Aerosol

UNUSUAL FIRE, EXPLOSION AND REACTIVITY HAZARDS

Aerosol product - Containers may rocket or explode in heat of fire.

IN CASE OF FIRE

Extinguisher Media: CO_2, Dry Chemical, Foam, Water fog.
Special Fire Fighting Procedures: Fight fire from maximum distance or protected area. Cool and use caution when approaching or handling fire-exposed containers. Fire fighters should wear self-contained breathing apparatus and protective clothing.

SECTION 6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR LEAK

If container begins to leak (through puncture, etc.), eliminate all ignition sources and allow to discharge completely in well ventilated area, then dispose of as directed below.

This product contains the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) listed chemical *Pyrethrins* which has a reportable quantity (RQ) of 1 lb. A release of more than 400 lbs. of this product (320 containers) is reportable to the National Response Center (800-424-8802).

Emergency Telephone Number of Chemtrec: (800) 424-9300 (for transportation spills)

PROTECTIVE EQUIPMENT FOR CLEANUP PERSONNEL

Eyes: Use proper protection – safety glasses as a minimum.
Skin: Wear chemical resistant gloves. (Good practice requires that gross amounts of any chemical be removed from the skin as soon as practical, especially before eating or smoking.)
Inhalation: If working in enclosed spaces, wear a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any R, P, or HE prefilter.

WASTE DISPOSAL METHOD

Take full or leaking containers to a local disposal company for biological treatment or incineration. Review all Local , State, and Federal regulations concerning health and pollution to determine approved disposal procedures. Do not contaminate water, food or feed by storage or disposal of wastes.

SECTION 7. HANDLING AND STORAGE

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Keep out of reach of children. CAUTION - Harmful if swallowed or absorbed through skin. Do not remain in treated area and ventilate the area after treatment is completed. Avoid breathing of vapor. Avoid contact with skin eyes or clothing. Wash thoroughly after using and before smoking or eating. Do not contaminate water, food or foodstuffs. Remove all pets and birds. Cover fish tanks or remove before treating. In hospitals, patients should be removed from room prior to treatment. Room should be ventilated for two hours after spraying. Do not return patients to room until after ventilation.

PHYSICAL OR CHEMICAL HAZARDS

Extremely flammable. Contents under pressure. Keep away from heat, sparks and open flame. Do not use this product in electrical equipment (where there is exposed wiring or contact points) due to possibility of short circuits and shock hazard. Do not puncture or incinerate container. Exposure to temperatures above 130° F may cause bursting.

STORAGE

Do not contaminate water, food or feed by storage. Store in a cool, dry area away from heat and open flame and inaccessible to children.

SECTION 8. EXPOSURE CONTROL / PERSONAL PROTECTION

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Respiratory Protection: For prolonged exposure or if used in enclosed areas, a NIOSH approved respirator with an organic vapor (OV) cartridge or canister with any R, P, or HE prefilter may be used.
Protective Gloves: Chemical resistant gloves are recommended if prolonged or repeated skin contact is likely. (Good practice requires that gross amount of any chemical be removed from the skin as soon as practical, especially before eating or smoking.)
Eye Protection: Use proper protection – safety glasses as a minimum.
Other Protective Equipment: None required.

PRESCRIPTION TREATMENT® brand 565 PLUS XLO® Pressurized Contact Insecticide Formula 1

VENTILATION
Local Exhaust: None required.
Mechanical: Provide adequate ventilation of treatment area.
Special: None required.
Other: None required.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Sprays as strong mist.
Solubility in Water: Slight
Viscosity: NE
Boiling Point: NE
pH: 6.8-7.2 @ 70° F
Odor: Characteristic Pyrethrin odor.
Vapor Pressure: 50 psig @ 70° F
Vapor Density: NE
Freezing/Melting Point: NE
Density: 0.99 g/ml @ 20° C

SECTION 10. STABILITY AND REACTIVITY

REACTIVITY
Stability: Indefinite when used according to label directions.
Conditions to Avoid: Do not spray into open flame or onto very hot surfaces.
Hazardous Polymerization: Will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS
Thermal decomposition in open flame may result in carbon dioxide and carbon monoxide.

SECTION 11. TOXICOLOGICAL INFORMATION

ROUTES OF ENTRY
Primary: Skin **Secondary:** Inhalation **Tertiary:** Ingestion

ACUTE
Eyes: Product produced slight reversible conjunctival irritation in rabbits. No corneal opacity or iritis was observed.
Skin: Prolonged exposure may cause skin irritation. Primary skin irritation index (rabbits) = 0.21. Acute dermal toxicity - LD_{50} > 2,000 mg/kg (rabbits).
Ingestion Acute oral toxicity - LD_{50} = 4,590 mg/kg (rats).
Inhalation: Unlikely due to product being pressurized and producing particles large enough not to be respirable. A few cases of extrinsic asthma from pyrethrin mixtures have been reported. Prolonged exposure may cause drying of nose and throat. Acute inhalation toxicity - LC_{50} > 6.33 mg/L (rats).

CHRONIC / CARCINOGENICITY
Neither this product nor any of its ingredients are classified as carcinogens by the National Toxicity Program (NTP), the International Agency for Research on Cancer (IARC) or the Occupational Safety and Health Administration (OSHA).

SECTION 12. ECOLOGICAL INFORMATION

This pesticide is highly toxic to fish. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Drift from treated areas may be hazardous to organisms in adjacent aquatic sites.

SECTION 13. DISPOSAL CONSIDERATION

Do not contaminate water, food or feed by disposal. Dispose of container and wastes in accordance with all Federal, state and local regulations.

Container Disposal: Do not puncture or incinerate! Empty container by using the product according to the label directions. Offer empty container for recycling, if available, or place in trash if allowed by state and local regulations. If container is partly full, contact your local solid waste agency or call 1-800-CLEANUP for disposal instructions.

SECTION 14. TRANSPORT INFORMATION

U.S. DOT CLASSIFICATION (U.S. Domestic Surface Transport)
Proper Shipping Name: Consumer Commodity
Hazard Class: ORM-D
Proper Shipping Description: NA
Package Marking: Consumer Commodity ORM-D

IMDG CLASSIFICATION (Ocean Transport)
Proper Shipping Name: Aerosols
Hazard Class: 2.1
UN I.D. NO.: UN 1950
Proper Shipping Description: Dangerous Goods in Limited Quantities of Class 2.1
Package Labeling: No label required.
Package Marking: Dangerous Goods in Limited Quantities of Class 2.1

ICAO/IATA CLASSIFICATION (Air Transport)
Proper Shipping Name: Aerosols, Flammable
Hazard Class: 2.1
UN I.D. NO.: UN 1950
Proper Shipping Description: Aerosols, Flammable, 2.1, UN 1950
Package Labeling: Flammable Gas
Package Marking: Aerosols, Flammable, UN 1950, LTD. QTY.
Packing Instruction: Y203, ERG code 10L

SECTION 15. REGULATORY INFORMATION

CERCLA
This product contains the CERCLA listed chemical *Pyrethrins* which has a reportable quantity (RQ) of 1 lb.

SARA TITLE III SECTION 311/312 HAZARD CLASS
This product has been reviewed according to the EPA "Hazard Categories" promulgated under Section 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Acute Health Hazard
Fire Hazard
Release of Pressure (Puncture) Hazard

SARA TITLE III SECTION 313 CHEMICALS
This product contains the following substances subject to the reporting requirements of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA Title III) and/or 40 CFR Part 372:

Piperonyl Butoxide, Technical	1.0% by weight

TSCA
All components of this product are listed or excluded from listing on the US Toxic Substance Control Act (TSCA) Chemical Substance Inventory.

SECTION 16. OTHER INFORMATION

NFPA HEALTH RATING INFORMATION
HEALTH - 1 FLAMMABILITY - 4 REACTIVITY - 1

HMIS HAZARD RATING INFORMATION
HEALTH - 1 FLAMMABILITY - 4 REACTIVITY - 1

KEY: 4 = Severe
3 = Serious
2 = Moderate
1 = Slight
0 = Minimal

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein.

Questions concerning the safe handling of the product should be referred to the Whitmire Micro-Gen Customer Service Department at 800-777-8570.

NA - Not Applicable
NE - Not Established
PEL - Permissible Exposure Limit
TLV - Threshold Limit Value
STEL - Short Term Exposure Limit (15 min.)
TWA - Time Weighted Average (8 hrs)

WHITMIRE MICRO-GEN
RESEARCH LABORATORIES, INC.

Effective Date: 4/30/03
Review Date: NA
Supersedes: 1/4/00
Code #: 089-069
Text ID: 030425-2
WMG Part #: 19-0781-2

MSDS Number: 000000000205

SUSPEND® SC INSECTICIDE

MSDS Version 1.2

SECTION 1. CHEMICAL PRODUCT AND COMPANY INFORMATION

Product Name	SUSPEND® SC INSECTICIDE
Chemical Name	
Synonym	
MSDS Number	205
Chemical Family	Mixture
Chemical Formulation	Mixture
EPA Registration No.	432-763
Canadian Registrat. No.	

Bayer Environmental Science
95 Chestnut Ridge Road
Montvale, NJ 07645
USA

For Product Use Information: (800)331-2867 Monday through Friday(CRLF) 8:00AM-4:30PM(CRLF) For Medical Emergency contact DART: (800) 334-7577 24 Hours/Day(CRLF) For Transportation Emergency CHEMTREC: (800) 424-9300 24 Hours/Day

SECTION 2. COMPOSITION/INFORMATION ON INGREDIENTS

Component Name	CAS No.	Concentration % by Weight	
		Minimum	Maximum
Deltamethrin	52918-63-5	4.7500	
Inert ingredients		95.2500	

SECTION 3. HAZARDS IDENTIFICATION

NOTE: Please refer to Section 11 for detailed toxicological information.

Emergency Overview Caution. Keep out of the reach of children. Harmful if inhaled. Contact with product may result in transient tingling and reddening of the skin. This product is extremely toxic to fresh water and estuarine fish and invertebrates.

Physical State liquid

Odor odorless

Appearance white

Routes of Exposure	Inhalation.
Immediate Effects	
Eye	May cause slight irritation.
Skin	Contact with product may result in transient tingling and reddening of the skin.
Inhalation	Harmful if inhaled.
Signs and Symptoms	Acute overexposure may result in respiratory irritation and transient paresthesia. Chronic overexposure produced pale kidneys and discoloration of the lungs in rats.

SECTION 4. FIRST AID MEASURES

Inhalation	Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth to mouth. Get medical attention.

SECTION 5. FIRE FIGHTING MEASURES

Flash Point	> 93 °C / > 199 °F
Suitable Extinguishing Media	carbon dioxide (CO2), dry chemical, foam, water
Fire Fighting Instructions	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH approved (or equivalent) and full protective gear.

SECTION 6. ACCIDENTAL RELEASE MEASURES

General and Disposal	Soak up with an absorbent material such as sand, sawdust, earth, fuller's earth, etc. Dispose of with chemical waste.

SECTION 7. HANDLING AND STORAGE

Handling Procedures	Avoid breathing vapors and spray mist.
Storing Procedures	Do not contaminate water, food, or feed by storage or disposal. Mix as needed. Store in original container in a secured, dry storage area. Avoid exposure to extreme temperatures. Prevent cross-contamination with other pesticides and fertilizers.
Work/Hygienic Procedures	Wash with soap and water after handling. Remove and wash contaminated clothing before re-use.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye/Face Protection	safety glasses or goggles
Body Protection	Long-sleeved shirt and long pants impervious gloves
Exposure Limits	None Established

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	white
Physical State	liquid
Odor	odorless
pH	6.6 in suspension
Specific Gravity	1.05 at 20 °C
Solubility (in water)	Suspends

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability	Stable
Conditions to Avoid	Keep away from sources of ignition.
Incompatibility	strong reducing agents strong oxidizing agents
Hazardous Products of Decomposition	Decomposition Type: thermal carbon dioxide (CO_2) carbon monoxide

Hazardous Polymerization (Conditions to avoid)	Will not occur

SECTION 11. TOXICOLOGICAL INFORMATION

Acute Oral Toxicity	Rat: LD50: > 15,000 mg/kg
Acute Dermal Toxicity	Rabbit: LD50: > 10,000 mg/kg
Acute Inhalation Toxicity	Rat: LC50: > 1.02 mg/l 4 h Rat: LC50: > 4.08 mg/l 1 h for DOT purposes
Skin Irritation	Rabbit: Slightly irritating
Eye Irritation	Rabbit: Very slightly irritating.
Sensitization	Guinea pig: Negative
Chronic Toxicity	Deltamethrin technical is not carcinogenic based on animal studies.

Assessment Carcinogenicity

ACGIH
None
NTP
None
IARC

Deltamethrin	52918-63-5	3

OSHA
None

Reproductive & Developmental Toxicity	Deltamethrin is not considered to be a reproductive toxin based on animal studies.
Teratogenicity	Deltamethrin is not considered to be teratogenic based on animal studies.

SECTION 12. ECOLOGICAL INFORMATION

Environmental Precautions	This product is extremely toxic to fresh water and estuarine fish and invertebrates. Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Use with care when applying in areas adjacent to any body of water. Do not contaminate water when disposing of equipment washwaters. This product is highly toxic to bees exposed to direct treatment or residues

remaining on the treated areas. Do not apply this product or allow drift when bees are actively visiting the treatment area. Do not apply it or allow it to drift to crops or weeds on which bees are actively foraging.

SECTION 13. DISPOSAL CONSIDERATIONS

General Disposal Guidance

Pesticide Disposal: Wastes resulting from use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal

Container One Gallon and Smaller: Wrap container in several layers of newspaper and discard in trash.

Non-refillable Container: Triple rinse (or equivalent). Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill or incineration, or if allowed by State and Local authorities, by burning. If burned, stay out of smoke.

Refillable Container: Replace the dry disconnect cap if applicable, and seal all openings which have been opened during use. Return empty container to a collection site designated by Bayer. If container has been damaged and cannot be returned according to the recommended procedures, contact Bayer to obtain proper handling instructions.

RCRA Classification

Not Regulated under this Statute

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME: Not DOT regulated

SECTION 15. REGULATORY INFORMATION

US Federal

EPA Registration No. 432-763

TSCA list

None

TSCA 12b export notification

None

SARA Title III - section 302 - notification and information

None

SARA Title III - section 313 - toxic chemical release reporting

None

US States Regulatory

CA Prop65

This product does not contain any substances known to the State of California to cause cancer.

This product does not contain any substances known to the State of California to cause reproductive harm.

US State right-to-know ingredients

None

Canadian Regulations

Canadian Registrat. No.

Canadian Domestic Substance List

None

Environmental

CERCLA

None

Clean Water Section 307 Priority Pollutants

None

Safe Drinking Water Act Maximum Contaminant Levels

None

International Regulations

EU Classification

Deltamethrin	52918-63-5	Toxic Dangerous for the environment
R Phrases	Also toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.	
S Phrases	Keep locked-up and out of the reach of children. Avoid contact with the skin. After contact with skin, wash immediately with plenty of water. Wear suitable protective clothing, gloves and eye/face protection. In case of insufficient ventilation, wear suitable respiratory equipment. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). This material and its container must be disposed of as hazardous waste. Avoid release to the environment. Refer to special instructions/safety data sheets.	

European Inventory of Existing Commercial Substances (EINECS)

Deltamethrin	52918-63-5

SECTION 16. OTHER INFORMATION

	Health	Flammability	Reactivity	Others
HMIS	1	1	0	B
NFPA	1	1	0	

REVISED SECTIONS:
MSDS REVISION INDICATOR: Company name change.

Print Date: 12/09/2002
Supersedes MSDS, which is older than: 12/09/2002

This information is provided in good faith but without express or implied warranty. Buyer assumes all responsibility for safety and use not in accordance with label instructions. The product names are registered trademarks of Bayer AG. Bayer Environmental Science

MATERIAL SAFETY DATA SHEET

Product Name: **M-Pede Insecticide/Fungicide**

Common Synonyms: Insecticidal Soap Concentrate
EPA Registration No.: Reg. No. 53219-6
Primary Hazards: Eye Irritant, Flammable

Contact: Mycogen Corporation
5501 Oberlin Drive
San Diego, CA 92121
1-800-745-7475

SECTION 1 - MATERIAL IDENTIFICATION

INGREDIENT 1

Common Name:	Potassium salts of fatty acids
Chemical Name:	Potassium salts of unsaturated aliphatic carboxylic acids
Molecular Formula:	Primarily Potassium oleate ($KC_{18}H_{34}O_2$)
CAS Number:	10124-65-9
Percent:	49%

INGREDIENT 2

Common Name:	Ethanol
Chemical Name:	Ethyl Alcohol
Molecular Formula:	C_2H_6O
CAS Number:	64-17-5
Percent:	36%

SECTION 2 - PHYSICAL DATA

Boiling Point:	Not Determined
Melting Point:	Not Determined
Vapor Pressure:	Not Determined
Specific Gravity:	0.93
Solubility in Water:	Highly Soluble
pH:	10.3
Appearance:	Clear amber liquid
Odor:	Lard-like odor

SECTION 3 FIRE AND EXPLOSION DATA

Flash Point:	16°C
Method:	Tag open cup
Extinguishing Media:	Water, alcohol foam, dry chemical, or carbon dioxide
Special Fire Fighting Procedures:	This product contains 36% alcohol which contributes to its flammability. Water should be sufficient to dilute the alcohol and extinguish the flame. If difficulty occurs, use an alcohol foam, dry chemical, or CO_2.
Unusual Fire and Explosion Hazards:	Flammable liquid.

SECTION 4 - REACTIVITY

Stability:	Stable
Hazardous Polymerization:	None likely
Materials to Avoid:	Concentrated mineral supplements (fertilizers), strong oxidizing agents.
Hazardous Decomposition Products:	Decomposition may produce carbon dioxide and carbon monoxide.

SECTION 5 - HEALTH HAZARD

Primary Route of Entry:	Dermal
Exposure Limit:	Ingredient 2 contains methanol. OSHA TLV for ethanol is 1000 ppm, for methanol 200 pp.
Corrosivity:	Not corrosive
Skin/Eye Irritation:	Mild skin irritant, irritating to eyes
Sensitization:	Not a sensitizer
Effects of Overexposure:	Prolonged or repeated exposure may be irritating to skin, eyes, and mucous membranes. Methanol can be fatal or cause blindness if swallowed in quantity; however, levels of methanol in this product are not expected to pose an ingestion hazard.

Toxicity: None of the components of this product are listed as carcinogenic by NTP, IARC, or OSHA

Acute Studies:

Oral LD50 (Rat):	> 5,000 mg/kg (low toxicity)
Dermal LD50 (Rabbit):	> 2,000 mg/kg (low toxicity)
Inhalation LC50 (Rat):	> 0.853 mg/L (low toxicity)

SECTION 6 - FIRST AID

Emergency First Aid Procedures:

If Swallowed:	Give demulcent (milk)
If Inhaled:	Remove to fresh air.
If In Eyes:	Flush eyes with plenty of water. See a physician if irritation persists.
If On Skin:	Wash affected area.

SECTION 7 - SPILL, LEAK AND DISPOSAL PROCEDURES

Steps To Be Taken In Case Material Is Released Or Spilled:

Do not breath vapor. Do not handle in confined spaces without adequate ventilation. If inadequate use suitable respirator.
Avoid contact with skin and eyes.

Contain leaking liquid with sand or other non-combustible absorbant and place in a clean container for disposal.

Waste Disposal Method:

Waste, including spills or rinsates, and leftover pesticide that cannot be used according to label instructions must be disposed of according to applicable federal, state, and local procedures.

SECTION 8 - SPECIAL HANDLING

Respiratory Protection:	Ensure good ventilation. Specific respiratory protection should not be necessary.
Protective Gloves:	Recommend wearing impervious gloves when repeated or prolonged exposure is likely.
Eye Protection:	Chemical safety goggles should be worn whenever there is the possibility of splashing or other contact with the eyes.

Although general guidance has been provided, the degree of protection required in a particular situation depends on factors such as concentration and duration. More detailed advice on protective devices is available from Mycogen.

SECTION 9 - SPECIAL PRECAUTIONS

Precautions To Be Taken In Handling And Storing:

Keep in original container, tightly closed in a safe place.
Empty container completely and dispose of safely.
Wash any contamination from skin or eyes immediately.
Remove any heavily contaminated clothing immediately.
Wash hands and exposed skin before eating, drinking, or smoking and after working with product. Do not use, store, spill or pour near heat or open flame.

Environmental Hazards:

This product may be hazardous to aquatic invertebrates. Do not apply directly to water, areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water by cleaning of equipment or disposal of water.

SECTION 10 - SHIPPING REGULATIONS

Proper Shipping Name	Ethanol Solutions
Description:	Ethanol Solutions, 3, UN 1170, PG II
DOT Label(s):	Flammable Liquid-3
Freight Classification:	Insecticides or Fungicides, Agricultural N.O.I., Other Than Poisons. NMFC 102120. Class 60.

SARA Title III Hazard Classification:

Immediate (acute) Health:	No
Delayed (chronic) Health:	No
Fire:	Yes
Sudden Release of Pressure:	No
Reactive:	No

National Fire Protection Association Rating:

Health:	1
Flammability:	3
Reactivity:	0

This information is provided in good faith but without express or implied warranty.

MYCOGEN CORPORATION

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CONTRAC® All-Weather Cake MSDS

MANUFACTURER'S ADDRESS:	PREPARED BY:	TELEPHONE NO:	EMERGENCY PHONE NOS:
BELL LABORATORIES, INC. 3699 KINSMAN BLVD. MADISON, WI 53704	PSM/CAR	(608) 241-0202	**Medical** (877) 854-2494 **Transportation (Spills)** (800) 424-9300 CHEMTREC
PRODUCT NAME: CONTRAC® All-Weather Cake			
USE: Anticoagulant Rodenticide	**BAIT FORM:** Formulated Dry Bait		**EPA REGISTRATION NO:** 12455-34

SECTION I. HAZARDOUS INGREDIENTS

INGREDIENT NAME	% BY WEIGHT	CURRENT TLV
Bromadiolone [3-[3-(4'-Bromo-[1,1'-biphenyl]-4-yl)-3-hydroxy-1-phenylpropyl]-4-hydroxy-2H-1-benzopyran-2-one] CAS No. 28772-56-7	0.005 %	N/A

This product contains no components subject to the reporting requirements of Section 313 of the Superfund Amendment and Reauthorization Act (SARA) of 1986

SECTION II. PHYSICAL DATA

APPEARANCE:	COLOR:	ODOR:	SPECIFIC GRAVITY:
Polygonal Block	Blue	Sweet, grain-like	0.629 gm/cc
VAPOR DENSITY:	**MELTING POINT:**	**WATER REACTIVITY:**	**EVAPORATION RATE:**
N/A	N/A	N/A	N/A
VAPOR PRESSURE:	**BOILING POINT:**	**SOLUBILITY:**	**BULK DENSITY:**
N/A	N/A	Not soluble in water	N/A

SECTION III. FIRE AND EXPLOSION DATA

FLASH POINT (Method Used):	FLAMMABLE LIMIT:	AUTOIGNITION TEMP:
N/A	**Upper Limit**: N/A **Lower Limit:** N/A	N/A

EXTINGUISHING MEDIA:
Extinguish with water, foam or inert gas

SPECIAL FIREFIGHTING PROCEDURES:
Firefighters should be equipped with protective clothing and self-contained breathing apparatus.

UNUSUAL FIRE OR EXPLOSION HAZARDS:
None

SECTION IV. REACTIVITY HAZARD DATA

STABILITY:	CONDITIONS TO AVOID:
Stable	None
POLYMERIZATION:	**CONDITIONS TO AVOID:**
Will not occur	None

INCOMPATIBILITY (MATERIALS TO AVOID):	HAZARDOUS DECOMPOSITION PRODUCTS:
Strongly alkaline materials	Oxides of carbon

SECTION V. TOXICITY DATA

LD50, ORAL (INGESTION):	LD50, DERMAL (SKIN CONTACT):	LC50, INHALATION:
>5000 mg/kg (rats)	> 5001 mg/kg (rats)	N/A
EYE IRRITATION:	**SKIN IRRITATION:**	**DERMAL SENSITIZATION:**
None (rabbits)	None (rabbits)	Not Considered a Sensitizer

SECTION VI. HEALTH HAZARDS

PRIMARY ROUTE OF ENTRY:	SIGNS & SYMPTOMS OF EXPOSURE:
Ingestion	Nausea, vomiting, loss of appetite, extreme thirst, lethargy, diarrhea, bleeding

EMERGENCY FIRST AID PROCEDURES:
Eyes: Flush with cool water for at least 15 minutes. If irritation develops, obtain medical assistance.
Skin: Wash with soap and water.
Ingestion: Call physician or emergency phone number immediately. Do not give anything by mouth or induce vomiting unless instructed by physician.
Inhalation: None.

NOTE TO PHYSICIAN: If ingested, administer Vitamin K_1 intramuscularly or orally as indicated by bishydroxycoumarin overdoses. Repeat as necessary as based upon monitoring of prothrombin times.

SECTION VII. CONTROL AND PROTECTIVE MEASURES

RESPIRATOR TYPE:
Not required

EYE PROTECTION:	GLOVES (Recommended):	VENTILATION:
Not required	Rubber Gloves	Not required

OTHER PROTECTIVE MEASURES:
Not required

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:
HEALTH: 1 (Caution) **FIRE**: 0 (Will not burn) **REACTIVITY**: 0 (Stable) **SPECIFIC HAZARD**: None

HAZARDOUS MATERIAL INFORMATION (HMIS) RATINGS:
HEALTH: 2 (Moderate) **FLAMMABILITY**: 0 (Minimal) **REACTIVITY**: 0 (Minimal) **PROTECTIVE EQUIPMENT:** B

SECTION VIII. SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN THE EVENT MATERIAL IS RELEASED OR SPILLED:
Sweep up spilled material, place in properly labeled container for disposal or re-use.

WASTE DISPOSAL METHOD:
Wastes resulting from use may be disposed of on-site or at an approved waste disposal facility. Dispose of all wastes in accordance with all Federal, state and local regulations.

SECTION IX. SPECIAL PRECAUTIONS AND STORAGE DATA

STORAGE TEMPERATURE:	AVERAGE SHELF LIFE:
Room temperature	Bait is stable for a minimum of 1 year when stored at room temperature

SPECIAL SENSITIVITY (HEAT, LIGHT, MOISTURE):
Avoid exposure to light and extreme humidity

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:
Store in a cool, dry place inaccessible to children, pets and wildlife. Keep container tightly closed when not in use. Avoid contamination of lakes, streams and ponds by use, storage or disposal. Wash thoroughly with soap and water after handling.

SECTION X. SHIPPING DATA

DOT SHIPPING NAME:	DOT HAZARD CLASSIFICATION:
None required	Non-hazardous
DOT LABELS REQUIRED:	**FREIGHT CLASSIFICATION:**
None required	LTL Class 60

WARRANTY: The information provided in this Material Safety Data Sheet has been obtained from sources believed to be reliable. Bell Laboratories, Inc. provides no warranties, either expressed or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your consideration and investigation. The user is responsible to ensure that they have all current data relevant to their particular use.

MONSANTO PRODUCT NAME

ROUNDUP® PRO Herbicide

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	ROUNDUP® PRO herbicide
Synonyms:	MON 65005
EPA Reg. No.:	524-475
Company ID:	Monsanto Company 800 North Lindbergh St. Louis, MO 63167, U.S.A.
Phone #s:	Emergency Phone Number (call collect): (314) 694-4000 Non-Emergency Information: 1-800-332-3111
Revisions:	Sections containing a revision or new information are marked with a ♣

MSDS Number: S00012732 **Date: November, 1995** **Supersedes: August, 1995**

2. COMPOSITION INFORMATION ON INGREDIENTS

Chemical Ingredients:

Active Ingredient: Glyphosate, N-(phosphonomethyl) glycine, in the form of its isopropylamine salt ..... 41.0 %

Inert Ingredients: (Including surfactant) ..... 59.0 %

100.0 %

Component	CAS Reg No	wt %
Glyphosate, isopropylamine salt	38641-94-0	41.0%
Phosphate ester neutralized polyethoxylated tallowamine	-----	14.5%

No Hazardous Chemicals Under OSHA Hazard Communication Standard (29 CFR §1910.1200).
No components subject to the reporting requirements of SARA §313.

See Section 8 for exposure limits.

3. HAZARDS IDENTIFICATION ♣

Emergency Overview:

Appearance & Odor: Clear, viscous amber-colored solution

Warning Statements: Keep out of reach of children.
CAUTION !
CAUSES EYE IRRITATION
REFORMULATION IS PROHIBITED
SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS

Potential Adverse Health Effects:

Likely Routes of Exposure: Skin contact and inhalation

Eye Contact: ROUNDUP® PRO herbicide may cause pain, redness and tearing based on toxicity studies.

Skin Contact: ROUNDUP® PRO herbicide is no more than slightly toxic and no more than slightly irritating based on toxicity studies.

Ingestion: ROUNDUP® PRO herbicide is no more than slightly toxic based on toxicity studies. No significant adverse health effects are expected to develop if only small amounts

(less than a mouthful) are swallowed. Ingestion of similar formulations has been reported to produce gastrointestinal discomfort with irritation of the mouth, nausea, vomiting and diarrhea. Oral ingestion of large quantities of one similar product has been reported to result in hypotension and lung edema.

Inhalation: ROUNDUP® PRO herbicide is no more than slightly toxic if inhaled based on toxicity studies.

4. FIRST AID MEASURES ♣

If In Eyes: Flush with plenty of water. Get medical attention if irritation persists.

NOTE: For additional human emergency first aid or treatment guidance, call collect, anytime, day or night (314) 694-4000.

5. FIRE FIGHTING MEASURES

Flash Point: >200°F **Method:** Pensky-Martens

Auto Ignition Temperature: Not determined

Extinguishing Media: Water spray, foam, dry chemical, CO_2, or any class B extinguishing agent.

Special Fire Fighting Procedures: Firefighters and others that may be exposed to vapors, mists, or products of combustion should wear full protective clothing and self-contained breathing apparatus. Equipment should be thoroughly cleaned after use.

Unusual Fire or Explosion Hazards: None

6. ACCIDENTAL RELEASE MEASURES

Observe all protection and safety precautions when cleaning up spills - See Exposure Controls/Personal Protection, Section 8.

Small Spills: For a spill less than one gallon on floor or other impervious surface, soak up with towels or other absorbent material and discard in the trash. Clean the spill area with soap and water and rinse the area thoroughly.

Large Liquid Spills on the floor or other impervious surface should be contained or diked and then absorbed with attapulgite, bentonite or other absorbent clays. Collect the contaminated absorbent, place in a metal drum and dispose of in accordance with the instructions provided under Disposal, Section 13 of this MSDS. Thoroughly scrub floor or other impervious surface with a strong industrial detergent and rinse with water.

Large spills that soak into the ground should be dug up, placed in metal drums and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Contact appropriate state agency when considering a land spreading disposal option.

Leaking containers should be separated from non-leakers and either the container or its contents transferred to a drum or other non-leaking container and disposed of in accordance with instructions provided under DISPOSAL, Section 13 of this MSDS. Any recovered spilled liquid should be similarly collected and disposed of.

7. HANDLING AND STORAGE ♣

Handling:

- Avoid contact with eyes or clothing.
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.

- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.
- Do not contaminate water when disposing of equipment washwaters.

Storage:

- Do not contaminate water, foodstuffs, feed or seed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Personal Protective Equipment:

Eye Protection: Workers handling the packaged concentrate should wear chemical safety goggles to prevent eye contact during mixing/transfer operations or other activities where there is potential for eye contact with the concentrated product. The wearing of goggles is not required during use of this product in accordance with label instruction.

Skin Protection: Wear appropriate protective clothing to prevent skin contact. Applicators and other handlers must wear long-sleeved shirt, long pants, shoes plus socks. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Respiratory Protection: *For Handling the Concentrated Product:* Avoid breathing vapor or mist. This product concentrate is not likely to pose an airborne exposure concern during manufacture or packaging. In the event of abnormal exposure conditions, use NIOSH/MSHA approved equipment. In work situations where an air purifying respirator is appropriate to be used, use of a full face respirator equipped with purifying elements for protection against organic vapor and dust/mist approved for pesticides is recommended. Use cartridges with NIOSH/MSHA approval number TC-23C or canister with NIOSH/MSHA approval number TC-14G. Full facepiece replaces the need for chemical goggles. Observe respirator use limitations specified by the manufacturers. Respiratory protection programs must comply with 29 CFR 1910.134.

For Use of Product in accordance with label instructions: Respirators are not required for use of ROUNDUP® PRO herbicide in accordance with label instructions.

Ventilation: No special precautions are recommended.

Exposure Guidelines:

Exposure Limits	OSHA PEL	ACGIH TLV
ROUNDUP® PRO	None established	None established

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: clear, viscous amber-colored solution
Odor: practically odorless to slight amine-like odor
Ph: 4.99 (1% solution)
Specific Gravity: 1.17 (Water = 1)

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

10. STABILITY AND REACTIVITY

Chemical Stability: Stable for at least 5 years under normal conditions of warehouse storage.

Conditions to Avoid: None

Incompatibility with Other Materials: Spray solutions of this product should be mixed, stored or applied using only stainless steel, aluminum, fiberglass, plastic or plastic-lined containers.

DO NOT MIX, STORE OR APPLY THIS PRODUCT OR SPRAY SOLUTIONS OF THIS PRODUCT IN GALVANIZED OR UNLINED STEEL (EXCEPT STAINLESS STEEL) CONTAINERS OR SPRAY TANKS. This product or spray solutions of this product react with such containers and tanks to produce hydrogen gas which may form a highly combustible gas mixture. This gas mixture could flash or explode, causing serious personal injury, if ignited by open flame, spark, welder's torch, lighted cigarette or other ignition source.

Hazardous Decomposition Products: None

Hazardous Polymerization: Does not occur. This product can react with caustic (basic) materials to liberate heat. This is not a polymerization but rather a chemical neutralization in an acid base reaction.

11. TOXICOLOGICAL INFORMATION ♣

Data from laboratory studies conducted by Monsanto with ROUNDUP® PRO herbicide are summarized below:

Single exposure (acute) studies indicate:

Oral - Rat LD_{50} - >5,000 mg/kg; FIFRA Category IV

Dermal - Rat LD_{50} - >5,000 mg/kg; FIFRA Category IV

Inhalation - Rat LC_{50} (4-hr. exp.) - 4.2 mg/l; FIFRA Category IV; Not DOT poisonous

Eye Irritation - Rabbit; moderately irritating.; all animals free of irritation by day 7, FIFRA Category III

Skin Irritation - Rabbit (4-hr. exp.); slightly irritating; PII - 0.63/8.0, all animals free of irritation by day 7, FIFRA Category IV

No skin allergy was observed in guinea pigs following repeated skin exposure.

COMPONENTS

Data from laboratory studies conducted by Monsanto and from the scientific literature on components of ROUNDUP® PRO herbicide:

Isopropylamine Salt of Glyphosate

Data from studies with a formulation comprised of 62% isopropylamine salt of glyphosate (MON 0139) indicate the following:

In repeat dosing studies (6-month), dogs fed MON 0139 exhibited slight body weight changes. Following repeated skin exposure (3-week) to MON 0139, skin irritation was the primary effect in rabbits.

Additional toxicity information is available on glyphosate, the active herbicidal ingredient of MON 0139. Following repeated exposures (90-days) to glyphosate in their feed, decreased weight gains were noted at the highest test level in mice, while no treatment-related effects occurred in rats. Following repeated skin exposure (3 weeks) to glyphosate, slight skin irritation was the primary effect observed in rabbits. No skin allergy was observed in guinea pigs following repeated skin exposure. There was no evidence of effects on the nervous system, including delayed effects in chickens (repeat oral doses) or cholinesterase inhibition in rats (single oral doses). Reduced body weight gain and effects on liver tissues were observed with long-term (2-year) feeding of glyphosate to mice at high-dose levels. Reduced body weight gain and eye changes were observed at the high-dose level in one long-term (2

year) feeding study with rats, while no treatment-related effects occurred in a second study. No adverse effects were observed in feeding studies with dogs. Glyphosate did not produce tumors in any of these studies. **Based on the results from the chronic studies, EPA has classified glyphosate in category E (evidence of non-carcinogenicity for humans).** No birth defects were noted in rats and rabbits given glyphosate orally during pregnancy, even at amounts which produced adverse effects on the mothers. Glyphosate was fed continuously to rats at very high dose levels for 2 successive generations. Toxicity was reported in offspring from the high dose, a level which also produced adverse effects on the mothers. In a 3 generation study conducted at lower dose levels, no effects were seen on the ability of male or female rats to reproduce. Glyphosate has produced no genetic changes in a variety of standard tests using animals and animal or bacterial cells.

12. ECOLOGICAL INFORMATION

Aquatic and Avian studies with this product have not been conducted at this time. However, an extensive database of studies exists for the active ingredient glyphosate. These studies indicate that glyphosate ranges from practically non-toxic to slightly toxic in a variety of aquatic and avian species. For glyphosate MSDS or additional information, contact Monsanto at 1-800-332-3111.

13. DISPOSAL CONSIDERATIONS

Wastes resulting from the use of this product that cannot be used or chemically reprocessed should be disposed of in a landfill approved for pesticide disposal or in accordance with applicable Federal, state or local procedures.

Emptied container retains vapor and product residue. Observe all labeled safeguards until container is cleaned, reconditioned or destroyed.

14. TRANSPORT INFORMATION

Follow the precautions indicated in the Handling and Storage Section, Section 7 of this MSDS.

DOT Proper Shipping Name: Not Applicable

DOT Hazard Class/I.D. No.: Not Applicable

DOT Label: Not Applicable

U.S. Surface Freight Classification: Weed killing compound, N.O.I.B.N.

15. REGULATORY INFORMATION

SARA Hazard Notification:

Hazard Categories Under Criteria of SARA Title III Rules (40 CFR Part 370): Immediate

Section 313 Toxic Chemical(s): Not Applicable

Hazardous Chemicals Under OSHA Hazard Communication Standard (29 CFR §1910.1200): None

Reportable Quantity (RQ) under U.S. CERCLA: Not Applicable

TSCA Inventory: All components are on the US EPA's TSCA Inventory List

APPENDIX B

SAMPLE MONTHLY PESTICIDE USE REPORT

MONTHLY SUMMARY PESTICIDE USE REPORT

OPERATOR (FIRM NAME)	ADDRESS	CITY	ZIP CODE	PHONE NUMBER
ORANGE COUNTY VECTOR CONTROL DISTRICT	**13001 Garden Grove Blvd.**	**Garden Grove**	**92843**	**(714) 971-2421 X102**

OPERATOR IDENTIFICATION / PERMIT NUMBER	LICENSE NUMBER	COUNTY (WHERE APPLIED)	COUNTY NUMBER	MONTH/YEAR OF USE	TOTAL NUMBER OF APPLICATIONS
30-11-301152		**ORANGE**	**30**	**May-12**	**#REF!**

1. Complete Columns A,B,C, and D for All Users

2. Complete Column E by Using One of the Following Codes

Code 10 - Structural Pest Control……. includes any pest control work performed within or on buildings and other structures.
Code 30 - Landscape Maintenance Pest Control……. includes any pest control work performed on landscape plantings around residences, or other buildings, golf courses, parks, cemeteries, etc.
Code 40 - Right-of-Way Pest Control……. includes any pest control work performed along roadsides, power lines, median strips, ditch banks and similar sites.
Code 50 - Public Health Pest Control……. includes any pest control work performed by or under contract with State or local public health or vector control agencies.
Code 80 - Vertebrate Pest Control……. includes any vertebrate pest control work performed by public agencies or work under the supervision of the State or county agricultural commissioner.
Code 91 - Commodity Fumigation (Nonfood/Nonfeed)……..... includes fumigation of nonfood/nonfeed commodities such as: pallets, dunnage, furniture, burlap bags, etc.
Code 100 - Regulatory Pest Control……..... includes any pest control work performed by public employees or contractors in the control of regulated pests.

3. Complete Columns F and G, if Use Does not Fit one of the Above Codes

A MANUFACTURER AND NAME OF PRODUCT APPLIED	B EPA/CALIFORNIA REGISTRATION NUMBER FROM LABEL - INCLUDE ALPHA CODE	C TOTAL PRODUCT USED (CIRCLE ONE UNIT OF MEASURE)	D NUMBER OF APPLICATIONS	E CODE	F COMMODITY OR SITE TREATED	G ACRES/UNITS TREATED
BELL LABORATORIES, INC. **CONTRAC CAKE .005%**	12455-34	(LB) OZ PT QT GA		50		
BVA OILS **BVA-2**	70589-1	LB OZ PT QT (GA)		50		
VALENT BIOSCIENCES **VECTOBAC G 2.8%**	73049-10	(LB) OZ PT QT GA		50		
WELLMARK INTERNATIONAL **ALTOSID BRIQUETS 8.62%**	2724-375	(LB) OZ PT QT GA		50		
WELLMARK INTERNATIONAL **ALTOSID PELLETS 4.25%**	2724-448	(LB) OZ PT QT GA		50		
WELLMARK INTERNATIONAL **ALTOSID XR BRIQUETS 2.1%**	2724-421	(LB) OZ PT QT GA		50		
COGNIS CORPORATION **AGNIQUE MMF**	53263-28	LB (OZ) PT QT GA		50		
CLARKE MOSQUITO CONTROL **NATULAR 2EC**	8329-82	LB (OZ) PT QT GA		50		
CLARKE MOSQUITO CONTROL **AQUA-ANVIL**	1021-1807-8329	LB OZ PT QT (GA)		50		
VALENT BIOSCIENCES **VECTOBAC 12AS 11.61%**	73049-38	LB OZ PT QT (GA)		50		
VALENT BIOSCIENCES **VECTOLEX WDG 51.2%**	73049-57	(LB) OZ PT QT GA		50		

REPORT PREPARED BY: JOHN NEWTON

DATE: MAY 12, 2012

MONTHLY SUMMARY PESTICIDE USE REPORT

OPERATOR (FIRM NAME)	ADDRESS	CITY	ZIP CODE	PHONE NUMBER
ORANGE COUNTY VECTOR CONTROL DISTRICT	**13001 Garden Grove Blvd.**	**Garden Grove**	**92843**	**(714) 971-2421 X102**

OPERATOR IDENTIFICATION / PERMIT NUMBER	LICENSE NUMBER	COUNTY (WHERE APPLIED)	COUNTY NUMBER	MONTH/YEAR OF USE	TOTAL NUMBER OF APPLICATIONS
30-11-301152		**ORANGE**	**30**	**May-12**	**#REF!**

1. Complete Columns A,B,C, and D for All Users

2. Complete Column E by Using One of the Following Codes

Code 10 - Structural Pest Control……. includes any pest control work performed within or on buildings and other structures.
Code 30 - Landscape Maintenance Pest Control……. includes any pest control work performed on landscape plantings around residences, or other buildings, golf courses, parks, cemeteries, etc.
Code 40 - Right-of-Way Pest Control……. includes any pest control work performed along roadsides, power lines, median strips, ditch banks and similar sites.
Code 50 - Public Health Pest Control……. includes any pest control work performed by or under contract with State or local public health or vector control agencies.
Code 80 - Vertebrate Pest Control……. includes any vertebrate pest control work performed by public agencies or work under the supervision of the State or county agricultural commissioner.
Code 91 - Commodity Fumigation (Nonfood/Nonfeed)……..... includes fumigation of nonfood/nonfeed commodities such as: pallets, dunnage, furniture, burlap bags, etc.
Code 100 - Regulatory Pest Control……..... includes any pest control work performed by public employees or contractors in the control of regulated pests.

3. Complete Columns F and G, if Use Does not Fit one of the Above Codes

A MANUFACTURER AND NAME OF PRODUCT APPLIED	B EPA/CALIFORNIA REGISTRATION NUMBER FROM LABEL - INCLUDE ALPHA CODE	C TOTAL PRODUCT USED (CIRCLE ONE UNIT OF MEASURE)	D NUMBER OF APPLICATIONS	E CODE	F COMMODITY OR SITE TREATED	G ACRES/UNITS TREATED
DuPONT **ADVION FAB**	352-627	(LB) OZ PT QT GA		50		
WELLMARK INTERNATIONAL **EXTINGUISH PLUS**	2724-496	(LB) OZ PT QT GA		50		
VALENT USA CORPORATION **DISTANCE FAB**	1021-1728-59639	(LB) OZ PT QT GA		50		
BASF CORPORATION **AMDRO .73%**	241-322	(LB) OZ PT QT GA		50		
VALENT BIOSCIENCES **VECTOBAC GS 2.8%**	73049-10	(LB) OZ PT QT GA		50		
MONSANTO **AQUA MASTER**	524-343	LB (OZ) PT QT GA		50		
VALENT BIOSCIENCES **VECTOLEX CG 7.5%**	73049-20	(LB) OZ PT QT GA		50		
		LB OZ PT QT GA		50		
		LB OZ PT QT GA		50		
		LB OZ PT QT GA		50		
		LB OZ PT QT GA		50		

REPORT PREPARED BY: JOHN NEWTON

DATE: MAY 12, 2012

APPENDIX C

MITIGATION MONITORING AND REPORTING PROGRAM

MITIGATION MONITORING AND REPORTING PROGRAM

ORANGE COUNTY VECTOR CONTROL DISTRICT
MITIGATION MONITORING FORM #1

ISSUE: POTENTIAL IMPACTS OF MOSQUITO PESTICIDE APPLICATION

Impact Bio-1: The use of certain mosquito control products may adversely affect listed rare or endangered species if used within occupied habitat.

Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.

The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. The District biologist and supervisor shall also meet with USFWS personnel on an annual basis at the beginning of the treatment season to receive updated occurrence information and to review potential impacts from District activities to listed species and critical habitats. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas, as recommended by USFWS. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats.

LEAD AGENCY: OCVCD

IMPLEMENTED BY: OCVCD

MONITORED BY: OCVCD

COMPLIANCE VERIFICATION: OCVCD

FUNDED BY: OCVCD

MONITORING ACTION AND FREQUENCY: annual

PERFORMANCE STANDARDS:

MONITORING RECORD:

Date	Signature of Monitor	% of Completion	Action/Accomplishment

ORANGE COUNTY VECTOR CONTROL DISTRICT
MITIGATION MONITORING FORM #2

ISSUE: POTENTIAL IMPACTS OF MOSQUITO PESTICIDE APPLICATION

Impact Bio-2: Application of petroleum distillate oils in habitats where Light-footed Clapper Rails are present is likely to significantly adversely affect this species and may impact other species of wetland nesting birds.

Mitigation Measure Bio-2: Prohibit petroleum distillate use within natural wetlands and waterways draining into intertidal areas to protect Light-footed Clapper Rail.
The District shall develop and adopt a BMP that prohibits use of petroleum distillate oils within natural marshes or wetlands that flow into intertidal areas to reduce the impacts to Light-footed Clapper Rail and other marsh nesting birds in these habitats.

LEAD AGENCY: OCVCD

IMPLEMENTED BY: OCVCD

MONITORED BY: OCVCD

COMPLIANCE VERIFICATION:

FUNDED BY: OCVCD

MONITORING ACTION AND FREQUENCY:

PERFORMANCE STANDARDS:

MONITORING RECORD:

Date	Signature of Monitor	% of Completion	Action/Accomplishment

ORANGE COUNTY VECTOR CONTROL DISTRICT
MITIGATION MONITORING FORM #3

ISSUE: POTENTIAL IMPACTS OF BIOLOGICAL CONTROL OF MOSQUITOES USING MOSQUITOFISH

Impact Bio-3: Distribution of mosquitofish by OCVCD to the public and subsequent unintended releases into natural environments has potential to adversely affect listed species of invertebrates, amphibians and/or fish in Orange County.

<u>Mitigation Measure Bio-3: Limit mosquitofish release to isolated artificial systems.</u> Mosquitofish shall only be introduced into isolated systems that are not connected to natural waterways to prevent inadvertent introduction of mosquitofish into natural ecosystems by the District. Determination of whether a system is isolated or not shall be made by OCVCD supervisory personnel, with the assistance of the GIS Mapping Department. If a determination cannot be made regarding the connectivity of a system to natural waterways, the system shall not be treated with mosquitofish.

LEAD AGENCY: OCVCD

IMPLEMENTED BY: OCVCD

MONITORED BY: OCVCD

COMPLIANCE VERIFICATION: OCVCD

FUNDED BY: OCVCD

MONITORING ACTION AND FREQUENCY: as needed during treatment season

PERFORMANCE STANDARDS:

MONITORING RECORD:

Date	Signature of Monitor	% of Completion	Action/Accomplishment

ORANGE COUNTY VECTOR CONTROL DISTRICT
MITIGATION MONITORING FORM #4

ISSUE: POTENTIAL IMPACTS OF VEGETATION MANAGEMENT

Impact Bio-4: Vegetation management incidental to surveillance and control operations and intrusion of vector control inspectors into occupied habitat may adversely impact listed shrub-nesting birds if performed during the breeding season or adversely impact their breeding habitat.

Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than ~~3 days~~ 48 hours prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. Flagging will be removed as soon as work is complete to avoid attracting predators to nests. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists, consult with agencies if necessary, and conduct an~~d~~y necessary pre-activity surveys for special-status species to avoid them.

LEAD AGENCY: OCVCD

IMPLEMENTED BY: OCVCD

MONITORED BY: OCVCD

COMPLIANCE VERIFICATION: OCVCD

FUNDED BY: OCVCD

MONITORING ACTION AND FREQUENCY: as needed

PERFORMANCE STANDARDS:

MONITORING RECORD:

Date	Signature of Monitor	% of Completion	Action/Accomplishment

ORANGE COUNTY VECTOR CONTROL DISTRICT
MITIGATION MONITORING FORM #5

ISSUE: POTENTIAL EFFECTS OF RODENTICIDE USAGE

Impact Bio-5: Application of the rodenticide, bromadiolone, has potential to adversely impact some listed wildlife species.

See Mitigation Measure Bio-1. The District's current BMPs help reduce the risk of significant adverse impacts to listed species to bromadiolone. However, the incidence and impact of secondary poisoning is difficult to evaluate because of lack of data. Mitigation Measure Bio-1 increases the ability of the District to avoid areas adjacent to habitat for listed species within Orange County by improving the ability of the District to detect where certain treatments or activities may be less favorable or where more caution is needed because of the presence or likely presence of rare or threatened or endangered species. This mitigation will also reduce the potential for bromadiolone applications to adversely impact listed species to less than significant.

LEAD AGENCY: OCVCD

IMPLEMENTED BY: OCVCD

MONITORED BY: OCVCD

COMPLIANCE VERIFICATION: OCVCD

FUNDED BY: OCVCD

MONITORING ACTION AND FREQUENCY: See Mitigation Measure Bio-1

PERFORMANCE STANDARDS:

MONITORING RECORD:

Date	Signature of Monitor	% of Completion	Action/Accomplishment

VOLUME II – PUBLIC DRAFT EIR

EXECUTIVE SUMMARY

This Program Environmental Impact Report (PEIR) has been prepared to cover ongoing activities of the Orange County Vector Control District (OCVCD or "District"), an independent special district charged with protecting citizens of Orange County from vectors (i.e., any insect or other organism capable of harboring and transmitting agents of human disease) and vector-borne diseases. Originally established in 1947 as the Orange County Mosquito Abatement District, the District's name was changed to the Orange County Vector Control District in 1975 and its services expanded from control of mosquitoes and surveillance of mosquito-borne diseases to include control of flies and rodents and surveillance of bubonic plague. Control of red imported fire ants (RIFA) was later added to the District's operations in 2004. The District currently provides services primarily to residents of Orange County but also provides vector control under contract to the University of California at Irvine, the San Joaquin Marsh of the University of California Natural Reserve System, Orange County Sanitation District, the Irvine Ranch Water District, the California State Lands Commission and the Naval Weapons Station at Seal Beach. The District is funded by property taxes, a service fee added in 1990-1991, and an assessment for control of red imported fire ants and enhanced vector-borne disease surveillance under Proposition 218, which was approved by the voters in July 2004.

The District has developed and adopted Integrated Vector Management practices to guide control programs for targeted species. Species targeted by the District include many species within several genera of mosquitoes that are vectors of serious diseases, such as West Nile, Saint Louis and Western equine encephalitis viruses, or nuisance species; the non-native roof rat (*Rattus rattus*), which can spread diseases such as bubonic plaque and fleaborne typhus; the red imported fire ant (*Solenopsis invicta*), an exotic species with a very painful sting; and filth flies and black flies, a group of flies that create nuisance conditions and bite humans. Integrated Vector Management practices include surveillance for vectors and disease, source reduction to limit breeding by vectors, education of the public in ways to aid source reduction and protect against disease-carrying vectors, and control of vector species using both chemical and biological agents.

The OCVCD uses a combination of physical inspections, trapping of vector species, remote sensing, and laboratory tests to establish the extent of vector populations and potential disease organisms. Information from field inspections is supplemented by contacts from the public about the presence and numbers of vectors and hosts. When vector populations surpass established thresholds and cannot be controlled with source reduction alone, the District applies chemical or biological control agents to reduce vector populations. Chemicals are rotated to reduce development of resistance in vectors and applied strictly according to label and safety requirements established by the U.S. Environmental Protection Agency and the California Department of Pesticide Regulation. The District has a general permit from State Water Resources Board (Order No. 2011-002-DWQ; General Permit No CAG 990004) for the application of mosquito pesticides to waterways and is a member of the Mosquito and Vector Control Districts' Monitoring Coalition, which has recently been instituted to monitor effects of chemical mosquito control on water quality. The District's program is overseen and monitored by the California Department of Public Health and the County Agricultural Commissioner.

CEQA/NEPA Process

Mosquito and vector control districts in California were established prior to the enactments of the National Environmental Policy Act (NEPA) in 1969 and the California Environmental Quality Act (CEQA) in 1970 and have been historically considered exempt from CEQA and NEPA analysis. However, recent federal court cases have raised questions about the potential effects upon rare and endangered species and water quality from habitat management activities and from pesticides. In 2001, the 9th Circuit Federal Court issued the first of three decisions (*Headwaters Inc. v. Talent Irrigation District*) that pesticides applied to waters of the United States constitute chemical wastes or biological material under the Clean Water Act, which resulted in the adoption of an order requiring National Pollution Discharge Elimination System (NPDES) permits for the public health use of larvicides (pesticides to kill larval mosquitoes) by the California State Water Resources Control Board (SWRCB). A 2009 6th Circuit Federal Appeals Court decision (*National Cotton Council v. United States Environmental Protection Agency; USEPA*) required NPDES permits for the use of pesticides to kill adult mosquitoes (adulticides) for public health.

The District is preparing this Environmental Impact Report (EIR)/Environmental Impact Study (EIS) to serve as a basis for any future state or federal permits required for their operations and to disclose to the public the nature of the District's activities and their potential effects on the environment.

The CEQA/NEPA process was initiated by preparation of an Initial Study to determine if there were gaps in information on environmental issues and to assess the extent of potentially adverse environmental impacts. The Initial Study revealed that there are potential adverse impacts from the District's programs in the areas of Air Quality, Biology, Water Quality, Greenhouse Gases, and Hazardous Materials; these areas are the focus of the program EIR/EIS.

Potential Areas of Controversy

Potential areas of controversy include concerns of the public about exposure to toxic chemicals and the effect of these chemicals on human health and health of rare and endangered wildlife and other organisms such as honeybees.

Alternatives

Three alternatives are discussed in this PEIR. Alternative 1, the "No Project" Alternative is a continuation of the present programs of the District and is the preferred alternative.

The current District program includes the following main activities that are analyzed within this PEIR:

Mosquitoes

- Monitoring and estimating mosquito populations;
- Surveillance of West Nile virus and other arboviruses (viruses transmitted by arthropod vectors) in mosquitoes, trapped wild Mourning Doves (*Zenaida macroura*), House Finches (*Carpodacus mexicanus*), House Sparrows (*Passer domesticus*) and American Crows (*Corvus brachyrhynchos*).

[Note: The District no longer uses sentinel chicken flocks, but some results from previous chicken flock surveillance are reported within the document].

- Source reduction by vegetation management with hand-held tools to increase water flow and emptying of artificial containers;
- Use and distribution of mosquitofish (*Gambusia affinis*) to the public for biological control of mosquitoes in unmaintained ornamental ponds and swimming pools;
- Chemical treatment with various larvicides (pesticides to kill larval mosquitoes, predominantly methoprene, water surface films, and bacterial larvicides) applied at ground level with truck-mounted or hand-held sprayers or very occasionally via helicopter;
- Application of adulticides (pesticides to kill adult mosquitoes, predominantly synthetic pyrethroids) to marsh habitats and inside underground storm drains using ultra-low volume (ULV) sprayers mounted on trucks;
- Public education about diseases risks and source reduction methods and responding to service requests made by the public;
- Surveillance activities and application of mosquito pesticides occasionally involve vegetation management with hand-held tools or limited use of an herbicide along upland trails to maintain access to treatment areas.

RIFA

- Surveillance of RIFA colonies using baited traps and information from public complaints;
- Treatment of RIFA colonies with a number of red imported fire ant baits (pyriproxifen, s-methoprene, indoxacarb, hydramethylnon);
- Public education;

Rodents

- Surveillance of roof rat populations through trapping and observation of sign;
- Surveillance of rodent-borne diseases within the County;
- Source reduction by public education on removal of harborage areas and conditions favorable to rats;
- Placement of rodenticide baits (bromadiolone) in tamper resistant bait stations on private residential properties only;

Flies

- Surveillance of filth and black fly populations through identification of larval sources and public complaints;

- Control of populations through source reduction of decaying organic matter or conditions favorable to fly generation;
- Chemical control of flies with pyrethroids in very rare instances of extreme nuisance conditions.

A second alternative, Alternative 2, is the elimination of or reduction in the application of chemical pesticides. Scenarios examined under this alternative include elimination of all pesticide application, discontinuation of ground-based ultra-low volume pesticide applications over marsh areas and/or in the underground storm drain systems, discontinuation of application of larvicides in natural waterways, and discontinuation of the use of red imported fire ant and rodenticide baits. None of the scenarios considered presented clear significant environmental benefits over the current program when weighed against the potential risks to human health by eliminating some or all of the chemical control of vectors. In addition, the use of the pesticides currently applied by the District for public health is a small fraction of the overall pesticide usage in Orange County and their elimination would not significantly decrease the amount of these pesticides in the environment.

Additional alternatives were considered but rejected as infeasible. They include a no vector control alternative, use of only biological organisms for control, and use of abatement proceedings to accomplish vector control.

Findings of Significance

The assessment for the Initial Study eliminated a number of areas of potential environmental effects because the project does not include new construction, any changes in land form or land use, or significant changes in activities. The project, as proposed, is a continuation of ongoing policies and activities.

None of the District's operations or policies induces, facilitates or stimulates growth. No major changes in activities or practices are currently being considered that would create additional impacts under the preferred alternative.

Because the current pesticides applied by the District are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they are unlikely to accumulate or produce long-term impacts. Current information suggests that impacts to water quality or the water supply from vector control pesticide applications are unlikely. The formation of the Mosquito and Vector Control Association of California (MVCAC) Monitoring Coalition to oversee water quality monitoring in conjunction with the issuance of the NPDES General Permits for application of mosquito larvicides and adulticides to waters of the U.S. offers additional assurance that water quality impacts will be detected and addressed should they be found to occur.

None of the active ingredients used by OCVCD is expected to have significant adverse effects on human health when applied as specified on the product labels as in the current vector control program. Based on studies by USEPA and several universities, there will be no cumulative impacts to human health with continued use of the pesticides at label rates and in the manner specified by USEPA. The District should continue to follow best management practices (BMPs) to protect human health.

The air quality and greenhouse gas impacts of the OCVCD will continue at below action threshold levels for the South Coast Air Quality Management District and are not cumulatively considerable. While the OCVCD is limited in its ability to reduce vehicle miles traveled as part of vector control operations, the policies of the program, such as upgrading and converting its fleet to alternative fuels and electric vehicles, are consistent with measures to reduce air pollutants including greenhouse gases.

No potentially significant impacts to urban and rural land uses would result from Alternatives 1 & 2. The District's operations do not have a significantly incremental or cumulative impact upon public services.

While scientific literature suggests District activities are unlikely to adversely affect non-endangered wildlife or plants significantly, several activities of the District were identified as having potential to adversely impact rare and endangered species or their habitats. The following impacts were identified, and mitigations were developed to reduce the impacts to less than significant:

Impact Bio-1: The use of certain mosquito control products may adversely affect listed rare or endangered species if used within occupied habitat.

Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.
The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats.

Impact Bio-2: Application of petroleum distillate oils in habitats where Light-footed Clapper Rails are present is likely to significantly adversely affect this species and may impact other species of wetland nesting birds.

Mitigation Measure Bio-2: Prohibit petroleum distillate use within natural wetlands and waterways draining into intertidal areas to protect Light-footed Clapper Rail.
The District shall develop and adopt a BMP that prohibits use of petroleum distillate oils within natural marshes or wetlands that flow into intertidal areas to reduce the impacts to Light-footed Clapper Rail and other marsh nesting birds in these habitats.

Impact Bio-3: Distribution of mosquitofish by OCVCD to the public and subsequent unintended releases into natural environments has potential to adversely affect listed species of invertebrates, amphibians and/or fish in Orange County.

Mitigation Measure Bio-3: Limit mosquitofish release to isolated artificial systems.
Mosquitofish shall only be introduced into isolated systems that are not connected to natural waterways to prevent inadvertent introduction of mosquitofish into natural ecosystems by the District. Determination of whether a system is isolated or not shall be made by OCVCD supervisory personnel, with the assistance of the GIS mapping department. If a determination cannot be made regarding the connectivity of a system to natural waterways, the system shall not be treated with mosquitofish.

Impact Bio-4: Vegetation management incidental to surveillance and control operations and intrusion of vector control inspectors into occupied habitat may adversely impact listed shrub-nesting birds if performed during the breeding season or adversely impact their breeding habitat.

Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should vegetation work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than 3 days prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists and conduct any necessary pre-activity surveys for special-status species to avoid them.

Impact Bio-5: Application of the rodenticide, bromadiolone, has potential to adversely impact some listed wildlife species.

See Mitigation Measure Bio-1. The District's current BMPs help reduce the risk of significant adverse impacts to listed species to bromadiolone. However, the incidence and impact of secondary poisoning is difficult to evaluate because of lack of data. Mitigation Measure Bio-1 increases the ability of the District to avoid areas adjacent to habitat for listed species within Orange County by improving the ability of the District to detect where certain treatments or activities may be less favorable or where more caution is needed because of the presence or likely presence of rare or threatened or endangered species. This mitigation will also reduce the potential for bromadiolone applications to adversely impact listed species to less than significant.

No significant unavoidable adverse impacts or significant irreversible environmental changes were identified by this PEIR.

ACRONYMS AND ABBREVIATIONS

µg/m^3	micrograms per cubic meter
µm	microns
ANTU	Alpha naphthythiourea
AB 32	Assembly Bill 32, The Global Warming Solutions Act of 2006
AB 599	Assembly Bill 599, The Ground Water Quality Monitoring Act of 2001
ac	acre
Bs	*Bacillus sphaericus*
Bti	*Bacillus thuringiensis israelensis*
Cal HSC	California Health & Safety Code
CARB	California Air Resources Board
Cal/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CDC	Centers for Disease Control and Prevention
CDFA	California Department of Food and Agriculture
CDFG	California Department of Fish & Game
CDPH	California Department of Public Health
CDPR	California Department of Pesticide Regulation
CE	California encephalitis
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulation
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CO_2	carbon dioxide

cu ft	cubic foot/feet
DDE	diclorodiphenyldicloroethylene
DDT	dichlorodiphenyltrichloroethane
EEE	Eastern equine encephalitis
EIR	Environmental Impact Report
EIS	Environmental Impact Study
ESRI	Environmental Systems Research Institute, Inc.
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
fl oz	fluid ounces
ft	feet
gal	gallons
GAMA	Groundwater Ambient Monitoring & Assessment Program
GB-1111	Golden Bear Oil-1111
Cal FGC	California Fish and Game Code
GHG	greenhouse gases
GIS	Geographic Information System
gpm	gallons per minute
HCP	Habitat Conservation Plan
HPS	Hantavirus pulmonary syndrome
hr	hour
IS	Initial Study
IGE	immunoglobulin
IVM	Integrated Vector Management
IVM &RP	Integrated Vector Management & Response Plan
kg	kilograms

l	liter
lbs	pounds
LC_{50}	lethal concentration for 50% of subjects
LD_{50}	lethal dose for 50% of subjects
LOC	Levels of Concern
mg	milligrams
MMWR	Morbidity & Mortality Weekly Report
MOU	Memorandum of Understanding
MSAA	Master Streambed Alteration Agreement
MSDS	Material Safety Data Sheets
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPIC	National Pesticide Information Center
NPTN	National Pesticide Telecommunication Network
OC	Orange County
OCVCD	Orange County Vector Control District
OCFCD	Orange County Flood Control District
OP	Organophosphates
oz	ounces
PBO	Piperonyl butoxide
PCBs	Polychlorinated Biphenyl
PEIR	Program Environmental Impact Report
PM	Particulate Matter

ppm	parts per million
RIFA	Red Imported Fire Ants
RQ	risk quotient
SB	Senate Bill
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SCVCET	Southern California Vector Control Environmental Taskforce
SLE	Saint Louis encephalitis virus
SOx	sulfur oxides
sq ft	square foot/feet
SR	service request
spp	species
ssp	subspecies
SWRCB	State Water Resources Control Board
tbl	tablespoon
TMDL	total maximum daily load
TDS	total dissolved solids
TDN	total dissolved nitrogen
UC	University of California
UCI	University of California – Irvine
ULV	ultra-low volume
URBEMIS	Urban Emissions software
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture

USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
var	variety
VOC	volatile organic compounds
VRM	Vector Reduction Manual
WEE	Western equine encephalitis virus
WNV	West Nile virus

1 INTRODUCTION

This Program Environmental Impact Report (PEIR) has been prepared to cover ongoing activities of the Orange County Vector Control District (OCVCD or "District"), an independent special district charged with protecting citizens of Orange County from vectors (i.e., any insect or other organism capable of harboring and transmitting agents of human disease) and vector-borne diseases. OCVCD provides vector control and disease surveillance for the 798 square miles of Orange County (County) and immediately adjoining lands. This PEIR was prepared using documents supplied by the District, as well as County of Orange data and scientific literature on control methods and materials and their potential environmental impacts.

Mosquito and vector control districts operate under Division 3 (Pest Abatement) of the California Health and Safety Code (Cal HSC § 2000-2910). The current law was approved in 2002 and contains explicit policy statements that were not included in the original 1939 statute. The opening provisions of the current law state that "surveillance, protection, abatement and control" are the primary purposes of these districts. Under Article 4, Powers, a district may exercise its powers to check for vectors and take any and all action to control vectors and vector-borne disease, including abatement proceedings within the district and in adjoining lands from which vectors and vector-borne disease may enter the district.

All districts have a Memorandum of Understanding (MOU), (i.e., the "Cooperative Agreement"), with the California Department of Public Health (CDPH) covering the use of pesticides. Districts file monthly reports on pesticide applications with the local County Agricultural Commissioner and the regional Water Quality Control Board(s). These monthly reports are used to generate the annual reports filed with the CDPH and California Department of Pesticide Regulation (CDPR). The County Agricultural Commissioner conducts annual compliance inspections of each district, and the CDPH conducts inspections every other year or as time and budget allow.

Forty-three mosquito abatement and vector control districts were established and functioning in California prior to the 1969 and 1970 enactments of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Eleven additional districts were formed after 1970. All were considered exempt from NEPA and CEQA. The surveillance activities of this district and other districts are considered data gathering and, therefore, exempt under § 15306, Article 19, of CEQA.

There have, however, been questions raised by federal agencies and federal appeals court cases about potential effects upon rare and endangered species and water quality from pesticides. In 2001, the 9th Circuit Federal Court issued the first of three decisions *(Headwaters Inc. v. Talent Irrigation District*) that pesticides applied to waters of the United States constitute chemical wastes or biological material under the Clean Water Act. This decision resulted in the adoption of an order requiring National Pollution Discharge Elimination System (NPDES) permits for the public health use of larvicides, i.e., pesticides to kill larval mosquitoes, by the California State Water Resources Control Board (SWRCB). A 2009 6th District Federal Appeals Court decision (*National Cotton Council v. United States Environmental*

Protection Agency; USEPA) required National Pollutant Discharge Elimination System (NPDES) permits for the use of pesticides to kill adult mosquitoes (adulticides) for public health.

This PEIR is designed to provide detailed information and assessments on the operations of the District, including its use of pesticides and source reduction methods, which may include minor habitat management, usually as trail maintenance or sediment removal. The SWRCB is in the process of completing a General Permit for the application of all pesticides to surface waters. This permit includes ultra-low volume (ULV) application of adulticides in addition to the larvicides that are already covered by the current permit.

1.1 CEQA/NEPA Process

CEQA was initiated during the development of NEPA to provide a full disclosure process for public projects. The District is preparing this Environmental Impact Report (EIR)/Environmental Impact Study (EIS) to serve as a basis for any future state or federal permits required for their operations and to disclose to the public the nature of the District's activities and their potential effects on the environment.

The process was initiated by reviewing the District's records and documents and preparing an Initial Study (IS) checklist to determine if there were gaps in information on environmental issues. The checklist revealed several areas that require additional information to assess the extent of potentially adverse environmental impacts. The IS was submitted to the State Clearinghouse to distribute to state and federal agencies. Additionally, the District sent copies to local agencies not on the State's list of responsible and trustee agencies.

This document is a combined EIR/EIS, in which the project description is included as the preferred alternative and compared to possible alternative actions.

1.2 Notice of Preparation

A Notice of Preparation for this EIR was prepared and filed with the State Clearinghouse in August 2010 and ran until September 27, 2010. Responses were received from the Native American Heritage Commission, Orange County Water District, Caltrans District 12, and Orange County Local Agency Formation Commission. A later mailing was sent to the California Department of Public Health Vector-Borne Disease Section, and local Orange County agencies including the Agricultural Commissioner, Health Department, and Orange County Water Agency. Copies were also sent to the California Department of Fish and Game (CDFG), U.S. Fish and Wildlife Service (USFWS) and regional U.S. Army Corps of Engineers (USACE). The Orange County Water Agency, CDFG, Orange County Public Works, South Coast Air Quality Management, and the Vector-Borne Disease Section of the California Department of Public Health responded with comments.

1.3 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

1.3.1 POTENTIALLY SIGNIFICANT IMPACTS

The District's files and area records were examined to establish the potential for significant adverse impacts. An Initial Study was prepared and determined that there were several areas of potential impacts, which included Air Quality, Biology, Water Quality, Greenhouse Gases, and Hazardous Materials. These areas of potential impact are analyzed in greater detail in this PEIR.

1.3.2 IMPACTS NOT FOUND TO BE SIGNIFICANT

Sufficient information was found during the preparation of the Initial Study to determine that there were no adverse impacts to Aesthetics, Agricultural Resources, Cultural Resources, Geology/Soils, Mineral Resources, Noise, Population/Housing, Public Services, Recreation, Transportation/Traffic, and Utilities/Service Systems.

1.3.3 POTENTIAL AREAS OF CONTROVERSY

In recent years, there has been a resurgence of concern and even fear about the potential effect of pesticides applied or deposited in urban areas on human and environmental health. Concerns have included the toxicity and carcinogenicity some of these chemicals present to humans, as well as the potential for being exposed to chemicals directly from aerosol sprays (fogging) and indirectly through their deposition on lawn furniture and vegetable gardens. Additional concerns have been expressed about potential impacts to rare and endangered species and beneficial insects, such as honeybees and dragonflies, from the use of these pesticides.

Some people have voiced skepticism about the extent and severity of West Nile virus (WNV) and other mosquito-borne diseases, as the majority of human infections are mild or even asymptomatic. They consider the extra efforts exerted by vector control districts because of WNV and additional control measures taken after WNV was diagnosed in humans as wasteful and unnecessary.

1.4 ORANGE COUNTY VECTOR CONTROL DISTRICT'S PURPOSE AND OBJECTIVES

The OCVCD has a mission statement that describes its philosophy:

"The Orange County Vector Control District shall:

Be proactive in response to current and future vector threats,

Respond efficiently and courteously to the needs of the public,

Inform and educate the public about the shared responsibility of vector control,

Utilize the most effective and safest methods available for the control of vectors, and

Provide vector control services in the most cost-effective manner."

1.4.1 HISTORY

The District was established in 1947 as the Orange County Mosquito Abatement District under the authority of the Mosquito Abatement Act of 1915. All 798 square miles of the County lie within its jurisdiction (Figure 1-1 & Figure 1-2). The governing legislation was re-formalized in 1939 under the California Health and Safety Code. Minor amendments were made in the early 1980s. In 2002, there was a complete review and revision of the Mosquito Abatement and Vector Control District statute, which provided more details on policy and governance. In 1975, the name of the District was also changed to Orange County Vector Control District and control of flies and rodents and bubonic plague surveillance were added to the District's functions under an MOU with the Orange County Board of Supervisors. Control of red imported fire ants was added to the District's operations in 2004. The District is supported by property taxes, a service fee added in 1990-1991, and an assessment for RIFA control under Proposition 218, approved by the voters in July 2004. The District currently offers mosquito, rat, fly, and fire ant control services to the citizens of Orange County. Vector control is also provided under contract to the University of California at Irvine, the San Joaquin Marsh of the University of California Natural Reserve System, Orange County Sanitation District, the Irvine Ranch Water District, the California State Lands Commission and the Naval Weapons Station at Seal Beach (Figure 1-3). The District also works with the Orange County Flood Control District (OCFCD) to reduce ponding and improve drainage.

1.4.2 REGULATORY SETTING

Activities related to mosquito and vector control districts are regulated by a variety of local, state and federal regulatory agencies. Alternately, vector control districts themselves act as regulators through surveillance, public education, and, if necessary, the issuance of abatement orders. Districts may issue abatement orders to uncooperative property owners or managers either to reduce mosquito sources such as dirty pools, ponds, or similar mosquito production sources or to pay for the costs of control by the district issuing the abatement order.

Agencies that have some regulatory influence over mosquito and vector control districts include the U.S. Environmental Protection Agency, the California Environmental Protection Agency (Cal/EPA), State and Regional Water Boards, the CDPH, the CDPR, and County Agricultural Commissioners. In addition, vector control districts may have some of their activities restricted by CDFG and/or USFWS in certain environmentally-sensitive areas or operate within areas covered by federal habitat conservation plans (HCPs) and California natural community conservation plans (NCCPs), although they are not always signatories to them.

The following legislation and organizations help regulate the activities of mosquito and vector control districts:

Federal

U.S. Environmental Protection Agency

The USEPA, in cooperation with State of California agencies, registers or licenses pesticides for use in the United States through authority granted by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; 7 USC § 136 et seq.). Aspects of these agencies' work involve evaluating potential new pesticides and uses, providing for special local needs and emergency situations, reviewing the safety of older pesticides, registering producers of pesticides, implementing pesticide field programs aimed at education of users of pesticides and enforcing existing pesticide regulation by working with the State. USEPA is responsible for the language on pesticide labels.

Agreements with other Federal Agencies

The District also has an MOU with the U.S. Department of the Navy and the USFWS and a special permit with USFWS to conduct mosquito control on the Seal Beach National Wildlife Refuge. The District maintains a current federal bird banding permit for staff that trap and handle House Finches (*Carpodacus mexicanus*), American Crows (*Corvus brachyrhynchos*) and Mourning Doves (*Zenaida macroura*) for disease surveillance.

State

State laws related to vector control districts' activities, including pesticide use, are created in the California legislature. The original laws governing mosquito abatement districts were first codified in 1939 and were revised most recently in 2004. Once enacted, these laws are translated into specific regulations, which are included in the California Code of Regulations. Bills recently enacted into laws as of January 1, 2010, include SB 1723, *Pesticide container recycling*. Within California, several regulatory agencies oversee many aspects of the operation of vector control districts. These include the Cal/EPA, the CDPR, the CDPH, and the State and Regional Water Boards.

California Environmental Protection Agency

Cal/EPA is charged with developing, implementing, and enforcing the State's environmental laws, including the California Environmental Quality Act. The Department of Pesticide Regulation is the department within Cal/EPA responsible for regulating all aspects of sales and use of pesticides.

California Department of Pesticide Regulation

The primary responsibility of CDPR is the regulation of pesticide use and its potential impacts on water, air, soil, and biological organisms. CDPR has a number of MOUs with other agencies responsible for the health of the environment, such as the California Air Resources Board (CARB), SWRCB, and CDFG to ensure a coordinated approach to pesticide regulation. CDPR conducts preliminary rulemaking activities, such as research and stakeholder workshops, and prepares proposed actions including notice, regulation text, reasons for regulation, and costs to state and local government and the economic impact on business. CDPR also frequently engages in consultations with other agencies and chairs

advisory committees such as the Pesticide Registration and Evaluation Committee and the Pest Management Advisory Committee.

California Department of Public Health

CDPH and vector control agencies maintain a cooperative agreement obligating signatory agencies to certain practices that promote safe and effective vector control and ensure that all state and federal pesticide use requirements are met. Among the current requirements of the agreement are: regular and proper calibration of all application equipment and maintenance of calibration records; maintenance of comprehensive pesticide application records; monthly submission of monthly pesticide use reports; reporting of any suspected adverse effects upon non-target organisms or property from pesticide applications; employee certification through and maintenance of continuing education; and regular compliance inspections by the County Agricultural Commissioner.

State and Regional Water Boards

SWRCB and Regional Water Quality Control Boards regulate impacts on state waters under the authority of the Porter-Cologne Water Quality Act (CCR Title 23, Water, and CCR Title 27, Environmental Protection), the federal Clean Water Act (33 USC § 1251 et seq.) and other legislation. SWRCB currently issues and NPDES permit for biological and residual pesticide discharges to waters of the U.S. for vector control applications (Order No. 2011-0002-DWQ) that covers both larvicide and adulticide applications. This order replaced the preceding one (Order No. 2011-0002-DWQ), which addressed larvicide applications only. The District has acquired the new General Permit for mosquito larvicides and adulticides (CAG 990004) and received a Notice of Applicability on October 31, 2011 for discharge of biological and residual pesticides to waters of the U.S. (Water Quality Order No. 2011-0020DWQ). The District is a member of the Mosquito and Vector Control Association of California (MVCAC) Monitoring Coalition, which will perform water quality monitoring in accordance with the General Permit. The MVCAC NPDES Monitoring Plan for Mosquito Larvicides and Adulticides is attached to this document as Appendix A.

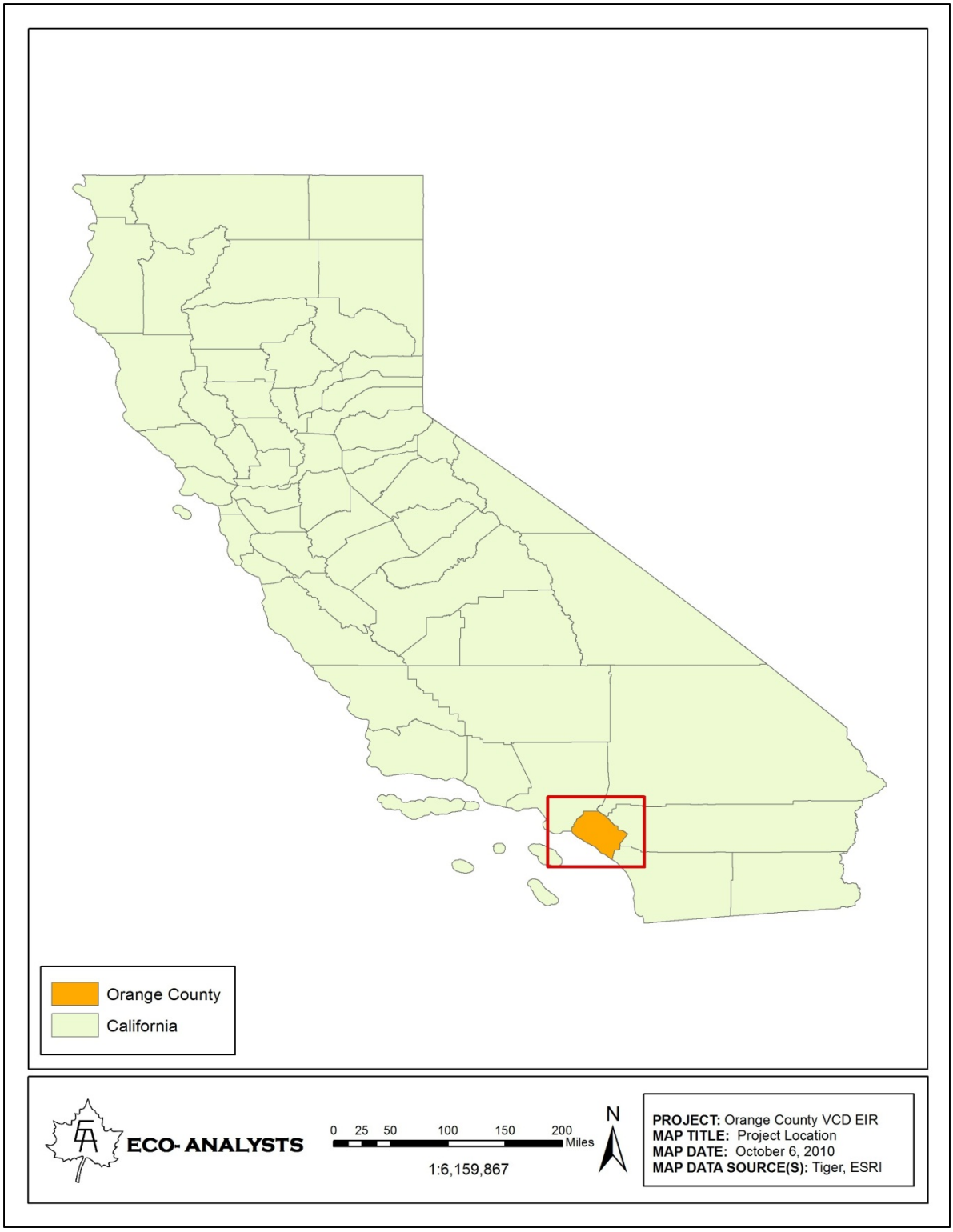

Figure 1-1. Project location.

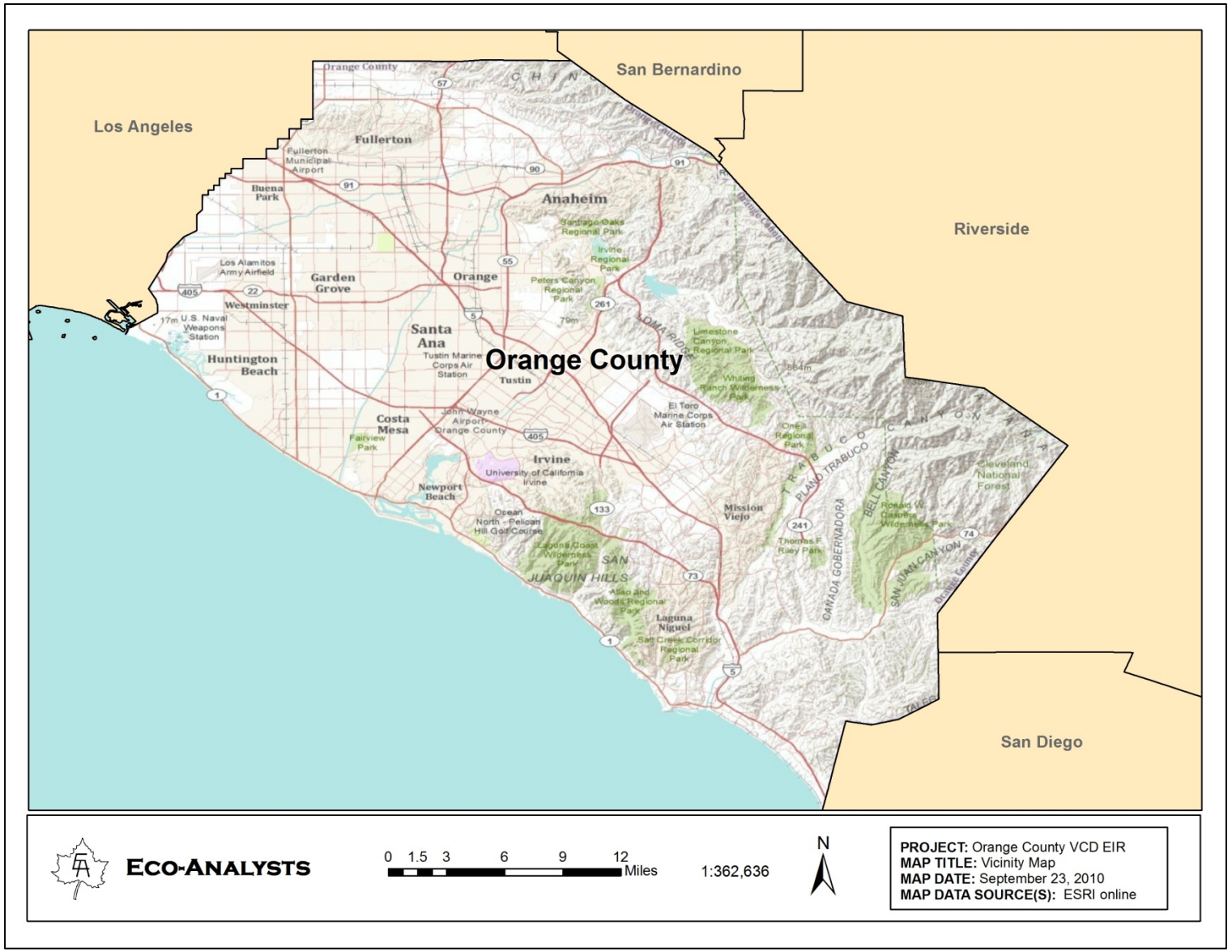

Figure 1-2. Orange County vicinity map.

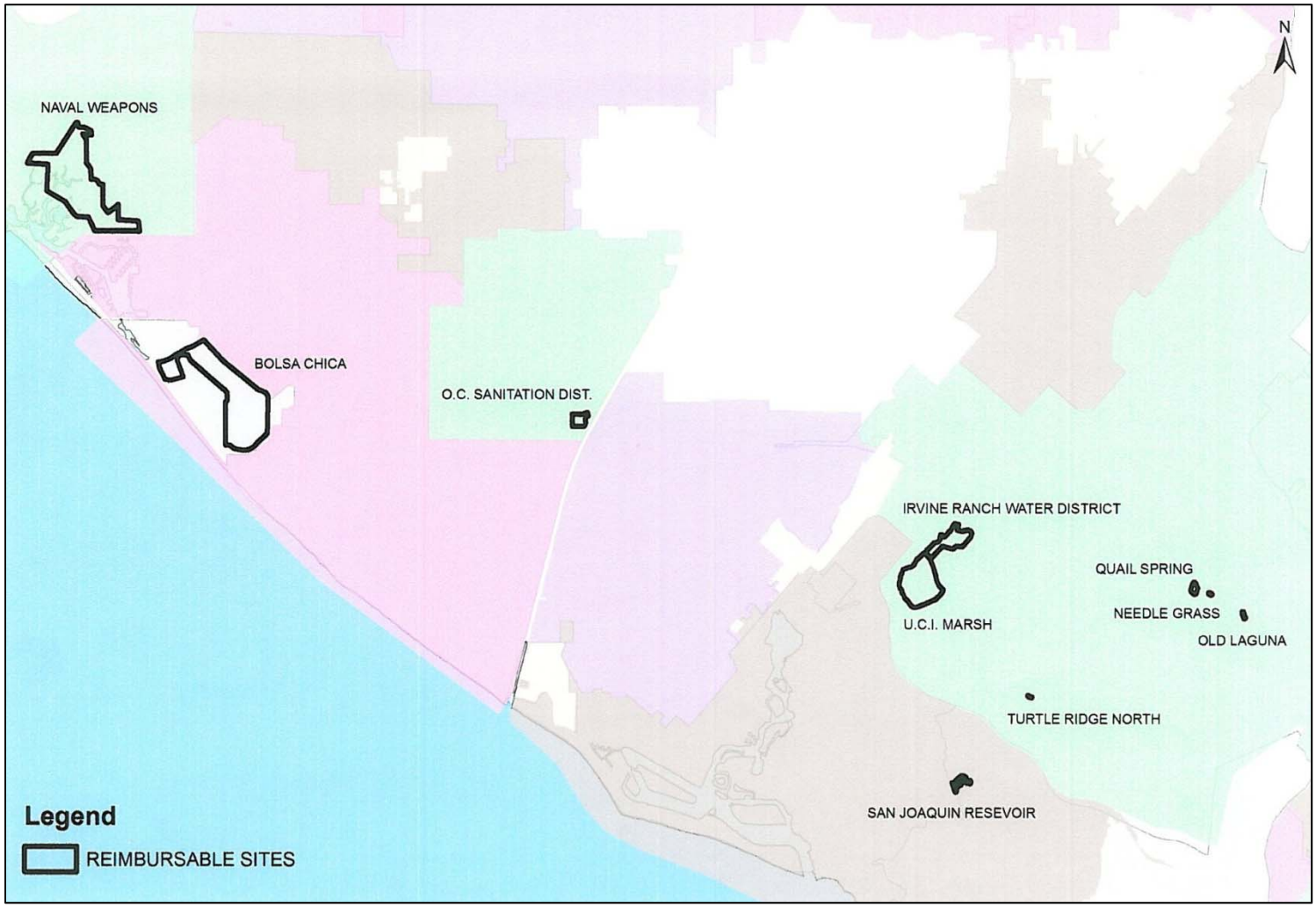

Figure 1-3. Areas with contracts with the OCVCD for vector control. Source: OCVCD 2010.

2 ALTERNATIVES

2.1 ALTERNATIVE 1: NO PROJECT (FULL IMPLEMENTATION OF THE CURRENT PROGRAM AND POLICIES)

Under CEQA, Title 14 of the California Code of Regulations [14 CCR § 15126.6 (e)(3)(A)], "When the project is a continuation or revision of an existing land use or regulatory plan, policy or operation the "no project" alternative will be the continuation of the existing plan, policy or operation into the future." Thus, under the "no project" alternative of this PEIR, the District's Board of Trustees would renew the current program and continue to implement or modify it in the future.

2.1.1 INTEGRATED VECTOR MANAGEMENT POLICIES AND PRACTICES

The District uses Integrated Vector Management (IVM) techniques to guide its comprehensive control programs. IVM includes surveillance for vectors and disease, source reduction, public education and chemical and biological control. IVM establishes thresholds for the initiation of physical and chemical control based on numbers and species of vectors and the presence or absence of infective agents. The District has adopted these guidelines into two documents, the Integrated Vector Management and Response Plan (IVM & RP), Appendix B, and the Vector Reduction Manual (VRM), Appendix C.

2.1.2 VECTOR SPECIES CONTROLLED

The primary species controlled by the OCVCD are mosquitoes, roof rats, red imported fire ants, black flies, and filth flies.

Mosquitoes

Mosquitoes are prehistoric insects with narrow abdomens, long thin antennas, and slender wings. Females feed on blood with a set of needle-like organs in the proboscis. The majority of mosquito species lay eggs on top of stagnant water. Their development consists of four aquatic larval stages and an aquatic pupal stage (Kwasny et al. 2004). Larvae support their development by feeding on micro-organisms in the water. After the pupal stage, the mosquito emerges from the water completing its metamorphosis. Development averages from 3 to 12 days depending on environmental factors and species (Kwasny et al. 2004). Factors that affect development are light, temperature, humidity, weather and soil. Warmer temperatures speed development; different species have light and humidity preferences for optimum development. Weather affects habitat availability and behavior, and soil and substrates supply nutrients and affect water chemistry (Durso 1996). Mosquitoes breed in a wide variety of aquatic habitats from forest ponds to storm gutters. The habitats of most concern to the OCVCD for mosquito production are stagnant water in urban stormwater channels, neglected swimming pools, artificial containers and freshwater marshes. Many species of mosquitoes occur in Orange County (Table 2-1) but only a few are of concern to public health.

In Orange County, as in most other areas of California, mosquitoes of the genus *Culex* are the primary carriers of WNV and mosquito-borne encephalitis. The three main species that carry WNV to humans are *Culex tarsalis*, *Culex quinquefasciatus,* and *Culex erythrothorax*, with *Culex stigmatosoma* a likely vector for transmission of WNV to birds. Other mosquitoes that are important vectors in Orange County and their associated diseases (OCVCD 2006) include:

- *Aedes squamiger*, a major pest and carrier of a California encephalitis (CE) group virus, Morro Bay virus;
- *Aedes sierrensis*, a primary vector of dog heartworm;
- *Anopheles hermsi*, a malaria vector;
- *Culiseta inornata*, a CE group virus, Jamestown Canyon.

Table 2-1. Mosquito species in Orange County.

Scientific name	Habitat
Aedes dorsalis	Brackish and saline waters of intertidal marshes
Aedes nigromaculis	Irrigated pastures
Aedes sierrensis	Tree holes or containers with moist vegetation
Aedes squamiger	Tidal and reclaimed salt marshes
Aedes taeniorhynchus	Salt marshes
Aedes washinoi	Freshwater marshes, river pools
Aedes vexans	Floodwater habitats, irrigated pastures
Anopheles franciscanus	Creeks, lakes, ponds, freshwater marshes
Anopheles hermsi	Cattail stands, willow tree root systems, river margins, canyon stream edges and pools
Anopheles punctipennis	Clear, shaded pools along creeks and streams
Culex apicalis	Creeks, temporary stormwater pools, freshwater marshes, occasionally lakes and ponds
Culex boharti	Natural creeks, freshwater marshes, lakes, ponds
Culex erythrothorax	Ponds, lakes, marshes and streams with cattails or tule
Culex quinquefasciatus	Permanent or semi-permanent foul water
Culex restuans	Stagnant pools of ground water
Culex stigmatosoma	Natural and manmade polluted habitats (lagoons, sewage ponds, etc.)
Culex tarsalis	Rain pools, marshes, swimming pools, ponds, other freshwater sources
Culex thriambus	Rock pools, isolated ponds, hoof prints along streams and creeks
Culiseta incidens	Natural and artificial depressions filled with rainwater
Culiseta inornata	A wide variety of habitats, seepages, rain pools, ditches, salt marshes, etc.
Culiseta particeps	Cutoff pools and streams in wooded habitats
Orthopodomyia signifera	Tree holes (willows, cottonwoods) containing water year round

The following life history information for mosquito species found within Orange County is summarized from Durso (1996), the Alameda County Vector Control website (www.mosquitoes.org), and the OCVCD bulletin, "Mosquitoes of Orange County" (OCVCD 2006).

California Mosquito Life History Summaries

Aedes dorsalis breeds in brackish and saline waters in intertidal marshes and is highly localized in the coastal strand of Orange County (OCVCD 2006). This species' hosts are cows, horses and humans. It is a potential vector of Western equine encephalitis (WEE), Saint Louis encephalitis (SLE) and CE viruses, but is rare in Orange County.

Aedes nigromaculis (the irrigated pasture mosquito) breeds primarily in irrigated pastures in Orange County. New generations are produced during each irrigation period (generally March to November), causing peaks of populations in July and August. The aquatic life cycle stage varies from 5 to 16 days depending on the temperature of the water. Warmer waters increase the speed of development. Each female, due to her short lifespan, will lay one or two batches of 100-150 eggs in a lifetime. *Aedes nigromaculis* mainly feeds on the blood of domestic animals and humans at dusk but is also known to feed during the day. This species is a secondary or suspected vector of WEE and CE. It is now rarely found in the County due to urban development and reduction of farmlands.

Aedes sierrensis (the western treehole mosquito) is present throughout Orange County in coastal riparian and inland canyon habitats. This species breeds in moist areas inside tree holes or containers with a bunch of leafy material. These mosquitoes are found in greatest abundance in the spring and stay active until summer. Late season rainfall, light, and certain temperatures can contribute to occurrence in the fall. *Aedes sierrensis* stays dormant in the egg or larval stage over winter. This species lays eggs in batches of 50-150 that hatch in 12 or more days. The larval stage may last from 10 days to several months. Females are small and aggressive feeders, feeding mainly on large mammals including humans. This species is the primary vector of heartworm in domestic dogs.

Aedes squamiger is present along Orange County's coastline. This species breeds in tidal and reclaimed salt marshes in the late spring and early summer, remaining in the larval stage over winter and hatching in the spring. Females are known to travel great distances to feed and are a major pest to humans at dawn and dusk. A new California-group encephalitis, the Morrow Bay virus, has been isolated in this species.

Aedes taeniorhynchus (the black salt marsh mosquito) is present in salt marsh areas along the coast of Orange County. The eggs are laid on damp substrates and hatch after they are flooded with salt water. This mosquito is an aggressive biter of humans and livestock. Although encephalitic viruses have been isolated from this species, no evidence exists to support a role in the transmission of disease in California.

Aedes washinoi is found along the coast of Orange County. Breeding occurs in freshwater ground pools, marshes, and heavily shaded river pools in upland areas. This species is abundant in late winter and early spring and has the ability to produce multiple broods a year but generally only produces one. Females bite during the day and are known to prey on humans. Nothing is known about this species' vector potential.

Aedes vexans (the inland floodwater mosquito) is rarely found in Orange County. This species breeds in woodland watercourses and flooded fields and is considered a secondary vector of several arboviruses (WNV, WEE) and dog heartworm.

Anopheles franciscanus is present in southern Orange County. Its natural breeding habitats include creeks, lakes, ponds, and freshwater marshes, though this species may also breed in stock ponds, agricultural drains, commercial seepage, and unlined channels. These mosquitoes lay dormant as adults throughout winter. Their main food sources are rabbits, cattle, horses, domestic pets, rodents and chickens. Females are most active at dusk and rarely attack humans. This species is a known potential carrier of Main Drain Virus and avian malaria and has been infected with *Plasmodium vivax* under laboratory conditions.

Anopheles hermsi is present primarily in southern Orange County. Breeding habitats include matted cattail stands, matted root systems of willow trees, river margins, edges of canyon streams and pools. Populations peak in June and July and maintain low numbers throughout the rest of the year. This species exhibits two peaks of hunting activity, one a half an hour before sunset and another one half hour before sunrise. These mosquitoes are aggressive feeders on chickens, goats, cattle, dogs, and humans. This species is a known vector of *Plasmodium vivax* and is responsible for malaria outbreaks in San Diego County.

Anopheles punctipennis (the woodland malaria mosquito) is a rare species restricted to the San Clemente area.

Culex apicalis is present in undisturbed areas of Orange County. Breeding occurs in natural habitats including creeks, temporary pools composed from stormwater, freshwater marshes, and occasionally lakes and ponds. Larvae are present from April to December and survive winter as adults. This species feeds on toads, reptiles, and songbirds. This species' potential as a vector of disease is unknown but suspected to be insignificant.

Culex boharti is found in natural habitats including creeks, temporary pools, stormwater, freshwater marshes, and occasionally lakes and ponds. Adults feed on toads and are not known to bite humans. This species' vector potential is unknown.

Culex erythrothorax (the tule mosquito) is widespread in Orange County, mainly in the coastal region. The tule mosquito breeds in ponds, lakes, marshes, and streams with cattail or tule growths. This species is atypical in that it spends winter in a larval stage. Females consume the blood of a variety of hosts including humans and birds one to two hours after sundown and during the day in shaded areas. This species is a known carrier but a relatively poor vector of WNV, WEE, SLE, and Turlock viruses.

Culex quinquefasciatus (the southern house mosquito) is found near permanent or semi-permanent foul or polluted waters, including artificial containers such as fish ponds, swimming pools, and septic tanks. This species breeds year round with females producing batches of 120-200 eggs. Aquatic development takes between six and 10 days. Birds are their primary blood source, but humans are also fed

upon. They are active in the evening and at night. This species is a known carrier of WNV, SLE, and avian pox viruses, along with dog heartworm in the southern U.S.

Culex restuans is rare in Orange County and is found primarily in southern areas. These mosquitoes breed in stagnant pools of ground water, such as hoof prints and artificial containers. Their main food sources are mammals and birds (primarily songbirds); they rarely bite humans. This species is a known carrier of WNV and dog heartworm. WEE has been found in a Canadian population, and Eastern equine encephalitis (EEE) has been found in a New Jersey population.

Culex stigmatosoma (the banded foul water mosquito) is present throughout Orange County. This species breeds in natural and manmade habitats, but mainly in polluted waters. These mosquitoes breed year round but are most active during the summer. They can produce broods of up to 250 eggs, and under optimal conditions, the larvae develop within seven to 15 days. They feed primarily on birds and seldom attack humans. This species is a known vector of WNV, WEE, SLE, and Turlock viruses, as well as avian malaria.

Culex tarsalis (the western encephalitis mosquito) is present throughout Orange County. These mosquitoes breed in rain pools, marshes, neglected swimming pools, ponds, and other fresh water sources. They primarily feed at dusk on birds and mammals but are known to bite humans. This species is a known vector for WNV, WEE, SLE, Turlock, Hart Park and Lokern viruses, as well as avian malaria.

Culex thriambus is a rare species mainly present in the foothill and coastal areas around Orange County. Breeding occurs in rock pools, isolated ponds, and hoof prints along streams and creeks. Their main food sources are songbirds. Potential as a vector of disease is unknown.

Culiseta incidens (the cool weather mosquito) is present throughout Orange County. Natural depressions and artificial habitats filled with rain are breeding sites. Other examples of breeding sites are watering troughs, hoof prints, small containers, and ground pools. This species breeds in the fall, winter, and spring and is dormant through the summer. Females lay 150-200 eggs in a brood. It generally takes around 17 days for the eggs to develop into adults. This species feeds mostly on large domestic animals but is also known to feed on humans. No known diseases have been found in wild populations. It can produce very large populations of biting adults and become a significant nuisance to residents living near wetlands.

Culiseta inornata (the large winter mosquito) populations are found in a wide variety of habitats, e.g., seepages, rain, duck club ponds and salt marshes. They are prevalent in spring and fall and are dormant in the summer. This species is tolerant of moderate levels of organic pollution and salinity. Females prefer to feed on large domestic animals and are known to bite humans. This species is a vector of a naturally occurring CE virus, Jamestown Canyon.

Culiseta particeps breeds in small cutoff pools of streams and the shallow margins of filled pools in wooded habitats. This species' peak abundance is in April and May with low population levels in the summer. Peak feeding activity occurs one hour after sunset. Large domestic mammals and humans are prey (Schreiber 1989). This species' potential as a vector of disease is unknown.

Orthopodomyia signifera is present in inland Orange County. These mosquitoes breed in tree holes that contain water year round, usually willows and cottonwoods. They are present in tree holes from May to October. Their main food sources are birds, and they are not known to bite humans. This species is a known vector of EEE in populations located in Mexico and Alabama.

Rats

Black rats (*Rattus rattus*), also known as roof rats due to their preference for climbing and fleeing upward, are long rodents up to 16" in total length with very long tails. Originally from Asia, this species spread throughout the Middle East and the Mediterranean region in antiquity and is thought to have arrived in western Europe in the 6th century A.D. Roof rats are now naturalized throughout most tropical and temperate areas of the world, though large populations are known from as far away from the equator as New Zealand (Integrated Taxonomic Information System 2010). Although it is not known precisely when roof rats entered California, they probably arrived with the first Europeans aboard ships in the 1700s.

The roof rat is a social, nocturnal, and omnivorous species that is more common in warmer climates than the brown or Norway rat (*Rattus norvegicus*), which is more prevalent in cooler climates. (Norway rats are rare in Orange County, primarily inhabiting coastal marinas and rock breakwaters. Roof rats are excellent climbers and rapid reproducers, having as many as six litters of up to ten young in a year. In many areas of the world where larger predators are generally lacking or scarce (e.g., New Zealand and Hawaii), roof rats are particularly destructive on native wildlife, especially birds, and are a major force in ecological change.

Rats are considered the most important source for diseases spread by rodents because they are so common and "share man's table" (Rackham 1979). Major diseases spread by rats include bubonic plague (*Yersenia pestis*) and fleaborne typhus (caused by the bacteria, *Rickettsia typhi* and *R. felis*). Combined, these diseases have killed millions of humans worldwide. Transmission of disease from rats to humans is thought to occur primarily through the spread of rat parasites, primarily the Oriental rat flea (*Xenopsylla cheopis*) and the human flea (*Pulex irritans*). Other diseases known to be spread by rats include toxoplasmosis, trichinosis, and Weil's disease (Carmichael 1993).

Parasites associated with rats in California include ectoparasites like the tropical rat mite, fleas, and lice, and internal parasites such as helminth worms (*Capilliaria* spp. and *Hymenolepsis diminuta),* bacteria (*Leptospira* spp., *Listeria* spp., *Pseudomonas* spp., *Pasteurella* spp.), protozoa (*Toxoplasma gondii*) and viruses (Dabritz et al. 2008). The District has detected a number of human pathogens from wild rats collected in Orange County, including *Yersinia pestis* (plague), Seoul virus, Rickettsial pox, Hepatitus E, *E. coli, R.typhi, R. felis*, and Salmonella. Additionally, human cases of rat bite fever (*Streptobacillus moniliformi)* have been reported in the County.

Besides spreading disease, roof rats are responsible for damaging property by chewing electrical equipment and structures and can also damage ornamental plants and backyard fruit trees. An opening of one-half inch is adequate to allow roof rats access to walls, attics, and building interiors. Harborage

areas within buildings can provide protection and rearing sites for rats and increase the potential for disease transmission between rats and humans.

Rats are both an indoor and outdoor pest in California and will take refuge in buildings, on roofs, and in residential vegetation. Rats have been particularly associated with spreading invasive plants, including Himalayan blackberry (*Rubus discolor*) and Algerian ivy (*Hedera canariensis*) (Dutson 1974). Both species provide food and shelter for rats and are widespread throughout both developed areas and wild lands.

Red Imported Fire Ants

Red imported fire ants (*Solenopsis invicta*), or RIFA, are one species of a widespread genus of fire ants found in tropical and temperate countries around the world. They range from 1/16 to 1/4 of an inch in length, are reddish-brown and are extremely aggressive. They produce characteristic mounds in soft soils from which they boil out when disturbed. A related native species, the southern fire ant (*Solenopsis xyloni*), is difficult to differentiate visually from the introduced species. However, the constructed mound of a RIFA colony characteristically lacks a central opening but has multiple openings out of the mound from this species' extensive tunneling system (California Department of Food and Agriculture; CDFA 2009).

Native to South America, RIFA were inadvertently introduced into the United States in the 1930s by infested shipping containers shipped from Brazil. RIFA are now found in most southern states of the U.S., including Alabama, Arkansas, California, Delaware, Florida, Georgia, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nevada, New Mexico, North and South Carolina, Oklahoma, Tennessee and Texas, as well as Oregon. Successful eradication of RIFA has been claimed in Arizona, Missouri, and Virginia (Pest Tracker 2010).

RIFA are known for their strong, painful sting and resulting pustule on the skin of those stung. They are very aggressive and tend to swarm, attacking humans, pets, and livestock that may have disturbed their mound. They can both bite and sting repeatedly. In rare cases, RIFA have been known to cause death to adult humans (ABC News 2006) when the victims have had severe allergic reactions, including throat and brain swelling.

RIFA typically build their mounds in open, sunny areas in almost any type of soil in lawns, pastures, gardens, parks, meadows and cultivated fields, particularly those that are irrigated. Colonies have also been found in rotting logs, voids in walls, cracks in buildings, under sidewalks and around stumps. Colonies can migrate quickly to new locations with as little as one queen and six workers. Both single queen (monogyne) and multiple queen (polygyne) colonies have been found, although to date most colonies found in California have been polygynous. Polygynous colonies typically have greater ant and mound densities, smaller workers and interconnected colonies. More recently monogynous colonies have been observed in Orange County (personal communication, Robert Cummings, OCVCD, September 2010), perhaps an effect of RIFA having met its northern geographical limit in California.

RIFA were first reported in California in 1998 when officials from Las Vegas, Nevada, notified CDFA officials of infested nursery products originating from Orange County and were later confirmed in Orange County in 1999. Significant RIFA populations have now been confirmed in five southern California counties, including Los Angeles, Orange, Riverside, San Bernardino, and San Diego. Isolated occurrences of RIFA have also been documented in Kern, Fresno, Madera, Merced, Sacramento, San Joaquin and Stanislaus Counties (CDFA 2009).

RIFA are a quarantined species in California through the United States Department of Agriculture and the CDFA. Plant nurseries in southern California and Orange County must control RIFA on their properties every 90 days and treat all plant material and soil mix with RIFA pesticides (OCVCD 2008). The CDFA runs a Red Imported Fire Ant Program, which publishes treatment protocol and information related to the species. The vector control districts of Orange County and the Coachella Valley have established RIFA control programs to assist the public in controlling occurrences. In other areas, local Agricultural Commissioners may provide public assistance with control, but in most areas no local eradication program exists. Hiring a licensed pest control operator is the recommended approach for residents of those areas.

Flies

Filth flies is a general term applied to a diverse group of fly species (e.g., House Fly, Blow Fly, Black Garbage Fly, Stable Fly, etc.) that develop in decomposing organic matter. As larvae, these flies feed on septic sources such as animal feces, rotting food and garbage. They can become numerous in sludge settling areas of wastewater treatment plants that do not dry rapidly enough, in agricultural field where large amounts of unharvested vegetables remain on the ground and are not disced under and in any place that manure or garbage is allowed to accumulate. Flies pick up bacteria from these sources and transmit them to human food sources.

Black flies (flies in the family Simuliidae) are vicious day-biters that can make outdoor existence unbearable. The larvae develop in running water environments and become a problem in Orange County in years with higher than normal and prolonged rains. The eggs are laid in running water and hatch and mature within one to two weeks.

2.1.3 VECTOR AND DISEASE SURVEILLANCE

The District uses a combination of physical inspections, trapping, remote sensing and laboratory tests to establish the extent of vector populations and potential disease organisms. Information from field inspections is supplemented by contacts from the public about the presence and numbers of vectors and hosts. The District's vector control inspectors check for vector species, control vectors with source reduction and by application of pesticides or biological controls, if warranted, and supply affected homeowners with informational brochures to assist them in reducing vector species and exposure to vector-borne diseases.

Mosquitoes

Known vector-producing sites within each of the 20 mosquito control zones are inspected visually and may be sampled for larvae with dippers to determine species and estimate populations. The District has adopted CDFG inspection and cleaning procedures to avoid the spread of aquatic invasive species. In addition to sampling mosquito larvae, the District uses CO_2-baited traps, gravid traps and vacuum traps to estimate the numbers and determine species of adult mosquitoes (Figure 2-1). These data are used to determine when thresholds (Table 2-2) have been met for chemical control. Sampled mosquitoes are also tested for presence of viruses. During 2009-2010, 3,225 pools (i.e., batches of mosquitoes from 5 - 50 each) were tested for the presence of viruses, and 38 were positive for WNV.

Sentinel chickens[1] and wild birds, both those trapped by the District, primarily House Finches, House Sparrows (*Passer domesticus*) and Mourning Doves, and those reported by local residents are also tested for the presence of arboviruses (i.e., viruses carried by arthropods). In 2009-2010, 582 wild dead birds collected from residents' reports were tested; eleven were positive for WNV. Infected birds include 23 American Crows, one Mourning Dove, two House Finches, one Red-tailed Hawk (*Buteo jamaicensis*) and one Cooper's Hawk (*Accipiter cooperi*). In 2009-2010, 14 eastern fox squirrels (*Sciurus niger*) were tested for WNV; two tested positive. The District's traps captured 1,493 free-ranging birds, of which 5.1% were positive for WNV. Infected birds included 61 House Finches, 14 House Sparrows and one Mourning Dove.

An annual over-flight of urban areas is conducted each spring to locate unmaintained sources of stagnant water such as swimming pools, fish ponds and landscape ponds for added inspections and control. Over 5,000 unmaintained pools were discovered in 2010; approximately half were treated with *Gambusia affinis,* the western mosquitofish, a non-native fish species used for biological control of mosquitoes. Complaints from local residents about mosquito problems are followed up with site and area inspections and control.

Rats

The District's vector control inspectors respond to complaints from local residents about rats (Figure 2-2), inspect those properties for conditions that support rat populations and conduct trapping. Inspectors look for signs of rodent activity, which include rodent droppings, "rub marks" or stains caused by repeated contact with rodent fur, gnaw marks and availability of rodent harborage and food sources. Live-trapped rodents are anesthetized and tested for pathogens. Threatened and endangered animals or those with legal protection that are incidentally trapped are released on site. Snap traps are sometimes used in urban areas to determine rodent presence and numbers. Animal carcasses are disposed of in accordance with federal, state and local regulations.

[1] The District no longer maintains and tests sentinel chicken flocks.

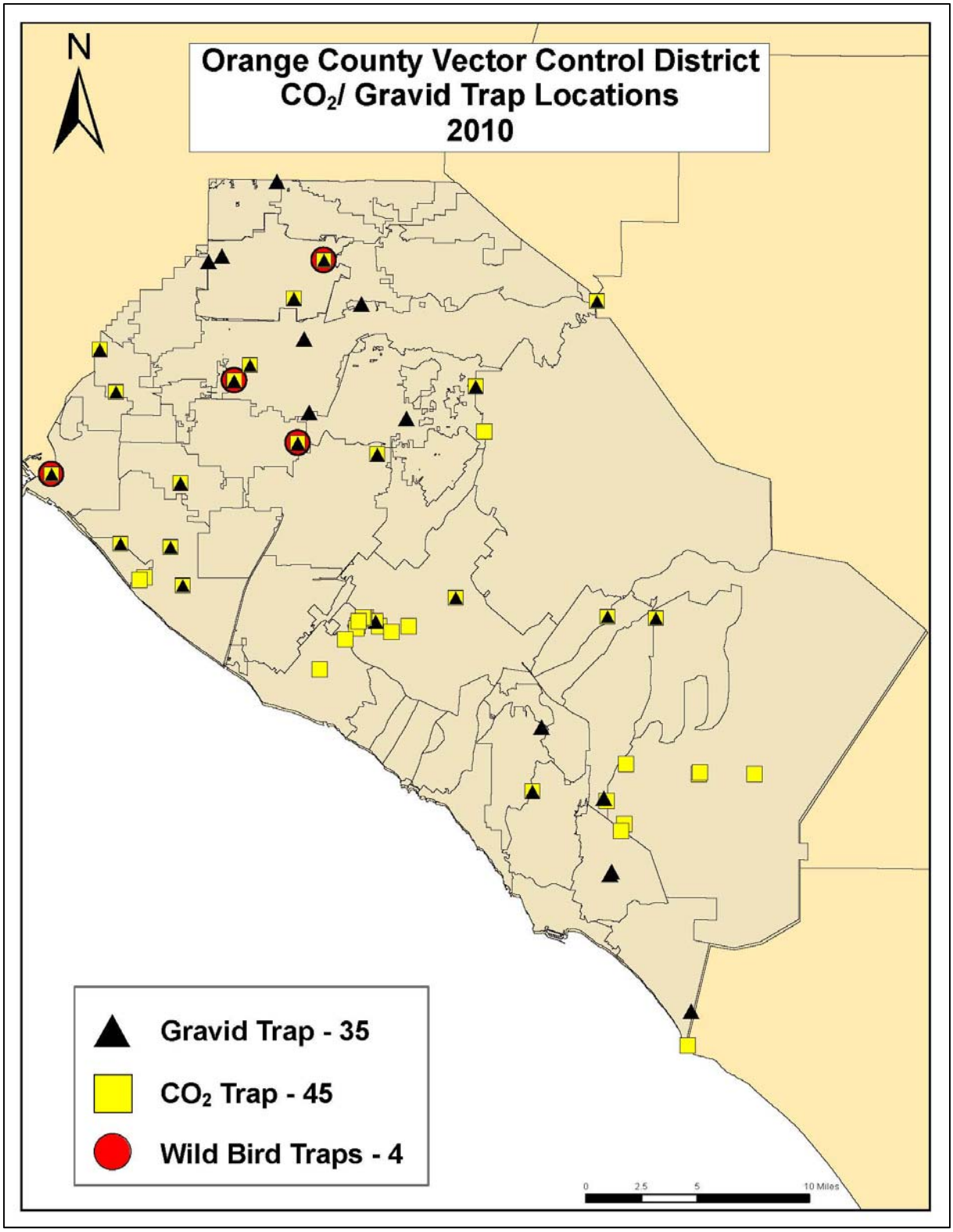

Figure 2-1. Orange County Vector Control District trap locations, 2010. Source: OCVCD 2011.

Table 2-2. Initiation thresholds for treatment of mosquito sources.

Initiation Thresholds for Treatment for Adult Mosquitoes			
Species	**Threashold Per Trap Night**	**Presence of Adult in catch basin, or freeway drum**	**Mosquitoes creating nuisance at a residence**
Culex tarsalis	≥ 50 females		≥ 1 female
Culex quinquefasciatus	≥ 75 females		≥ 1 female
Culex erythrothorax	≥ 75 females		≥ 1 female
Culex stigmatastoma	≥ 75 females		≥ 1 female
Anopheles	≥ 75 females		≥ 1 female
Aedes	≥ 5 females		≥ 1 female
Culiseta	≥10 females		≥ 1 female
Culex		1 ≥ female	≥ 1 female
Initiation Thresholds for Treatment for Immature Mosquitoes			
Species	**Per Dip**		
Anopheles	≥ 2 larvae per 40 dips		
Culex	≥ 2 larvae per 20 dips		
Aedes	≥ 2 larvae per 10 dips		

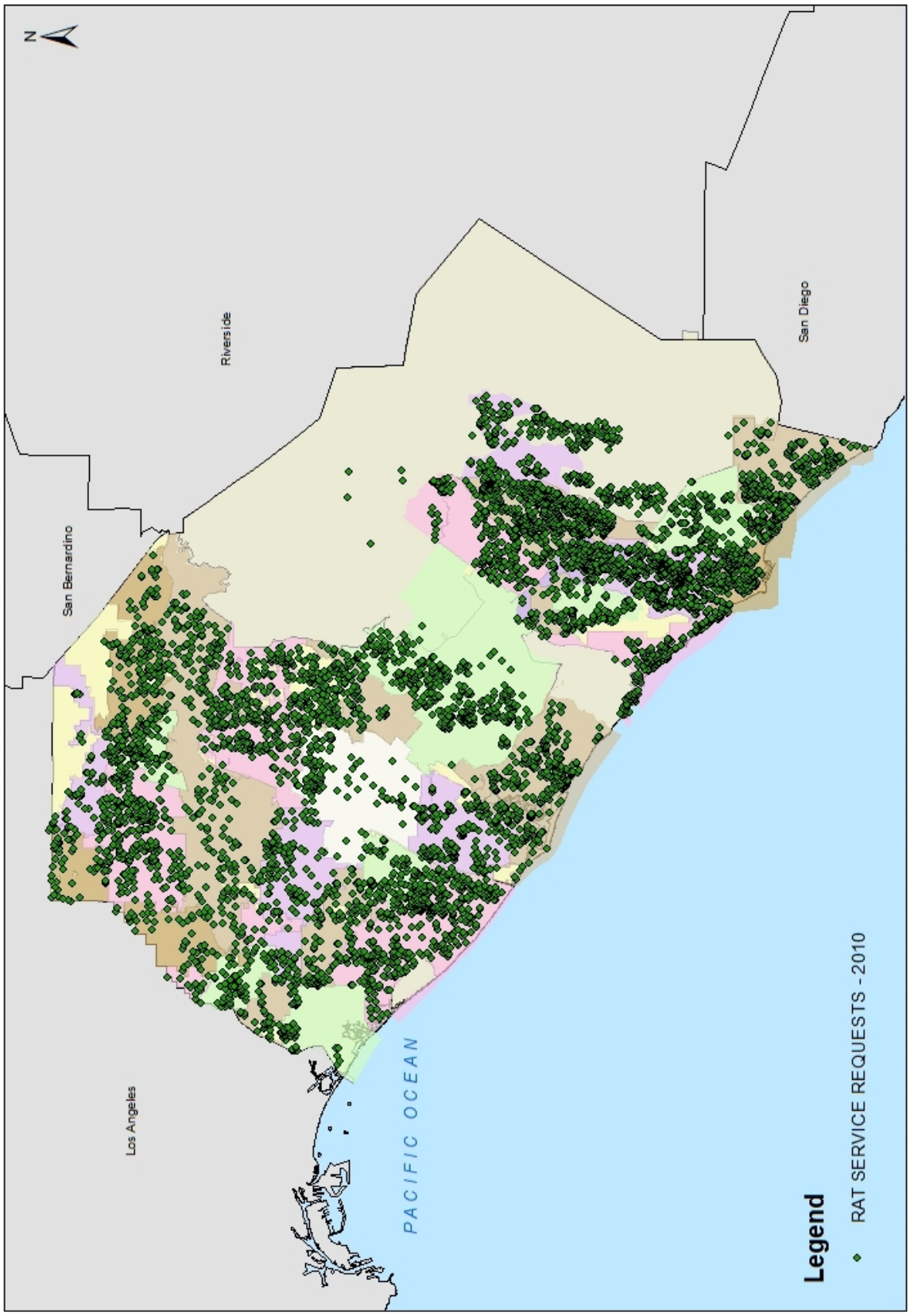

Figure 2-2. Rat service requests, 2010. Source: OCVCD 2010.

Red Imported Fire Ants

District vector control inspectors routinely inspect public open space areas that are irrigated, including parks, golf courses and road median strips, for the presence of RIFA mounds and foraging ants. Surveillance lures, consisting of small plastic baskets containing food (corn chips) mounted on metal flags, are also used in areas where mounds are not apparent. Service requests from homeowners (Figure 2-3) result in inspection of the parcel and immediate area by District inspectors.

Flies

Surveillance of filth flies by the District is conducted with attractant baited traps to estimate population density of adults and is supplemented by notation of residents' complaints and identification of possible breeding sources.

Black fly surveillance is conducted through analysis of complaints by the public, collection of host-seeking adults and evaluation of sites for immature black fly habitat. Adult black flies are collected using host-seeking mosquito traps. Larvae are found by monitoring the underside of rocks and debris found in moving water.

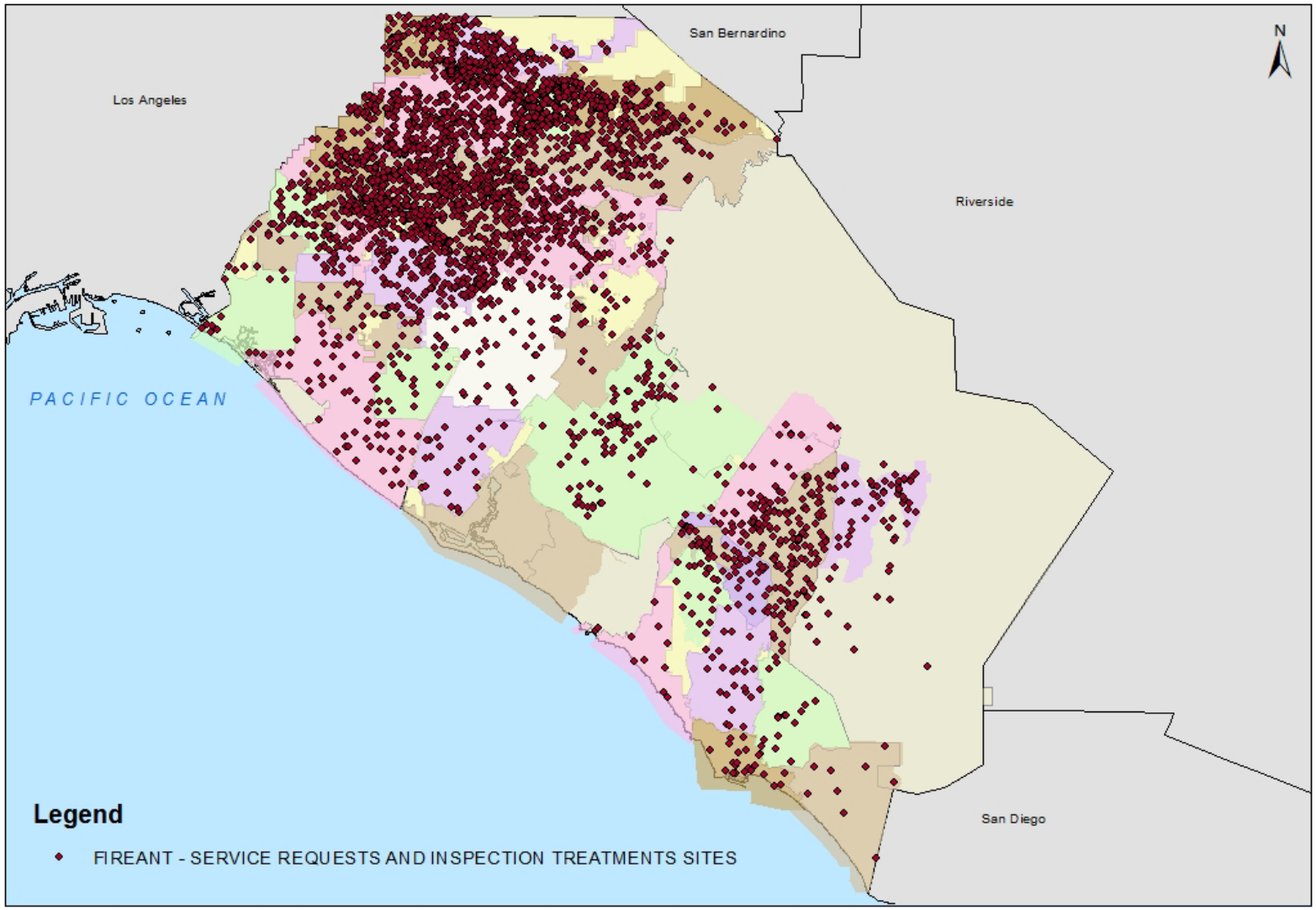

Figure 2-3. Red imported fire ant service requests and treatment, 2010. Source: OCVCD 2010.

2.1.4 SOURCE REDUCTION

Source reduction, or "environmental management," of sites in which vectors multiply was originally the primary method of control and remains an important part of vector control today. Source reduction involves physical control of environmental conditions that favor production of vector species.

Mosquitoes

The classic method of reducing areas where mosquitoes breed involved draining or filling swamps and marshes once they were recognized as the sources of this important group of disease vectors. The first recorded environmental management work in California for mosquitoes was performed by the University Experiment Station of U.C. Berkeley when its researchers assisted the Burlingame Improvement Club (San Mateo County) by recommending ditching and repair of dikes and tide flow gates in the reclaimed salt marsh areas adjacent to that city in 1904 (San Mateo County Mosquito and Vector Control District, no date). Mosquito control was often a secondary effect of reclaiming fresh water marsh lands for agriculture or for residential and commercial development. These activities are now limited by the State of California and federal Clean Water Act regulations, although it is still possible in some instances to reduce mosquito populations by improving water circulation. Reclaimed salt marshes and standing water in irrigated agricultural areas produce enormous numbers of mosquitoes (predominantly *Aedes* species), and the proliferation of mosquitoes in these aquatic features continues to be an ongoing issue for vector control agencies. Urban development and associated drainage systems have added new sources of mosquito habitat that have increased over the past century. Poorly designed storm drain systems, vegetation-clogged ditches, above ground and underground detention basins, swimming pools, landscape pools, cemetery flower vases and abandoned tires and containers can all produce large numbers of mosquitoes. The absence of proper vector reduction strategies during the design and construction phases of state, local and private projects all contribute to mosquito production. Furthermore, if a thoughtful ongoing maintenance schedule is not implemented for aquatic features associated with these aforementioned projects, this factor alone may greatly exacerbate mosquito production. Detection of unmaintained swimming pools and spas and the elimination of mosquito breeding in these and other such sources are a major focus of the District's program.

While the change from flood to drip irrigation for agricultural crops in Orange County has greatly reduced mosquito generation related to crop production, urban areas continue to have the most sources of mosquitoes. Orange County contains approximately 1,409 miles of storm drain channels, both surface and underground (Figure 2-4), which are a major source of breeding sites for mosquitoes within the County (OCVCD 2010). Drain inlets and ponded underground drains caused by settling and accumulations of debris produce areas of mosquito habitat within urban areas. Surface channels may also develop dense vegetation and/or accumulations of debris that create standing water and become mosquito development areas. Unless channel modification or fill is required, no permits from the U.S. Army Corps of Engineers are required for modifications of these areas to reduce conditions that produce mosquitoes. When work inside the banks of natural and artificial watercourses is required, it is usually

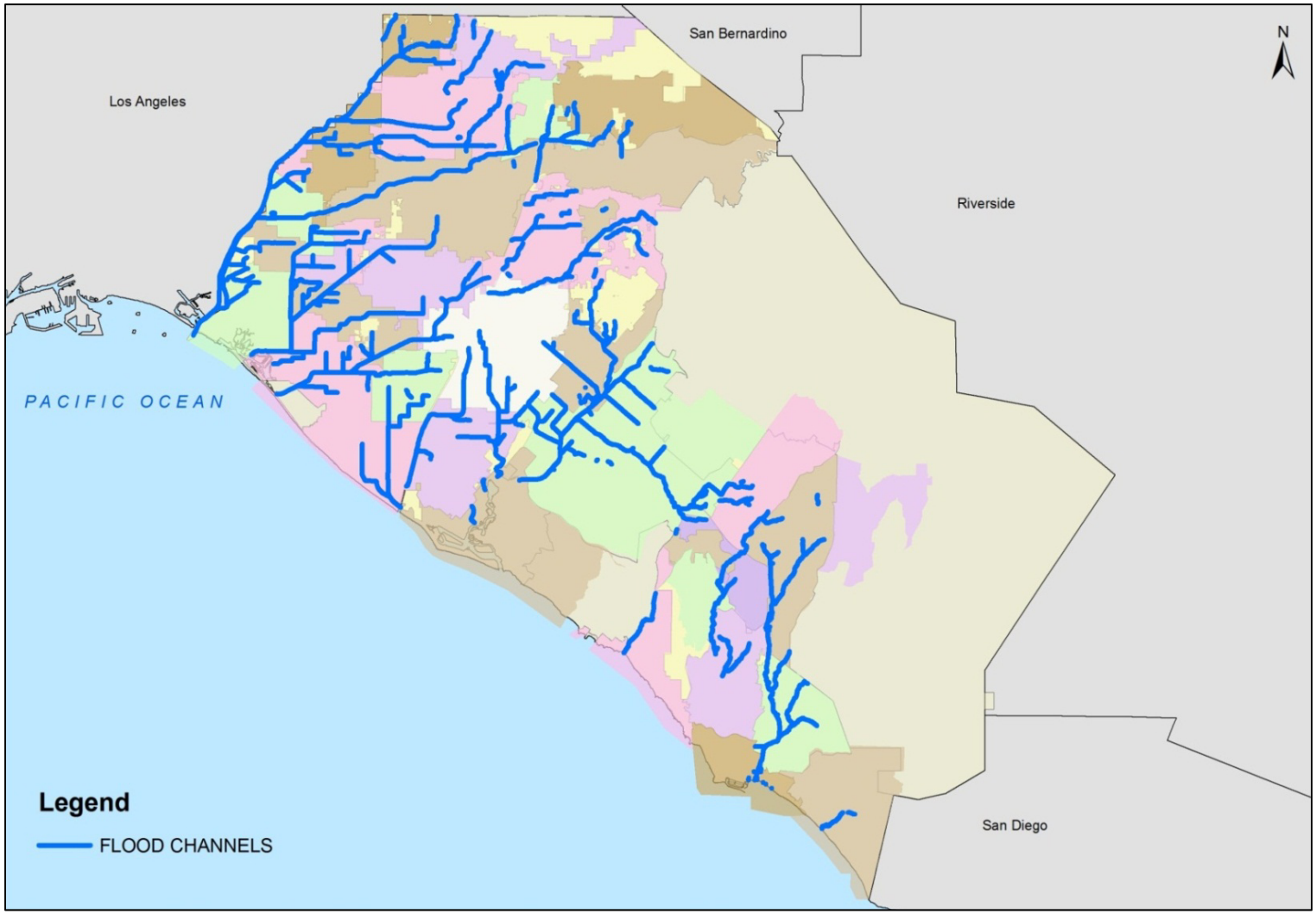

Figure 2-4. 2010 flood route sources and treatment sites. Source: OCVCD and OCFCD 2010.

done to restore the channel to its original contours; these modifications are seldom necessary and do not require permits.

The District's physical control program consists primarily of three activities: vegetation management to maintain access on existing trails to sources and/or restore water movement; drainage ditch maintenance to restore water flow in an area; and water removal from artificial containers. OCVCD's vector control inspectors must occasionally clear narrow access paths through vegetation on banks to evaluate channel conditions and control mosquito larvae (Figure 2-5). The supervisory staff review areas proposed for vegetation management or channel maintenance prior to the work. Control activities on state and federal contract lands currently include annual training sessions on rare and endangered species and sensitive habitats by state and federal biologists for assigned District personnel. All vegetation management is done with hand-held equipment and is usually scheduled between October and February to reduce disturbance to sensitive species.

Rats

Source reduction for rats is primarily the responsibility of the landowners. District staff provide inspections and supply informational pamphlets to guide landowners in removing harborage areas or food, including fallen fruit, on their property. The District's website (www.ocvcd.org) also offers a number of resources for landowners seeking to reduce rat populations on their properties, such as a list of alternative groundcovers that are less attractive to rats that landowners can use in their landscaping. The website describes other ways to rat-proof residences, including simple measures such as changing the placement and storage of pet foods and bird-feeding stations. Vector control inspectors will indicate rat entry points into buildings and recommend that homeowners eliminate or prevent rats from entering these access points. Building repairs to exclude rats are referred to private businesses.

Red Imported Fire Ants

The only practical form of source reduction for RIFA is to greatly reduce landscape irrigation, which attracts the ants. At the current time, the District does not practice or recommend physical control for RIFA abatement.

Flies

Source reduction for filth flies includes recommendations for site cleanup and removal of excess organic matter that creates fly breeding habitat. Practical source reduction techniques for black flies do not exist because these flies reproduce in the substrate under moving water.

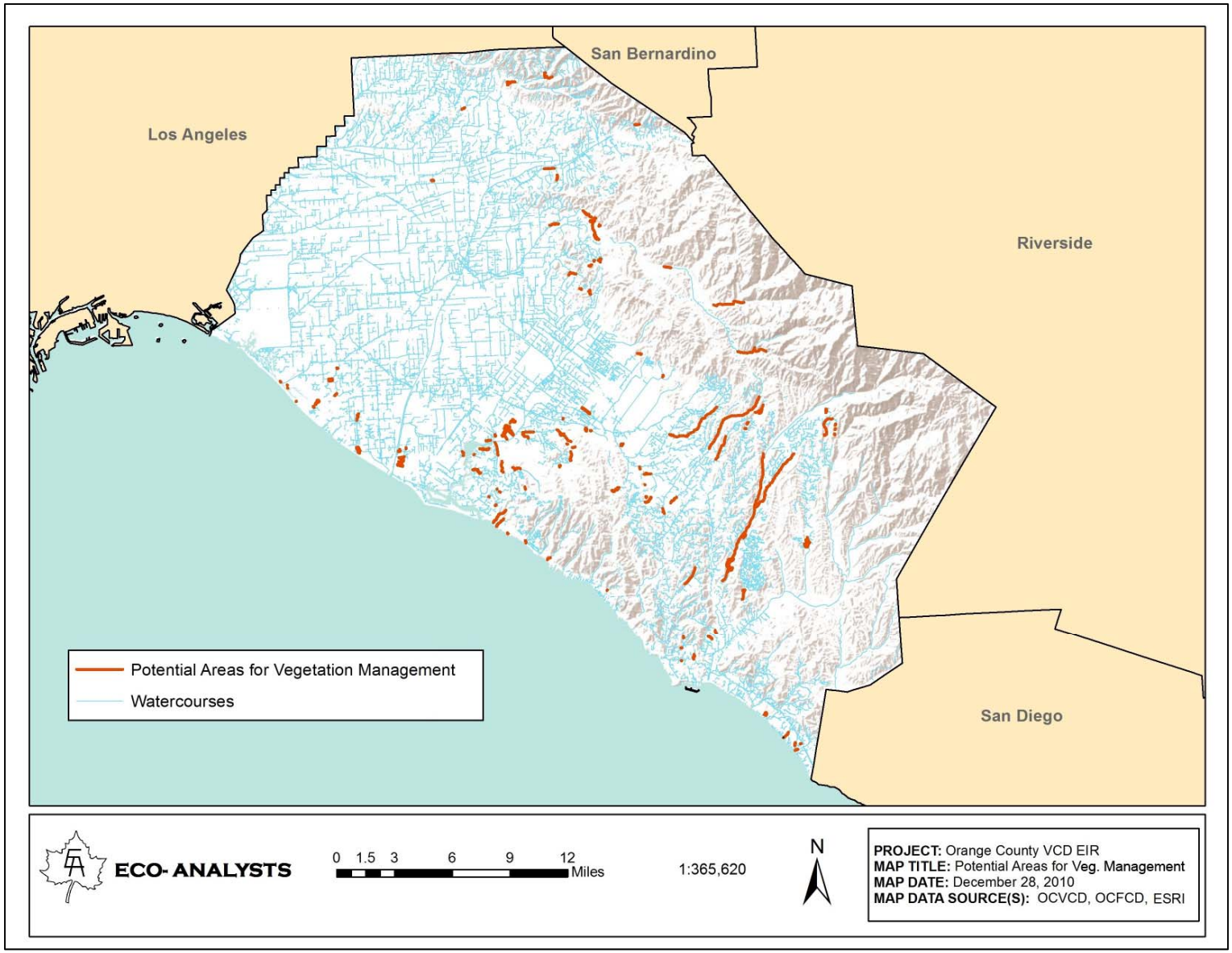

Figure 2-5. Potential areas for vegetation management to aid in source reduction and/or site access. (Potential areas highlighted are not to scale) Source: OCVCD and OCFCD 2010.

2.1.5 CHEMICAL CONTROL

In addition to the use of source reduction techniques, the District applies both synthetic chemicals and biological agents to control vector populations. The District uses a variety of chemical compounds with differing actions to reduce the development of resistance in mosquitoes and other vector species (Table 2-3 and Table 2-4; see Appendix D for annual amounts applied from 2007-2009).

Table 2-3. Mosquito pesticides applied by OCVCD. Source: OCVCD 2010.

Product Name	Active Ingredient	Concentration	Average Application Rate
Mosquito Larvicides			
Agnique® MMFG	alcohol ethoxylated surfactant	32.00%	15 lbs/acre
Agnique® MMF	alcohol ethoxylated surfactant	100.00%	0.5-1.0 gal/acre
Altosid® Briquets	methoprene	8.62%	1/100 sq ft, 2 ft water depth
Altosid® XR Briquets	methoprene	2.10%	1/100 sq ft, 2 ft water depth
Altosid® Pellets	methoprene	4.25%	4 lbs/acre
Altosid® Liquid Larvicide	methoprene	20.00%	¾ to 1 oz/acre
BVA-2*	petroleum distillate oil	97%	5 gal/acre
GB-1111	petroleum distillate oil	98.70%	5 gal/acre
VectoBac® CG	*Bacillus thuringiensis israelensis* (Bti)	4.95%	2.5-10 lbs/acre
VectoBac® G	*Bacillus thuringiensis israelensis*	2.80%	10-15 lbs/acre
VectoBac® 12AS	*Bacillus thuringiensis israelensis*	11.61%	2 pints/acre
VectoLex® WDG	*Bacillus sphaericus* (Bs)	51.20%	16 oz/acre
VectoLex® CG	*Bacillus sphaericus*	7.50%	15 lbs/acre
Natular™ 2EC	Spinosad	20.62%	1.2-2.8 fl oz/acre
Natular™ T30	Spinosad	8.33%	1 tablet/100 sq ft
Natular™ XRT	Spinosad	6.25%	1 tablet/100 sq ft
Natular™ XRG	Spinosad	2.5%	5-20 lbs/acre
Mosquito Adulticides			
Aqua Anvil™	Sumithrin, piperonyl butoxide	50%	1.63 fluid oz/acre

Table 2-4. Additional pesticides and herbicides applied by OCVCD. Source: OCVCD 2010.

Product Name	Active Ingredient	Concentration	Average Application Rate
Red Imported Fire Ant Pesticides			
Distance®	pyriproxyfen	0.50%	4 tbl/mound (1.5 lbs/acre)
Amdro® Pro	hydramethylnon	0.73%	4 tbl/mound (1.5 lbs/acre)
Advion®	indoxacarb	0.045%	4 tbl/mound (1.5 lbs/acre)
Extinguish™	methoprene	0.50%	4 tbl/mound (1.5 lbs/acre)
Extinguish™ Plus	methoprene hydramethylnon	0.37% 0.25%	4 tbl/mound (1.5 lbs/acre)
Miscellaneous Insectides			
Prescription Treatment® brand 565 Plus XLO®	pyrethrins, piperonyl butoxide	2.5%	1-3 sec/ 1000 cu ft fog
Suspend® SC	deltamethrin	4.75%	0.25-1.5 fl oz/1000 sq ft
M-Pede®	potassium salts, propylene glycol, postassium hydroxide	49%	50+ gal/acre
Rat Pesticides			
Contrac® – All Weather Cake	bromadiolone	0.005%	1-4 lbs/yard
Herbicides			
Roundup Pro®	glyphosate-isopropylamine	50.2%	2.9 fl oz/1,000 sq ft

Future modifications of the current programs will involve greater use of species- or genus- specific chemicals and biological control agents, less persistent chemicals and improved methods of delivery.

Handling and applications of pesticides by OCVCD are governed by federal and state laws and are reviewed by the CDPR. All mosquito and vector districts operate under the oversight of the CDPH under an MOU. All materials used are applied by the District according to the label rates established by the USEPA for use in California. In addition to strict adherence by the OCVCD to pesticide use and application regulations, each District vehicle used in chemical control has a spill kit and instructions for cleaning up accidental spills of pesticides (Appendix E).

The following discussion provides a historical overview of the major pesticides used in the control of vectors in California and the U.S. The major active ingredients in the larvicides, adulticides and other pesticides applied by OCVCD are highlighted with relevant information on toxicity including persistence

in the environment and effects on non-target species. This information is derived from a number of sources including the USEPA registration data and acute toxicity (i.e., single dose or short-term exposure) classifications (Table 2-5), CDPR reviews, and university testing.

Table 2-5. USEPA toxicity categories of pesticides. Source: USEPA Label Review Manual 2007.*

Toxicity Category	Signal Word Required on the Label	Categories of Acute Toxicity LD_{50} Oral	LD_{50} Dermal	LC_{50} Inhalation	Probable Oral Lethal Dose for 150 lb Man	Antidote Statement Other Cautions[a]
		mg/kg		mg/l		
I Highly Toxic	DANGER ☠ POISON	0 thru 50	0 thru 200	0 thru 0.2	A few drops to a teaspoonful	Skull and Crossbones "Call Physician Immediately" Antidote Statement
II Moderately Toxic	WARNING	from 50 thru 500	from 200 thru 2000	from 0.2 thru 2	> 1 teaspoonful to one ounce	
III Slightly Toxic	CAUTION	from 500 thru 5000	from 2000 thru 20,000	from 2.0 thru 20	> 1 ounce to one pint or one pound	
IV Relatively Non-toxic	CAUTION	>5000	>20,000	>20	Over one pint or one pound	

[a]All pesticide labels are required to include statement, "Keep out of reach of Children

* http://www.epa.gov/oppfead1/labeling/lrm/chap-07.pdf.

Mosquito Larvicides

Larvicides are the preferred form of chemical control because they can be applied to much smaller (5-10% the size) areas than can adulticides because adult mosquitoes range so widely. When adult mosquitoes emerge, they are capable of dispersing great distances—over 40 miles in the case of some salt marsh mosquitoes and over nine miles for some local Orange County species. The District applies larvicides predominantly from ground-level using spray tanks mounted on truck beds and hand-held spraying devices or from helicopters when large sources requiring treatment exist and ground application is infeasible.

The first larvicide used in the United States was an unspecified oil recommended in the Philadelphia Daily Advertiser on August 23, 1873 (American Mosquito Control Association 1952). In 1892, L. O. Howard recommended the use of paraffin or kerosene oil on all mosquito breeding puddles. In 1940, the Rockefeller Foundation, in cooperation with the Brazilian Government, used a mixture of pyrethrum, carbon tetrachloride and kerosene as a supplement to copper arsenate for control of *Anopheles* larvae. Copper arsenate (or Paris Green) had been used as a larvicide successfully in the southern United States for malaria control but was replaced by pyrethrum-oil mixtures in fish ponds and ornamental pools, and in many other areas, by diesel oil or fuel oil plus an emulsifying agent (Rudd and Genelly 1956). This mixture covered three to eight times the surface area required for oil without the emulsifier.

In 1943, the Bureau of Entomology and Plant Quarantine in Orlando, Florida, established the residual effects of DDT (dichloro diphenyl trichloroethane) as well as its effectiveness as a larvicide for *Anopheles* mosquitoes (Florida Coordinating Council on Mosquito Control 2009). DDT became widely used throughout the United States. Unfortunately, its use as both a larvicide and adulticide and its widespread use as an agricultural pesticide caused the rapid development of resistance of many insects including mosquitoes to this chemical in California and Florida. More toxic chlorinated hydrocarbon relatives of DDT replaced it in many areas, but resistance of mosquitoes to these compounds also developed rapidly, causing the need to replace these with organophosphate compounds (Rudd and Genelly 1956, Florida Coordinating Council on Mosquito Control 2009). It was soon realized that the persistence of DDT and other chlorinated hydrocarbon compounds resulted in bioaccumulation in aquatic and terrestrial vertebrates, another reason for restricting or eliminating the use of this group of chemicals in the U.S. DDT is still used a residual spray on buildings in high malaria infection areas in the tropics.

Use of organophosphate pesticides (OP), which are cholinesterase inhibitors, began replacing use of chlorinated hydrocarbons in the late 1950s and early 1960s (Rudd and Genelly 1956). One important advantage of the organophosphates is their relatively rapid breakdown to less toxic or non-toxic substances when exposed to sunlight and moisture. Parathion was the first OP used in many mosquito control programs. It was effective at controlling mosquitoes and a large number of agricultural pests that were resistant to DDT and related organochlorine compounds. It is, however potentially highly toxic upon contact with the skin or when inhaled. Resistance of mosquitoes to parathion began developing as well, and agencies began substituting malathion, a related chemical considered to be slightly toxic (USEPA 2006a) and originally used in mosquito control as both a larvicide and adulticide. It

was effective as a larvicide because of its solubility in water and its rapid degradation to non-toxic by-products. Carbaryl, a carbamate compound used in many regions of the world, became another alternative to OPs for mosquito control when this pesticide, originally used on lawns and gardens, was found to be very effective against mosquitoes. While very toxic for honeybees and parasitic wasps, it presents relatively low toxicity for mammals and birds (USEPA 2004). Carbamates degrade rapidly in the environment after application and do not bioaccumulate (Fishel 2005, International Programme on Chemical Safety 1986).

Number 2 diesel oil, the first widely used water surface field agent for mosquito larvae and pupae was replaced with Golden Bear Oil (GB-1111), a petroleum distillate. It is toxic to most air-breathing aquatic larvae and is more effective on the pupal stage of mosquitoes (Mulla and Darwazeh 1981). It is no longer manufactured, and mosquito districts including OCVCD have switched to BVA 2, a new, highly-refined petroleum distillate. The District reduces the potential for non-target effects in the use of this product by using it mainly for spot treatment in areas where the more selective products (Bti, Bs; see below) are ineffective, such as where mosquito pupae predominate and in highly polluted sources, and avoids their use in large areas of aquatic sites in which non-target species are present. An improvement over these oils was the development of Agnique, an ethoxylated alcohol. Agnique forms a monomolecular film, making it difficult for mosquito larvae and pupae to attach to the surface of water, resulting in drowning of these life-stages. It does not enter the water column and does not appear to affect other aquatic species (Stark 2005).

Methoprene is an insect growth regulator that is used in a variety of pest control formulations. It is a synthetic juvenile insect hormone used to disrupt the transformation of mosquito larvae into adults and is an active ingredient in larvicides such as Altosid® and Aquaprene.™ It is also used in baits for RIFA (e.g., Extinguish™) as well in pesticides used against fleas, ticks, flies and beetles. The District uses a variety of mixtures and forms for mosquito control (i.e., powders, pellets, granules and briquettes) in both freshwater and saltwater environments. It is most effective when late instar larvae (4th molt) are present and prevents their metamorphosis to adults.

Methoprene has been extensively tested and is non-toxic to birds, humans and other mammals and is somewhat toxic to fish, amphibians and non-target aquatic invertebrates (USEPA 2001). When applied in the manner recommended on product labels, the concentrations used are well below the harmful levels established in laboratory tests. Methoprene is the primary mosquito larvicide used by the District. Because mosquitoes can become resistant to methoprene (Florida Coordinating Council on Mosquito Control 2009), the District periodically rotates larvicides.

Bacillus thuringiensis israelensis (Bti) and *Bacillus sphaericus* (Bs) are commercially produced and used extensively in control of larval mosquitoes. Although these materials are biological products, they are discussed under chemical control because they are evaluated and regulated in the same way chemicals are by the USEPA and CDPR. One reason for the popularity of these products is that they produce toxins effective in killing larval forms of various mosquitoes, fungus gnats and blackflies but have almost no effect on other organisms. OCVCD uses Bti in several forms for mosquito control in Orange County. Both *Bacillus* species have the advantages of being water insoluble and not affecting vertebrates. Some

studies have shown reductions in populations of some aquatic invertebrates with the use of Bti, but these reductions have been largely short-term (Boyce et al. 2007, Hershey et al. 1998, Jensen et al. 1999, Lawler et al. 2008). Bti is considered by the EPA to be non-toxic (USEPA 1998a) and is used around schools, while Bs is the preferred strain for waters with high organic waste loads.

Spinosad (Natular™) is a relatively new larvicide derived from a naturally-occurring soil bacterium. It has been approved for use in California and is being used by OCVCD in 2011. Spinosad has been categorized as a "reduced risk" larvicide by USEPA because of its very low toxicity to humans and most other non-target organisms, although it is toxic to oysters, diatoms and fish on an acute basis (Kollman 2003).

Adulticides

Where mosquito breeding occurs over large areas with limited access, adequate control of mosquito populations with larvicides may not be feasible. In such situations, use of adulticides is necessary. Adulticides are applied using ultra-low volume (ULV) dispersal, which is defined by the USEPA "as a method of dispensing liquid insecticides at the rate of one half gallon or less per acre (ac)." Formulations for the control of public health vectors and pests are dispersed at concentrations of 10-90% at flow rates up to 18 fluid ounces per minute. Technical grade application rates are from 0.001-0.1 gallons (0.006 - 0.06 pounds) per acre. ULV insecticides are applied as an aerosol consisting of particles ranging in diameter from 0.1 to 50 microns (µm); 80% of the particles must have a diameter within the 0.1 to 30 micron range. Droplet parameters are further defined for each insecticide labeled for ULV dispersal (U.S. Department of Defense 1999).

Application of adulticides is generally a third-level measure to control mosquitoes in cases where source reduction and application of larvicides have been infeasible or insufficient to reduce populations. Adulticides are applied to habitats using ULV aerosol machines mounted on truck beds. Applications of adulticides are generally made in large open spaces near residential areas and in the underground storm drain systems. In sensitive habitats or when conditions may lead to habitat damage if vehicles are used, low level ULV spraying is done by staff on foot using hand-held equipment to avoid damage.

The main adulticides used in mosquito control are natural pyrethrins or synthetic pyrethroids. Natural pyrethrins are derived from chrysanthemum flowers, particularly strains from Africa and the Middle East and surrounding areas. These compounds kill larvae of mosquitoes by acting on the sodium and potassium pumping mechanisms necessary for transmission of nerve impulses in arthropods. They do not act significantly on mammals owing to the presence of mammalian enzymes that break down its active compounds (USEPA 2006b). Pyrethrins are not utilized by OCVCD as much as the synthetic pyrethroids (see below) because their availability has been limited by problems with production in the areas of origin and, in some years, they have not been available in the quantities needed for vector control activities. They are not stable in sunlight and breakdown in a few hours. Pyrethrins have been largely replaced by a variety of synthetic pyrethroids, which can be manufactured to meet demand. Pyrethroids are less costly than natural pyrethrins and last longer, up to weeks after treatment when they become incorporated in sediments (Weston et al. 2006). Pyrethrins and pyrethroids both depend upon a synergist to offset detoxification by the target insects. Use of a synergist allows lower initial

doses and prolongs the persistence of the pesticides. The most commonly used synergist is piperonyl butoxide (PBO). PBO has low acute oral, dermal and inhalation toxicity, degrades rapidly (8.4-hour half-life) in the environment by photolysis in water, and is metabolized by soil microorganisms (USEPA 2006c). It is moderately acutely toxic to freshwater fish, moderately to highly toxic to freshwater invertebrates and estuarine and marine fish, and highly acutely toxic to estuarine invertebrates (USEPA 2006c).

The District currently uses one pyrethroid adulticide, Sumithrin, (active ingredient d-phenothrin) plus a synergist (PBO) in the product, Aqua Anvil®. Sumithrin is non-toxic to humans, other mammals, and birds but toxic to bees and aquatic organisms on an acute basis (USEPA 2008).

Rodenticides

Early rodenticides were metallic or organic poisons applied to grain baits (Rudd and Genelly 1956). Unfortunately, they were wide spectrum poisons affecting both birds and mammals. Alpha naphthythiourea (i.e., ANTU) was developed and widely used after World War II (Rudd and Genelly 1956). It was often used as a tracking powder, which rats ingested from their feet while grooming. Resistance of rats to this compound developed rapidly, and control agencies had to alternate its use with other compounds. Another widely used rodenticide was sodium fluoroacetate (Compound 1080). Compound 1080 is very toxic to birds and mammals when treated grain is ingested or when a carnivore scavenges dead rodents killed by this chemical. It is also highly toxic to humans (USEPA 1995).

A major change in rodenticides was the development in the 1950s of warfarin, an anti-coagulant. It is potentially toxic to all mammals in high enough doses. Birds are relatively resistant to the effects of warfarin, and toxicity to aquatic organisms is generally low (USEPA 1991). When rats began exhibiting resistance to warfarin, second generation anticoagulants were developed.

The District uses the rodenticide Contrac® All Weather Cake (0.005% active ingredient bromadiolone and 99.995% inert ingredients including denatonium benzoate, a bitter chemical used to discourage consumption by animals other than rats) as the primary chemical control agent against roof rats. Bromadiolone is known to be toxic to humans, birds and fish (USEPA 1998b). Secondary poisoning or sublethal effects such as liver damage can result when wild predators such as owls consume mice containing bromadiolone (Mendenhall and Pank 1980). Because of its toxicity to mammals precaution statements on the label include:

> "Do not expose children, pets, or non-target animals to rodenticides; this product is toxic to fish, birds and other wildlife; store unused product out of reach of children and pets; apply bait in locations out of reach of children, pets, domestic animals and non-target wildlife; or in tamper-resistant bait stations; store only in original container, in a place inaccessible to children and pets; do not reuse empty container; replace contaminated or spoiled bait immediately. Environmental hazards include: the product is toxic to fish, birds, and other wildlife; predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten bait; do not apply directly

to water. The product can be applied around the periphery of homes, industrial, commercial, public buildings, transport vehicles and alleys. The product is not to be applied in areas where there is a possibility of contaminating food or food sources, or sewers. The product is not to be broadcast."

Rat control by the District is only conducted in the residential setting; it is not performed on federal state or county lands, commercial properties, parks, rights-of-way, or schools, or on residential properties adjacent to environmentally sensitive areas. The first course of action by the District in responding to a rat service request is to advise home or property owners on elimination of rat harborage areas and dropped fruits or other foods. Only when habitat modification is unsuccessful at controlling rats will OCVCD inspectors place one of more USEPA-approved bait stations containing a wax bait block (Contrac® All Weather Cake) on a property. Residents whose properties are treated with rodenticide must sign a rat bait liability waiver (see Appendix B, Integrated Vector Management & Response Plan) to indicate they have been educated about safety precautions associated with the use of the bait stations. The tamper-proof baffled chambers containing the baits are designed to provide access only to rats or other small commensal rodents and are hung in trees or large shrubs, a measure to prevent accidental poisoning of non-target species, children and pets, or placed no greater than 50 feet from the structure near access points used by rats to enter buildings. The stations are secured to a stationary object with copper wire, which will not rust. The District places one to four bait stations in a yard, depending upon the size of the property and the estimated rat population. Residents are instructed to contact the District in six months to schedule a re-inspection of the property. If rat activity is noted at that time, the old bait stations are replaced with new ones. Old bait stations are transported to the District property for proper disposal.

Red Imported Fire Ant Pesticides

Control of RIFA colonies is accomplished with application of pesticide ant baits that the ants feed upon and take back to their queens. The initial response and treatment is made by District vector control inspectors, and two additional treatments are made by local pest operators. OCVCD uses several different chemicals in baits for the control of RIFA. The bait is placed near the nest or over a wider area if multiple colonies are evident. The main chemical is hydramethylnon (in Amdro® Pro). It is widely used in control of both indoor and outdoor domestic pests. It is slightly toxic to humans and pets and essentially non-toxic to birds (USEPA 1998c). It persists for one to two weeks on soil and for two to four weeks in water, depending on alkalinity. The District also uses baits with methoprene (toxicity discussed under Larvicides), indoxacarb, and pyriproxyfen, which are also widely used by private commercial applicators and agricultural operations. Indoxacarb kills insects by blocking nerve pulse transmission. It is moderately acutely toxic to birds and mammals and moderately to very highly toxic on an acute basis to freshwater, estuarine and marine fish. It is highly toxic to bees on contact but presents a low impact when the chemical is dry. Water solubility is low and persistence in aquatic systems is dependent on alkalinity. It degrades rapidly in sunlight (Moncada 2003, Dias 2006). Pyriproxyfen is a juvenile insect hormone analog that prevents development of larval insects into adults. It degrades rapidly in soil under aerobic conditions and in water with exposure to sunlight. It is practically non-toxic to bees and

birds and is moderately toxic to other insects though it has not shown marked effects on mayflies, dragonflies, copepods and beetles (Sullivan 2000). Pyriproxyfen is moderately to highly toxic to fish on an acute basis (PAN Pesticide Database 2010).

Because of their acute toxicity to aquatic organisms, ant baits are not applied within 2-4 feet of water or in intertidal areas below the mean water mark. The District takes care not to apply bait to urban runoff and does not treat with ant baits if rain or irrigation is expected within 24 hours of treatment. Treatments are made in the mid-morning when dew is no longer present and when ants are actively foraging so that ants will remove the bait. However, it can be assumed some bait will be left to decay on the soil surface though, if not picked up by ants, it will degrade rapidly in soil. The active ingredients are present in the products in extremely low concentrations and have fairly short half-lives in soil and water (Table 2-6).

Table 2-6. Environmental fate of RIFA ant bait ingredients.

Product Name	Active ingredient	Half-life in soil	Degradation in Water	Photodegradation
Distance®	pyriproxyfen (0.5%)	36 days (Fathulla 1996)	23.1 days (Fathulla and Ohno 1993)	5.4 days (Fathulla 1997)
Extinguish™ Plus	hydramethylnon (0.365%) s-methoprene (0.25%)	See below	See below	See below
Extinguish™	s-methoprene (0.5%)	10 days (Toxnet 2003)	80% within 13 days (USEPA 2001)	30-45 hours (Schooley et al. 1975)
DuPont Advion®	indoxacarb (0.045%)	16-114 days (Ferraro and McEuen 1996)	Hydrolysis increases with pH. The half-lives at pH of 5,7, and 9 were 500 days, 38 days and 1 day, respectively (Ferraro and McEuen 1996)	Rapid, < 3 days (Ferraro and McEuen 1996)
Amdro®	hydramethylanon (0.73%)	10 days (Ipser and Gardner 2010)	1 hr when exposed to sunlight (Bacey 2000)	1 hr in water, 5 days in soil (Bacey 2000).

Fly pesticides

The District controls flies by identifying and removing larval sources. District inspectors may also apply Bti to areas of flowing water when larval black flies are detected to control black fly populations. The District rarely uses chemicals to control adult flies but has applied synthetic pyrethroids to control adult

flies in situations involving sources that cannot be eliminated, such as sewer ponds or large agricultural culls.

Herbicides

The District has reduced its use of herbicides and does not apply herbicides to water. In 2009-2010, the District applied approximately two gallons of Roundup Pro® (a glyphosate salt) for control of poison oak along upland trails used to access mosquito breeding sites. Roundup Pro® is practically non-toxic to birds, mammals, honeybees, and fish. It adsorbs strongly to soil and breaks down rapidly in water (Anonymous 2002).

2.1.6 BIOLOGICAL CONTROL

The use of biological control agents for control of insect vectors, particularly mosquitoes, has increased dramatically in recent years, but the development and use of biological control agents for other vector species has not been pursued as extensively. The District is evaluating the use of the biological control agent, *Kneallhazia solenopsae*, a microsporidium, to control RIFA in Orange County. The current program utilizes a mosquito predator, the mosquitofish (*Gambusia affinis*), for biological control of larval mosquitoes in addition to the bacterial larvicides, which were already discussed above under chemical control. The following section provides an overview of the other types of biological agents used by the District or investigated by the District and/or others as alternatives to mosquito pesticides.

Microbes and Invertebrates

There are a number of microbes and invertebrates that provide control of mosquito larvae in addition to the bacterial products already discussed (i.e., Bti, Bs and Spinosad) under the topic of larvicides. Viral infections of mosquitoes are caused by iridoviruses, densonucleosis virus, nuclear polyhedrosis viruses, cytoplasmic polyhedrosis viruses, and entomopoxviruses (Genus C) (Webby et al. 1998, Buchatsky 1989, Arif 1995). Laboratory production tests are being run on densonucleosis virus to test for the feasibility of mass production (Buchatsky 1989).

Mosquito larvae are also known to be infected with parasitic fungi, including *Lagenidium giganteum, Coelomomyces* spp., *Culicinomyces clavosporus*, and *Metarhizium anisopliae* (Scholte et al. 2004). *Lagenidium* has a wide distribution in several continents and has caused high mortality rates in mosquitoes in both laboratory and field tests. It has been produced commercially as Laginex™ and appeared to be a promising control agent for mosquitoes. It reproduced during an entire mosquito season and maintained its effectiveness as a control agent for mosquito larvae in North Carolina (Jaronski and Axtell 1983). A larger scale field test in northern California resulted in 40-90% infection rates in *Culex tarsalis* and *Anopheles freeborni* sentinel larvae (Kerwin and Washino 1987). Overall the results have not been satisfactory for mosquito control because this fungus does not survive from year to year. Coelomyces has been observed to cause significant epizootics in mosquito larvae over a period of years. Field tests have resulted in unpredictable infection rates, and mass production of this fungus has been difficult (Scholte et al. 2004).

Protozoans attacking mosquito larvae include *Nosema algerae, Hazardia milleri, Vavraia culicis, Helicosporidium spp., Amblyospora californica, Lambomella clarki, and Tetrahymena* species*;* these species have not been commercially produced or applied in vector control. One nematode known to attack mosquito larvae, *Romanomeris culicivorax*, has also been used in laboratory tests.

Many aquatic insect larvae and some adults are predators of immature and adult mosquitoes. Water striders, spiders, and planaria (flatworms) feed on larvae and pupae at the surface (Mogi 2007). Predaceous diving beetles, notonectids (i.e., backswimmers) and water scavenger beetles feed on larvae below the surface. Dragonfly and damselfly nymphs feed on mosquito larvae, and the adult forms are voracious predators on adult mosquitoes (Chatterjee et al. 2007). Dragonflies can produce quite effective control of adult mosquitoes when they emerge at the same time; however, commercial production of dragonflies for mosquito control has not been pursued.

Birds and Bats

Vertebrate predators (mainly bats and several species of martins) of adult mosquitoes have also been investigated as biological control organisms. Most of the information on success of using these species has been anecdotal. The first attempts to create municipal bat roosts to control malaria were in the early 1930s when a dentist from San Antonio, Texas, C. A. R. Campbell, had some very large roosts constructed (Allen 1939). The attempt was met with limited success, and the numbers of Mexican free-tailed bats (*Tadarida brasiliensis*) using the roosts were small. Bats within the genus *Myotis* are the most likely feeders on mosquitoes because they choose prey of the same size as mosquitoes and hunt at the heights above the ground used by mosquitoes. A 2002 study of the foods of *Myotis lucifigus* in Fairbanks, Alaska, indicated that mosquitoes provided 1.8% of the bats' insect diet (Rydell et al. 2002). A study originally published in 2009 in the Journal of Medical Entomology used a more sophisticated approach (Reiskind and Wund 2009). The researchers placed plastic tubs with water and decaying hay (equivalent to gravid traps) inside and outside large wire enclosures that contained *Myotis septentrionalis*. They found that the bats reduced mosquito egg rafts by 32%. This level of success would be considered insufficient by mosquito abatement districts, however, and a disadvantage of using bats widely for mosquito control is their potential to harbor zoonotic diseases, such as rabies and histoplasmosis. There is no evidence that bats of Orange County produce any measurable levels of mosquito control through their feeding on flying insects.

Martins, large members of the swallow family of birds, feed at the same elevations above ground that mosquito swarms occur. The ecological equivalents of martins in Orange County are several species of native swallows. While swallows are capable of devouring hundreds of mosquitoes while the latter are swarming, they feed on all flying insects of a similar size, including chironomids (midges) and flying ants. Swallow colonies are never large enough to consistently reduce populations of mosquitoes in marshes or rice areas.

Mosquitofish (Gambusia)

Gambusia, also known as the western mosquitofish, is a small freshwater fish of the family *Poeciliidae* (guppy family) that has been distributed widely since the early 20th century as a method of mosquito control. It is the most effective vertebrate predator of mosquito larvae and pupae. The western mosquitofish is endemic to the Gulf States of the United States and Mexico where it was historically known to feed on larval and pupal stages of mosquitoes, other invertebrates and small organisms, including algae. Mosquitofish now enjoy a nearly global distribution in tropical and temperate countries.

Mosquitofish grow to a maximum size of almost three inches and can live two to three years. They are live-bearing, producing three to four broods a year with 15-50 fry per brood. They are tolerant of a wide range of temperatures and water quality conditions, and each individual is capable of eating over 100 mosquito larvae per day under optimal conditions. Although their high rate of reproduction can lead to large populations being quickly established, these same populations can crash dramatically in winter if temperatures plummet, water quality dramatically changes, diseases emerge or food sources become depleted. They also are eliminated when ephemeral pools dry up or ponds are drained.

Mosquitofish are a critical part of the District's IVM approach to mosquito control. The District places *Gambusia* in isolated water bodies such as non-chlorinated, out-of-service swimming pools and ornamental ponds, to control mosquito larvae over a longer period of time; this level of control is not possible with a single application of chemicals. District staff also collect mosquitofish from previously stocked areas, as needed, for redistribution by District inspectors. Collection of mosquitofish occurs in previously stocked artificial or isolated water bodies to avoid impacting native fauna. The District avoids use of mosquitofish in situations in which these fish might escape into natural waterways and become pests, as fish stocking guidelines are strictly regulated and authorized by CDFG. The District also distributes mosquitofish to the public, by request, for use in residential ponds and pools. District staff inform the public about the restricted use of mosquitofish and advise that they are not to be placed or dumped into natural aquatic features.

Between 1998 and 2010, over 1.3 million mosquitofish were distributed by OCVCD into field sources or provided to the public for residential use. Use averaged around 60,000 fish per year between 1998 and 2006. Distribution spiked dramatically after 2007, with over 300,000 fish distributed in 2008, in large part due to the home foreclosure crisis causing a substantial increase in the number of neglected residential pools. In 2009, OCVCD personnel placed 205,400 fish in 2,058 mosquito production sources throughout the County and provided an additional 16, 255 fish to the public for planting in their own pools and ponds. In 2009 and 2010, OCVCD personnel completed the relining and retrofitting of ten existing earthen ponds for holding *Gambusia* located within the OCVCD property, and in 2010, the District completed the construction and plumbing for ten 750-gallon fish tanks in the adjoining portion of the property. These improvements will allow the District to hold more fish under controlled conditions.

Native Fish

Researchers have examined using alternative species of fish and developed a rating system for determining the appropriateness of fish species selection for mosquito larvae control (Ahmed et al. 1988). In some cases, native fish species can be as, if not more, effective than mosquitofish at controlling larval mosquito populations (Childs 2006) because mosquitofish do not consume mosquito larvae equally in all aquatic habitats and are less effective predators in habitats with dense vegetation. OCVCD is also pursuing, under a cooperative effort with the CDPH, the potential use of local native fish to replace mosquitofish in habitats where native species are more compatible. The arroyo chub (*Gila orcutti*) has been identified as a good candidate for biological control of mosquito larvae in managed and natural wetlands in coastal southern California because of its ecology and wide environmental preferences (Van Dam and Walton 2007). This species has been successfully introduced outside of its native range and prefers slow moving, warm backwaters with muddy or sandy bottoms. It is omnivorous, preferring invertebrates when abundant but readily eating algae in the winter; it is not known to eat other fish or amphibian larvae.

Studies conducted in 2005 and 2006 indicated that while both *Gambusia* and arroyo chub reduced the abundance of target mosquito larvae, non-target microinvertebrates remained somewhat to significantly more abundant in pools stocked only with the chub (Van Dam and Walton 2007). These studies also found that mosquitofish production was four to 19 times higher than that of the arroyo chub, although the average chub was three times heavier than each mosquitofish. Overall, the two species were found to provide equivalent levels of mosquito control. This research suggests that the arroyo chub, if approved may be a viable replacement for mosquitofish in slow and fast moving streams in southern California, although further studies are needed to assess their viability as a mosquito control agent in wetlands. Mosquitofish remain, however, a commonly utilized control agent because of their high tolerance to polluted and poorly oxygenated water, rapid reproduction rate, widespread availability and effectiveness at controlling mosquito larvae

2.1.7 PUBLIC EDUCATION

An important component of integrated vector management is educating the public and local agency personnel about the extent of vector problems, the existence of disease organisms, ways to reduce or eliminate vectors and personal protection against vectors and vector-borne diseases.

OCVCD maintains a strong public outreach program within its jurisdiction and a cooperative effort with other southern California agencies to prevent disease by educating the public and government officials. The OCVCD's website provides information on both vector and non-vector nuisance species in the County. The website provides information on the OCVCD, including its staff, the Board of Trustees and its goals. Electronic versions of informational brochures are available as well as means to contact OCVCD staff for additional information or to place a request for control of the nuisance or vector species. Numerous informational brochures are available to the public on the District's website and at the District office and are supplied by vector control specialists when they respond to a service request.

In 2007, OCVCD initiated the formation of the Southern California Vector Control Environmental Taskforce (SCVCET), which it administers. This group includes all local mosquito and vector control districts in southern California and facilitates meetings with resource agencies and other local entities. SCVCET comments on permits and policies, provides guidance materials and recommendations for vector minimization and drafts regional permits. The OCVCD's Communications Department provides public presentations (33 in 2008-2009), and along with other members of its staff, attended 42 public events and 33 City Council meetings in 2008-2009. These continuing efforts are included in the department budget each year. The OCVCD also coordinated the Public Health and Environmental Resource Protection Forum in 2008 and 2009. In 2010, the SCVCET coordinated the Vector Minimization Workshop for private and public employees associated with development and maintenance of public and private facilities.

OCVCD's staff members are active in MVCAC and have been developing video training sessions to be used for employee training and continuing education certification for all vector control agencies within California. In addition, OCVCD's staff maintain ongoing memberships with other professional vector-related affiliations, such as the American Mosquito Control Association, the Society for Vector Ecology and the Entomological Society of America, whereby selected staff attend annual meetings that bolster opportunities for continuing education.

2.1.8 PERSONNEL

The District's 2009 Annual Report lists 56 regular staff positions, the majority (36) of which are in the Operations Department. Thirty-three staff members in this department are involved in the control of vector species; two are assigned to vehicle maintenance and one to building maintenance. The District hires approximately 40 seasonal personnel to aid in vector control (46 in 2010). Twenty-six are working on RIFA. The remaining seasonal personnel assist primarily in mosquito and rat control. Regular District employees all are certified as vector control inspectors with all four qualifications under this category. Vector control inspectors must attend continuing education programs created by the District, the combined districts of the region and the MVCAC. Seasonal personnel receive one week of in-house training before working in the field with the regular operators. Permanent staff begin each season with two weeks of additional training courses. Operators working in rural areas receive an annual training session with CDFG personnel about sensitive habitats and species.

Eight staff members in the Scientific Technical Department support the vector control inspectors in field studies, laboratory work, maintenance and husbandry of *Gambusia* for biological control of mosquitoes, environmental policy guidance and support and assistance to the public. They conduct the trapping of wild rodents and birds and process them for the presence or parasites and disease organisms and also sort and process the mosquitoes collected from the CO_2 and gravid traps.

In the Communications Department, there are two staff members assigned to public outreach, one person assigned to information technology and three public service personnel who handle telephone calls from local residents.

The Executive Department includes two executive staff positions and four administrative staff personnel. Also included in this department are the 35 members of the Board of Trustees and the District Counsel.

2.1.9 EQUIPMENT

Spray equipment includes motorized backpack sprayers as well as hand-pumped pressure cans for applying pesticides. The majority of the equipment used by the District is light-duty pickup trucks used in vector control activities. Twenty-five trucks are equipped for inspections, hand treatment of mosquito larvae and rat control. There are two trucks for ULV application of adulticides, and ten trucks are assigned as RIFA treatment vehicles. Some of the vehicles have been modified and carry special equipment for treatment of flood control channels and underground storm drains. When heavy rains saturate roads in marshes and other wetland areas, OCVCD may contract for the use of helicopters to dispense larvicides. Two trucks are used for transporting mosquitofish. The Scientific Technical Department maintains 11 vehicles for vector control inspections. The District Outreach Program has two vehicles, as does the administrative staff. The oldest two vehicles are 1998 and 1999 half-ton pickups; the rest of these vehicles are newer. The District has a formal vehicle replacement policy based on mileage and condition of vehicles and is reviewing the possibility of acquiring alternative fuel vehicles for replacements in the future.

2.2 ALTERNATIVE 2: ELIMINATION OF, OR REDUCTION IN, CHEMICAL PESTICIDE APPLICATIONS BY OCVCD

There are a small number of people who oppose the use of public health pesticides for mosquito control. Within California, the greatest opposition has been against ultra-low volume application of pesticides over urban areas by aircraft and in residential neighborhoods by ground fogging from vehicles.

In northern California, strong opposition to mosquito abatement practices was originally voiced by some members of the public in Sacramento and Yolo Counties when aerial applications of pesticides were used to combat mosquitoes in response to increases in West Nile virus in California. In Butte County, a small group protested the local mosquito and vector control district's use of ground-based fogging in Chico (Butte County Mosquito and Vector Control District Board Meetings 2008-2009). Trustees of the Marin/Sonoma Mosquito and Vector Control District listened to both strong opposition to ground-based ULV fogging and strong support for the same control activity (May 2010). One group in southern California, Friends of Ballona Wetlands (a marsh located just north of the Los Angeles International Airport), is opposed to pesticide use "where a target organism is merely a "nuisance" and there is no significant threat to public health or safety" (e-mail letter to State Water Resources Control Board, 18 October 2010).

Opponents of mosquito abatement programs primarily object to application of aerosolized pesticides on the grounds that they are being unnecessarily exposed to toxic compounds and do not receive adequate warning to protect their houses or lawn furniture and gardens from the chemicals. They object to the

use of larvicides because they believe that these compounds poison fish and other aquatic animals. Some of the opposition by these people is based on a perception of risk related to a practice over which they have no control (Peterson and Higley 1993). Many of the objections heard by the Sacramento-Yolo and Butte County Vector Control Districts were based on the erroneous perception that the pesticides used were organophosphate compounds or pyrethrin formulations containing lactones, two pesticides that have been largely abandoned by vector control districts in favor of safer, more environmentally friendly alternatives.

OCVCD uses truck-mounted fogging equipment only in open areas near residential developments where it is not possible to eliminate mosquitoes while they are still confined to standing water. OCVCD could eliminate all application of pesticides in response to the concerns of some members of the public, though this strategy would be counter to support for vector control expressed by other members of the public, as well as severely limit the ability of the District to accomplish its public health mission. Other potential and more practicable options under this alternative include discontinuation of treating marshes and underground storm drains with ULV applications of pesticides, discontinuation of application of larvicides in natural environments and treating only artificial and isolated mosquito breeding habitats, and/or discontinuation of pesticide application for rodent and RIFA control.

2.2.1 Option A: Elimination of All Pesticide Application by OCVCD

Elimination of the application of pesticides by the OCVCD would not significantly reduce the amounts of pesticides introduced into the environment in Orange County but would severely restrict the District's ability to carry out its mission of protecting the public from vectors and vector-borne diseases. Many of the pesticides used by OCVCD are the same compounds or chemically similar to those used in pest control and landscape management and by veterinarians and large animal owners. A study by Kreidich et al. (2005) of the University of California indicated that pesticide applications in 2003 for public health in Orange County comprised a small fraction (0.2%) of the non-fumigant, non-agricultural insecticides applied in that year. In 2010, Howard et al. published a review of public health pesticides in California and estimated that public health pesticides constituted only 0.9% of all pesticides applied. The consequences of eliminating pesticide application by the District are speculative, but it is likely that public use of pest control products and private pest control companies would increase so that there would be no appreciable change in overall pesticide use in Orange County.

Advantages: There are no significant advantages in discontinuing ULV and larvicidal applications, which comprise a small proportion of all pesticide applications in the County. Continuous water runoff from suburban landscape irrigation into water conveyance systems requires frequent larvicidal applications to control immature mosquitoes in these sources. Studies and risk assessments on effects of ULV aerosols on wildlife and humans and have not indicated significant adverse effects to non-target species when the particular adulticides in use by OCVCD are applied at label rates and in a manner consistent with label guidelines (Davis et al. 2007, Davis and Peterson 2008, Macedo et al. 2010).

Disadvantages: The District would be less able to adequately protect the citizens of Orange County from many potentially life-threatening illnesses using only public education, disease and vector surveillance,

and physical methods of source reduction. The large number of public service requests annually received by the District would be unaddressed or fall to the individual members of the public to resolve for themselves. The District is contracted to provide service to government lands; these agencies would need to make other arrangements to control vectors on public land. The use of vector control pesticides would likely occur at the same rate in Orange County, but their application would be more difficult to regulate and control. Scattered individual vector reduction efforts by the public and private pest control operators would be much less effective or ineffectual at controlling spread of vectors and disease on a countywide basis. In addition, pesticide applications by the public are subject to fewer safety requirements.

2.2.2 *Option B: Discontinuation of Ground-based ULV Pesticide Applications Over Marsh Areas and/or in the Underground Storm Drain Systems*

Control of adult mosquitoes is a "third level measure" by the OCVCD when source reduction and application of larvicides have not adequately reduced biting mosquito populations. On May 11, 2010, the District adopted formal guidelines for controlling vectors based on the numbers of mosquito species per larval dip or trap night and the presence of disease organisms. (This plan also formalizes thresholds for source reduction of rats, RIFA, black flies and filth flies). The OCVCD Vector Reduction Manual lists specific steps to be taken to control mosquito production to limit the necessity of applying adulticides and to determine when control of adult mosquitoes is necessary.

Some residential developments are near coastal marshes and other wetlands, and residents in these areas experience potentially significant exposure to large numbers of biting mosquitoes and disease. Various local, state and federal agencies that own or manage the large wetlands in the County have contracted with OCVCD to provide vector control. Because marshes and other wetland areas in Orange represent sensitive habitats, it is difficult to practice source reduction with the current federal and state restrictions on activities in wetlands. In addition, many of the wetlands are too large for effective control using larvicides alone.

Control of adult mosquitoes in Orange County is typically accomplished using ULV aerosol machines mounted on truck beds to apply pesticides. These applications are made in large open spaces near residential areas and, with special modifications, are used to control adults in the underground storm drain systems. After periods of heavy rainfall, when unpaved access roads may not support vehicles in the marsh areas, low level ULV spraying is done by staff on foot using hand-held equipment to avoid damage to habitat. Many of the ponded areas in these wetlands in which mosquitoes breed are not accessible for larval surveillance and treatment, so mosquito populations can only be controlled with adulticides. These wetlands are occasionally in densely populated areas; therefore, the mosquitoes within them are developing in close proximity to humans.

Under this alternative option, protection of residents living near coastal marshes and mitigation wetlands without using ULV application of adulticides would require an increase in source reduction activities and possibly the use of tracked amphibious or large, low pressure tire equipment to reach large areas of marshes and wetlands after heavy rains for application of larvicides. Some physical

damage to habitat in sensitive areas would still be expected to occur using this specialized equipment. Additional education efforts would also be required for local residents of areas producing large numbers of adult mosquitoes that are potential disease vectors.

Advantages: As under Option A, there are no significant advantages in discontinuing ULV applications in response to opposition that is based on perceptions and not scientific or medically confirmed evidence.

Disadvantages: The elimination of above-ground ULV applications in open space areas and in storm drains would not provide significant environmental benefits. Adequate control of mosquitoes in marsh habitats and surrounding areas without ULV applications of adulticides would be considerably more difficult and expensive and require increased public education. Humans and susceptible wildlife would have an increased risk of arbovirus infections, as well as possible health effects from large numbers of mosquito bites in sensitized humans and domestic animals.

2.2.3 Option C: Discontinuation of Larvicide Application in Natural Habitats

Limiting larvicide application to constructed environments and discontinuing application in natural habitats and channels leading to surface water streams and the ocean would eliminate potential effects upon non-target species and sensitive habitats; however, scientific research has not demonstrated clear adverse impacts to non-target species from the use of larvicides currently used by the District. Most studies in the United States and Europe have indicated minor, or only temporary (e.g., three days for GB-1111; Miles et al. 2002), effects upon non-target aquatic invertebrates from the use of the bacterial and surface film mosquito larvicides. Lawler et al. (2000) found no detectable effect upon non-target invertebrates in a salt marsh treated with methoprene. Bti has a wider range of effects upon aquatic insects, but the decreases in insect populations also tend to be short-term (Lundström et al. 2010a; Lundström et al. 2010b; Persson Vinnersten et al. 2010). Bs also may affect other aquatic insect larval stages but again effects are insignificant or short-term (Merritt et al. 2005). Surfactants such as Agnique® and GB-1111 demonstrate short-term effects upon aquatic invertebrates of a few days to a week (Miles et al. 2002, Zhong et al. 2005). Water surface films affect only the larval forms of insects that must reach the surface and breathe air.

Advantages: There are no clear advantages to eliminating larval control with pesticides currently in use by the District. Scientific studies do not support long-term adverse impacts to humans or non-target species from pesticides the District currently uses when they are applied according to label safety guidelines established by the USEPA. There is some concern, however, that petroleum distillate oils may adversely affect rare and endangered rails and other waterfowl that nest at the water surface in wetlands if eggs or feathers become oiled. Use of alternate larvicides, such as Agnique® or the bacterial products, in the habitats of these species as part of an IVM approach allows mosquito control to continue while protecting these resources.

Disadvantages: Control of mosquitoes in aquatic habitats is more effective than attempts to control them as dispersed adults. Allowing mosquitoes to develop to the adult stage increases the potential for nuisance conditions as well as disease transmission. Increases in source reduction activities to eliminate

standing surface water and the development of immature life stages of mosquitoes would be required to reduce mosquito populations under this option.

2.2.4 *Option D: Discontinuation of Rodenticide and RIFA Pesticide Applications*

The RIFA program is a Proposition 218-funded program approved by the property owners in Orange County, and there is still widespread support for RIFA control by OCVCD. Control of RIFA could be discontinued on public lands but continued only on private properties; however, this strategy would be inconsistent with the goals of the California Department of Food and Agriculture to control the spread of RIFA in California and would result in persistent infestation points within the County.

The rat control program was transferred to OCVCD from the County Health Department in 1975. If the District's education based rat control program were eliminated, some parts of it could possibly be replaced by private pest control operators. With community-based education about rat control less available and far more expensive, residents and business owners would try their own methods of rat control or tolerate the presence of rats. Testing of disease in rats and their ectoparasites might not be carried out, and disease surveillance would be less effective.

The rodent and RIFA programs of the OCVCD both seek to control populations of the targeted species, but the approaches are very different. The RIFA program is dependent on the public's participation in the discovery and reporting of RIFA colonies, with District staff using several different ant baits to eliminate the colonies. The rodent control program requires the long-term cooperation of the public in the form of actively taking steps to reduce the carrying capacity of the neighborhood. Rodenticides and traps are used to control stragglers and are not presented as solutions by the District. When District inspectors supply rodenticide, the baits are presented in proprietary, tamper-resistant container to reduce the impact to non-target species; however, the potential for secondary poisoning of wildlife is very difficult to eliminate. The rodenticide used by the District is also available for purchase by the public, and the contribution of public health applications versus private use of rodenticides to incidences of secondary poisoning of non-target wildlife is unknown. However, discontinuation of their distribution by the District would not eliminate use of the baits within the County by the public and private pest control companies.

Advantages: There is no clear environmental advantage from discontinuing of application of these pesticides by the District.

Disadvantages: Eliminating OCVCD's roof rat or RIFA control programs by the District would reduce control in public open space and lead to increased potential for disease transmission and property damage in these areas. The RIFA control efforts employed by the public likely would result in far more pesticide use as compared to the current usage by OCVCD based on a Texas A &M study of the economic impacts of fire ant control by Salin et al. 2000. Moreover, the elimination of the RIFA program is inconsistent with goals of the California Department of Food and Agriculture, which has designated RIFA a quarantined species.

2.3 OTHER ALTERNATIVES CONSIDERED

A number of other alternatives were considered, such as no vector control alternative, use of only biological organisms for control and use of abatement proceedings to accomplish vector control, but these were rejected as infeasible.

2.3.1 NO VECTOR CONTROL

A No Vector Control Alternative, i.e., elimination of the District, is considered infeasible because the California Health and Safety Code requires vector control to protect public health and establishes the operation of vector control districts. The District's activities, under the state Health and Safety Code, are designed as preventative measures for public health and welfare, and elimination of the control programs would result in adverse impacts upon humans, domestic animals, and wildlife with a significantly increased potential for disease transmission and adverse reactions to bites of large numbers of mosquitoes, black flies, rats, and RIFA. Annual surveys conducted by the District of Orange County residents show a high level of satisfaction with the existing programs. As more than two-thirds of local property owners approved increases in taxes to support more intensive control programs of both mosquitoes and red imported fire ants, the District's activities are understood and appreciated by the people they serve.

Mosquito abatement work has become more important with the re-introduction of *Aedes albopictus* into neighboring areas of Los Angeles County. This mosquito species is a very competent vector of Dengue Virus, and recent outbreaks in southern Florida indicate the need for coordinated programs such as those provided by OCVCD.

2.3.2 USE OF ONLY BIOLOGICAL ORGANISMS FOR CONTROL

This alternative strategy would depend upon predation by bats, birds and dragonflies for control of adult mosquitoes and mosquito fish, *Lagenidium*, *Coelomomyces*, and invertebrate predators such as *Planaria* for larval control.

All of the predators of adult mosquitoes are opportunistic feeders and feed on a wide variety of insects. Establishment of colonies of vertebrates large enough to provide countywide control would be difficult and expensive. Bats have been studied the most thoroughly, and the most recent investigation as a control agent (Reiskind and Wund 2009), showed a 32% reduction in mosquito egg rafts, a rate which would be considered a failure for a pesticide. Dragonflies can be effective when a local hatch of this predator occurs at the same time there is a large mosquito emergence, but populations are seldom large enough to control adults over a large area for the duration of the mosquito season.

Mosquitofish have proven to be an effective form of larval mosquito control in standing water situations but are less effective in the presence of dense emergent vegetation or very large water bodies, or small ephemeral puddles and pools, and release of mosquitofish into natural habitats is avoided to reduce impacts to native species. The invertebrate predators require standing water for several weeks to achieve populations large enough for larval control. Mass production has been possible in the case of

Lagenidium, but not the others. Overwintering of *Lagenidium* at the end of the season has not been good in most localities (Scholte et al. 2004).

Biological organisms can be important in vector minimization but have not been effective when used as the sole control agent. These agents alone cannot adequately control mosquito production from a multitude of stagnant water sources in street gutters, underground storm drains, and flood control channels in Orange County.

2.3.3 Use of Abatement Proceedings

Article 5, Division 3, Chapter 1, of the California Health and Safety Code provides mosquito and vector control districts with the legal power to require property owners to abate a public nuisance and to compensate an agency for the control. The statute is primarily written for mosquito control and focuses on water management. The OCVCD Vector Reduction Manual (2010) provides formal policies and guidelines to encourage property owners to control conditions that promote vector production on their land. When landowners are uncooperative, abatement proceedings by the District's Board of Trustees can provide a legal mechanism to correct the problem at the landowner's expense. Abatement proceedings could be used to control mosquitoes produced in neglected swimming pools if one or more lending institutions foreclosed and controlled a large number of properties. Summary abatement proceedings can be applied by cities in emergency situations in which a threat to public health or safety is involved. In Orange County, this would require all 34 cities and the County to enact summary abatement proceedings in their governing ordinances. These actions would not protect the local residents in nuisance situations.

Abatement enforcement is seldom used except for repeated or major vector production problems. It is an expensive, time-consuming process that allows vector production to continue during the gathering of evidence and hearings required to issue abatement orders.

3 Environmental Setting

3.1 Public Health And Disease

Vector-borne diseases have been a public health problem with many catastrophic epidemics occurring throughout the millennia. "Plagues" of various sorts have caused enormous losses of life and health problems since the earliest records of mankind. Modern public health practices and vector control agencies have reduced the impacts of many diseases, although few diseases have been completely eradicated. Intense short-term efforts to control disease have essentially eliminated small pox and reduced the incidence of poliomyelitis. Unfortunately, there are few effective vaccines for vector-borne diseases in humans (with the exception of yellow fever), and these illnesses continue to exact a serious toll in terms of human life and health.

3.1.1 MALARIA

Malaria, a serious infectious disease caused by protists in the *Plasmodium* genus and transmitted by mosquitoes, was one of the major vector-borne diseases affecting early Californians and was apparently brought into the state by fur trappers (Patterson 2009). The *Anopheles* species of mosquito was especially abundant in the Central Valley region and caused serious illness and deaths in the local Native American populations as well as the immigrant populations in the state. Major reclamation and drainage projects to produce more arable land in the early 20thcentury reduced the problem in many areas of the Central Valley.

Military personnel infected with malaria returning home at the end of World War II reintroduced this disease throughout California and the U.S. A number of mosquito abatement districts were established shortly after the war to counter this threat to public health. Improved housing, socioeconomic conditions and case management efforts assisted in this control effort. The conflicts in Korea and the war in Vietnam also resulted in small outbreaks of malaria spread by returning service personnel. Currently, malaria cases are primarily imported into the U.S. from areas in Asia and sub-Saharan Africa, where malaria is still present at high rates (CDC 2010a). A few localized outbreaks have occurred as a result of these introduced infections, but they have all been quickly controlled. In 2008, the Centers for Disease Control and Prevention (CDC) reported 128 cases in California (CDC 2010b).

3.1.2 BUBONIC PLAGUE

Bubonic plague, an infectious and virulent disease of the lymphatic system, is caused by the bacterium, *Yersinia pestis*. It is spread by fleas found on rodents; however, these same fleas and others capable of transmitting plague may occur on domestic pets, especially cats. Bubonic plague is believed to have been introduced into California in the 1850s by rats on ships from Asia. It became established in port cities along the West Coast and spread into the southern Cascades and Sierra Nevada Mountains. It remains endemic in ground squirrel populations in many areas of California. The mortality rate for bubonic plague is 50-70% if not diagnosed and treated (CDC 2005). When the bacillus mutates to the pneumonic form, spread through respiratory infections, the mortality rate becomes 90%. The last serious rat-borne outbreak occurred in Los Angeles in 1924 (CDC 2005). Since then, there have been sporadic outbreaks in ground squirrels and chipmunks, mainly in counties within the Cascade and Sierra Nevada Mountains.

Plague has occurred in Orange County sporadically, including instances in ground squirrels during the early 1980s in Tonner Canyon and Anaheim Hills, adjacent to Riverside and San Bernadino Counties, and in a roof rat from the City of Orange in 1998. The CDPH Vector-Borne Disease Section lists the Santa Ana Mountains as a plague endemic area. This means plague is present and capable of reoccurring at any time. Bubonic plague recently re-emerged in Los Angeles in 2009 and in Plumas Eureka State Park in 2010 (Business Wire 2010). Rats, squirrels, and other small mammals from Orange County tested by the OCVCD laboratory in 2009 (111 specimens) and 2010 (191 specimens) have tested negative to date. However, major epidemics have continued to threaten other parts of the world in places where the public health system has been allowed to fall into disrepair because of lack of funding (Garrett 2000).

3.1.3 MOSQUITO-TRANSMITTED VIRAL ENCEPHALITIS

Neuroinvasive viruses, viruses that affect the central nervous system, seem to be increasing in modern times, with new forms being introduced presumably by air travelers from exotic localities and by migratory birds. Communicable disease officials believe that one or more viruses will arrive from Africa or Asia in the near future. The following diseases are the primary neuroinvasive viruses that are transmitted by mosquitoes in California and that vector control districts seek to reduce or eliminate through their control efforts.

Saint Louis encephalitis (SLE) was the first (1933) recognized major neuroinvasive arbovirus in the United States. In 1975, there was a major outbreak of 2,000 cases in the Ohio-Mississippi River Basin (CDC technical report 2010). Sporadic human cases have been diagnosed in southern California, although the virus and antibodies are more frequently recovered from wildlife during research studies. Since 1945, 597 human cases have been reported in California. The most recent, large-scale outbreaks occurred in southern California in 1983-1984 (26 cases, five in Orange County) and the San Joaquin Valley in 1989 (29 cases); sporadic cases were reported in the Los Angeles Basin from 1990-1997. SLE was considered the most important mosquito-borne virus in North America until the arrival of WNV in 1999 (California Vector-borne Disease Surveillance System; www.calsurv.org).

Western equine encephalitis (WEE) has been a significant cause of death and disease in humans and horses in the United States. In 1938, more than 300,000 horses and mules were infected in the U.S. In 1952, an outbreak centered in Kern County resulted in 813 cases in humans and an infection rate of 1,120/100,000 in horses. Severe disease and mortality was especially high in very young children of farm workers who live in houses without air-conditioning or screened windows. Organized mosquito abatement has reduced the threat posed by this disease, but any potential financial reduction of abatement programs could result in resurgence of this virus.

West Nile virus (WNV) was first diagnosed in the United States in New York City in 1999 and rapidly spread westward throughout the United States. New York City had 62 confirmed cases of WNV, and seven deaths were reported. The epidemic was noticed in July and August, and an emergency spraying program was undertaken in September using chemicals to control adult mosquitoes. During subsequent years, WNV spread to nearby northeastern states, reaching all of the lower 48 states by 2003 (Macedo et al. 2010). Outbreaks in all 58 counties in California occurred in 2004, when 779 cases in humans were confirmed, and in 2005, when 880 cases were confirmed with 19 fatalities (Carney et al. 2008). The State of California initially provided funds for equipment and pesticides to supplement those of local mosquito and vector control districts. As numbers of confirmed cases in California have declined, supplemental state funds have ceased. However, WNV remains at unacceptably high levels and appears to be endemic in the state.

In the U.S. from 2004 to 2009, there were approximately 25,000 cases of WNV and 1,000 deaths. WNV has been considered to have caused the largest arboviral encephalitis epidemic outbreak in U.S. history (Davis et al. 2007). While the rate of incidence and the percentage of severe effects are relatively low (less than one tenth of one percent), the disease has been found to be persistent in kidneys in at least

five out of 100 patients studied and was fatal in some cases (i.e., led to kidney failure in six out of 100 cases; Murray et al. 2010). Other studies have found that pre-disposition to the virus may occur from receiving previous mosquito bites (Schneider et al. 2007). A study by Barber et al. (2010) reported that the total immediate cost of 163 cases of WNV (including diagnosis and treatment of infections, some physical therapy and subsequent control measures by the Sacramento-Yolo Mosquito and Vector Control District) was $2.98 million dollars. No estimate of cost was given by this study for the long-term care of those with severe neuroinvasive infections.

In 2008, 71 humans, 639 birds, four squirrels, three sentinel chickens, and two horses with WNV were confirmed within Orange County. In 2009, four human cases and 11 dead birds in Orange County were diagnosed with WNV. Sixteen mosquito pools were positive for this virus in 2009. A single human case, 19 mosquito pools, 2 dead squirrels and 17 dead birds were confirmed in Orange County in 2010 (Figure 3-1). Altogether, WNV infection has been confirmed in 182 people and has caused 7 deaths in Orange County from 2004-2010.

3.1.4 FLEA-BORNE TYPHUS

Rickettsia felis is a gram-negative bacterium that causes the predominant form of flea-borne typhus that occurs in Orange County, although *R. typhi* is also found in infected animals and fleas. The cat flea, *Ctenocephalides felis*, is considered the primary vector of both bacteria. This flea is also found on opossums (*Didelphis virginiana*) that enter the yards of homes with cats. The disease organism is not spread by a flea bite but by infected flea feces entering a cut in the skin or a skin abrasion. In California, it seems to be confined to Orange and Los Angeles Counties.

Control is usually achieved by treating household cats and dogs to rid them of fleas, although severe household infestations may require fumigation of the interior of the house and exterior yards. In 2007, 13 people in the southwestern portions of Orange County became severely ill with flea-borne typhus in one outbreak. Testing of small mammals and the fleas they carried produced four infected opossums and 13 pools of fleas from the immediate area of the outbreak (Bob Cummings, OCVCD, pers. comm.). In 2009, there were seven human cases of flea-borne typhus in the County, four of which were in one household in Westminster, while in 2010, eight human cases were reported (OCVCD 2010a). In total, 40 cases (no deaths) of flea-borne typhus have been reported in Orange County from 2006-2010.

3.1.5 HANTAVIRUS

Hantavirus pulmonary syndrome (HPS) is an infectious disease with flu-like symptoms that progresses rapidly to potentially life-threatening breathing problems. It was first recognized in 1993 as the cause of death in young, otherwise healthy Navaho men in non-urban environments. Transmisson was determined to occur through fomites (dried urine and fecal particles) from the deer mouse, *Peromyscus maniculatus*. This mouse is widely distributed in rural areas throughout the U.S., often in close association with human development. Occasionally, antibodies are found in the harvest mouse, *Reithrodontomys megalotis* (CDC 2004).

The original virus, **Sin Nombre virus**, is the primary hantavirus found in Orange County (Figure 3-2). A second variant, Morro Canyon Virus, also has been isolated from deer mice in Orange County. In 2009, the District laboratory found 23 infected deer mice of the 132 tested, with one of six harvest mice also testing positive; in 2010, three of 52 deer mice and one of one California mouse (*Peromyscus californicus*) tested hantavirus-positive (OCVCD 2010a).

3.1.6 TICK-BORNE DISEASES

Lyme disease was first recognized in 1975 and named after the town in Connecticut where it was diagnosed. The causal agent is a spirochete that, in California, is carried by the western back-legged tick, *Ixodes pacificus*. This tick often begins by parasitizing lizards. Later stages move to rodents, and the adults are found on deer. Humans are accidental hosts when working or hiking in areas that support deer. Lyme disease gradually becomes a systemic disease and, if not treated with broad spectrum antibiotics, it can become chronic with arthritis and nerve damage. Lyme disease is rare in Orange County, but occasional human cases occur and the spirochete has been found in ticks at a very low incidence. Since 1989, the OCVCD laboratory has processed over 3,000 ticks, which it checks for the presence of rickettsial and spirochete diseases.

3.1.7 RED IMPORTED FIRE ANTS (RIFA)

While RIFA are not associated with disease transmission, they are included with diseases in this section because of the extreme pain associated with the stings of these organisms and the severe anaphylactic reactions that they can cause in some people. RIFA aggressively defend their nests and are known to swarm on humans and other animals that disturb their mounds. RIFA inflict an extremely painful sting and multiple stings can be fatal to the young or very old to anyone who has an allergic reaction to them (OCVCD 2010b).

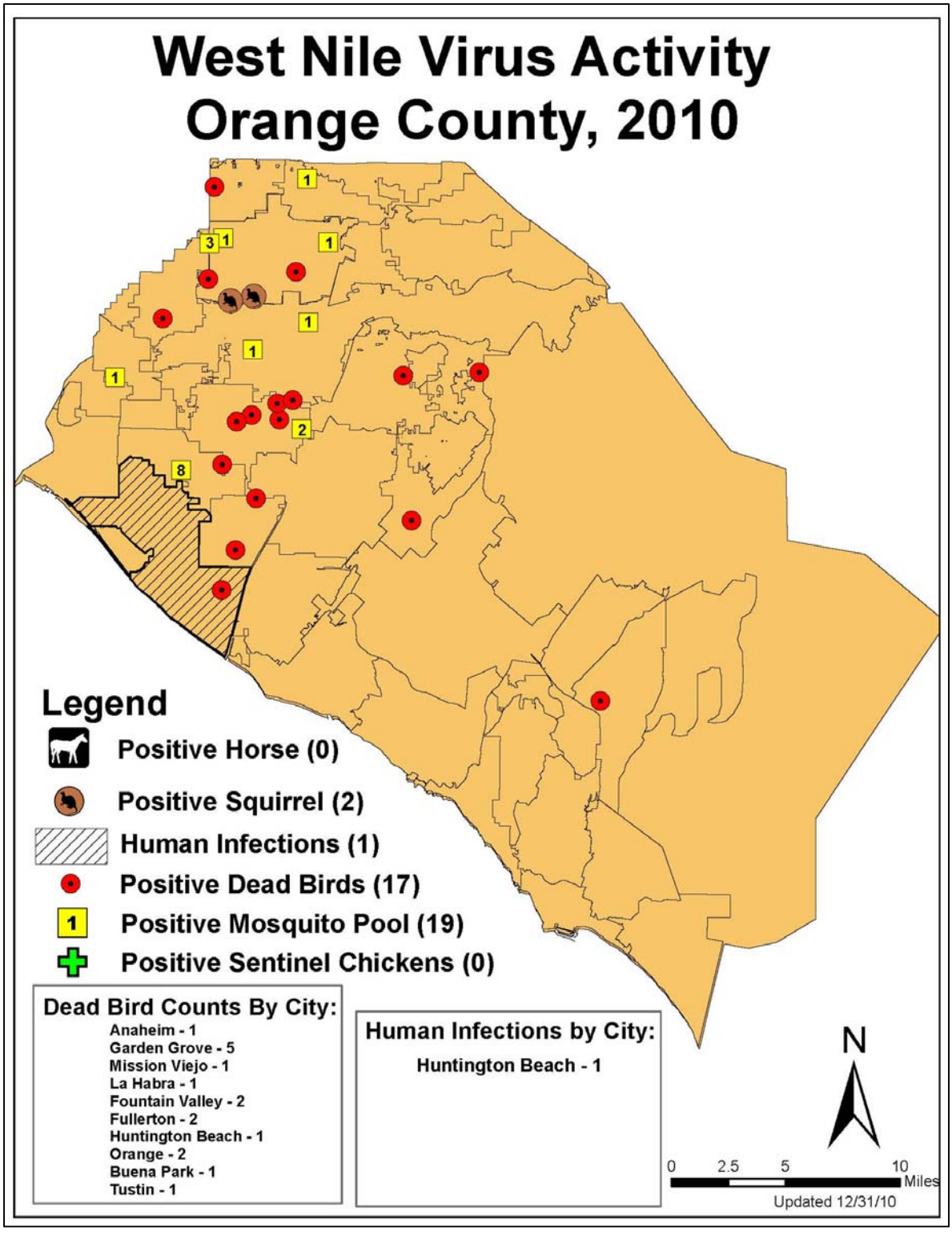

Figure 3-1. West Nile virus activity in Orange County, 2010. Source: OCVCD 2010a.

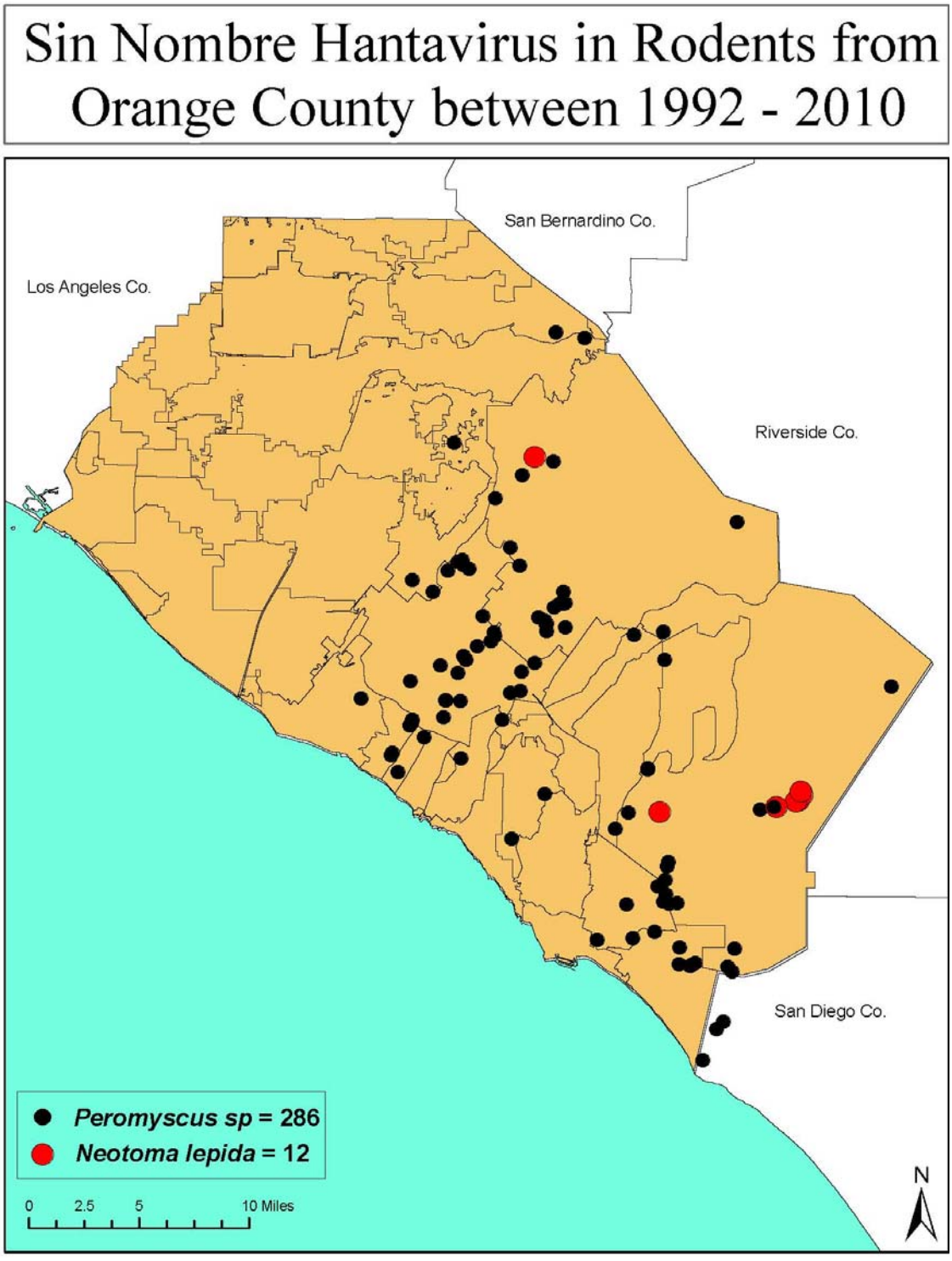

Figure 3-2. Hantavirus in Orange County, 1992-2010. Source: OCVCD 2010a.

3.2 PHYSICAL RESOURCES

3.2.1 TOPOGRAPHY

Orange County is comprised of four physiographic regions including coastal beaches and tidal flats, alluvial fan and flood plains, level terraces and rolling hills, and steep interior mountains (California Department of Agriculture 1978; Figure 3-3). Elevations range from sea level to over 5,600 feet. The extensive coastal beaches and tidal flat areas from Seal Beach to Newport Beach narrow southward to beaches generally affected by high tides. The alluvial floodplain and alluvial fans characterize the northern half of the County, extending from the area of Anaheim south to the coastline of Newport Beach; elevations range from sea level to 250 feet (California Department of Agriculture 1978). The coastal terraces of Huntington Beach, Costa Mesa and Newport Beach rise hundreds of feet, while the inland terraces of Buena Park, Yorba Linda and El Toro adjacent to the floodplain and alluvial fans extend up to approximately 500 feet in elevation. Terraces south of Newport Beach grade to rolling hills from sea level to nearly 1,200 feet and include the San Joaquin Hills, Laguna Hills and Niguel Hill.

The Santa Ana Mountains, forming the County's eastern boundary from the Puento Hills to beyond the county line, range from a few thousand to 5,689 feet in elevation on Santiago Peak. Narrow, steep walled canyons such as Trabuco Canyon, Silverado Canyon, Black Star Canyon and Fremont Canyon are prevalent. The Santa Ana Mountains are traversed by the Santa Ana River east of Yorba Linda.

3.2.2 GEOLOGY

Orange County is located within the Peninsular Range Geomorphic Province in which major mountain ranges and fault systems trend in a northwest/southeast direction (California Department of Agriculture 1978). General rock types of the four physiographic regions are:

- Beaches and tidal flats: alluvial beach and sand deposits;
- Alluvial floodplain and fans: alluvial deposits;
- Terraces and rolling hills: terrace deposits, sedimentary rocks and some volcanic rocks;
- Interior mountains: sedimentary, volcanic, plutonic and metamorphic rocks with some alluvial concentrations in canyons.

Orange County landscapes contain a diversity of soil types, which have been divided into 30 broad associations (United States Department of Agriculture 1977). The soil associations are grouped according to where they occur (Figure 3-4): soils of the floodplains and recent alluvial fans (1-8); soils of the older alluvial fans and terraces (9-13); soils on marine sediments (14-21); soils on crystalline rocks (22-24); and on miscellaneous land types (25-30).

Figure 3-3. Orange County terrain.

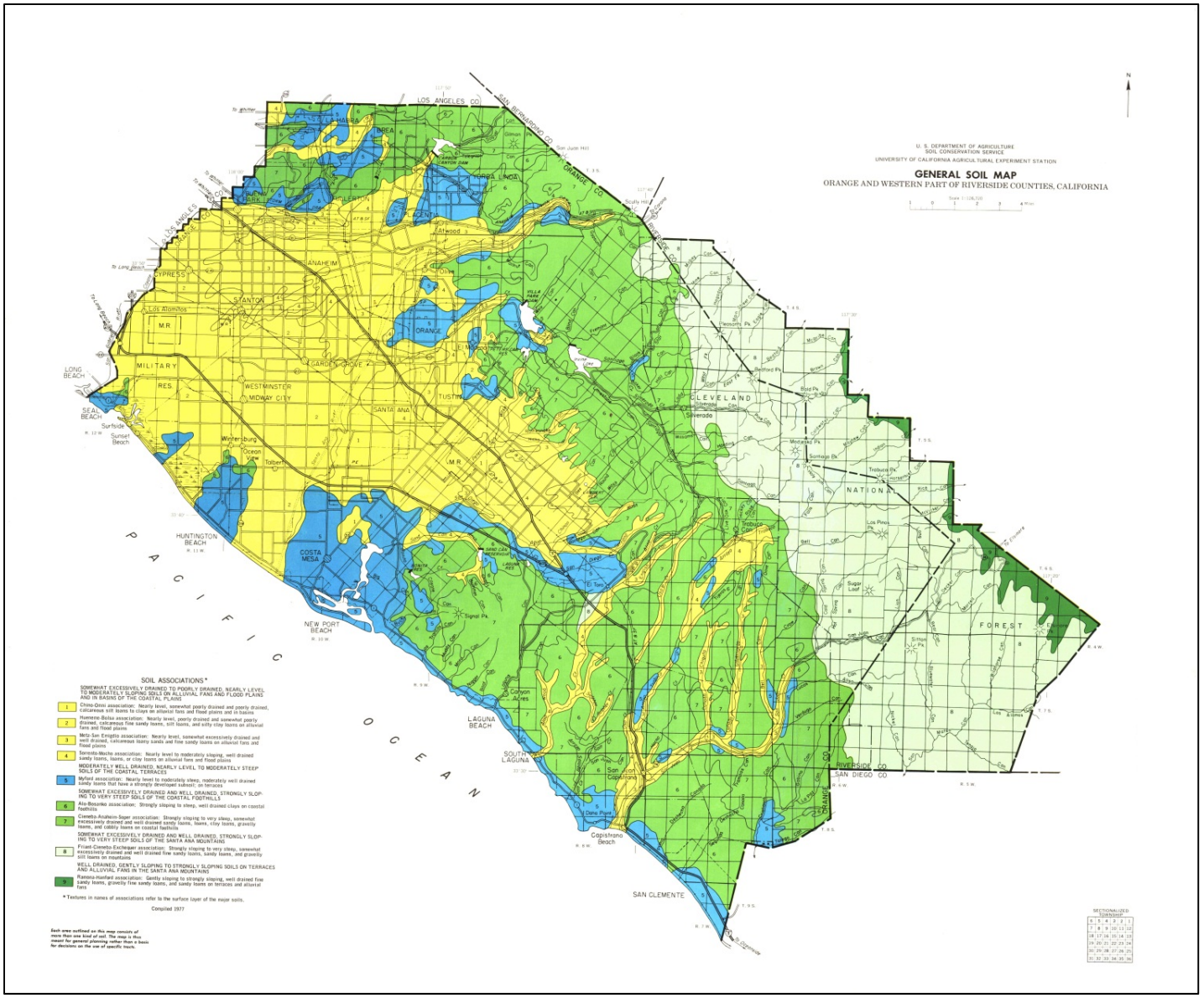

Figure 3-4. Soils of Orange County. Source: U.S. Department of Agriculture 1977.

3.2.3 HYDROLOGY

Surface Waters

Watersheds of Orange County include the larger Santa Ana River, San Gabriel-Coyote Creek, Anaheim Bay-Huntington Harbor, Newport Bay, Aliso Creek, San Juan Creek, San Mateo Creek, and the smaller San Clemente Coastal Streams, Dana Point Coastal Streams, Laguna Coastal Streams and Newport Coastal Streams Watersheds (Figure 3-5). The following information on watersheds has been summarized from watershed descriptions provided by the Orange County Public Works website (www.ocwatersheds.com) as well as the Orange County Water District's website information on the Santa Ana watershed (www.ocwd.com).

The Santa Ana River Watershed, covering 210.47 square miles, is the largest watershed in Orange County. Originating 75 miles outside the County in the San Bernadino Mountains, the Santa Ana River flows through San Bernadino and Riverside Counties before entering Orange County between the Chino Hills and the Santa Ana Mountains. The final 28 mile reach, entirely inside Orange County, empties into the Pacific Ocean. Santiago Creek is the largest tributary to the watershed. Portions of the cities of Anaheim, Brea, Huntington Beach, Orange, Placentia, Santa Ana, Villa Park and Yorba Linda lie within the watershed.

The Anaheim Bay-Huntington Harbor Watershed in northwest Orange County covers an area of 80.35 square miles. The main tributaries are Bolsa Chica Channel, East-Garden Grove Wintersburg Channel and the Westminster Channel. Cities within the watershed include portions of Anaheim, Cypress, Fountain Valley, Garden Grove, Huntington Beach, Los Alamitos, Santa Ana, Seal Beach, Stanton and Westminster. The watershed lies completely within urbanized land.

The San Juan Creek Watershed in southeastern Orange County drains 159.98 square miles. San Juan Creek, the watershed's largest tributary, originates in the Santa Ana Mountains in the Cleveland National Forest. Smaller tributaries are the Arroyo Trabuco and Oso Creek. Cities in the watershed include portions of Laguna Hills, Laguna Niguel, Mission Viejo and San Juan Capistrano.

The Newport Bay Watershed drains approximately 152.02 square miles within southern Orange County and includes all waters draining into Newport Bay. The watershed is further divided into four subwatersheds: Lower Bay, Upper Bay, Santa Ana Delhi Channel, and San Diego Creek/Peters Canyon Wash, the largest of the subwatersheds. Cities include Newport Beach, San Ana and Irvine.

The San Gabriel River-Coyote Creek Watershed in the northwest corner of Orange County covers 85.49 square miles of Orange County. The main tributary to the San Gabriel River is Coyote Creek, which flows from Riverside County. Cities included in the watershed are portions of Brea, Buena Park, Fullerton, La Habra, and La Palma. All flows in the watershed are channelized.

The Aliso Creek Watershed, located in south central Orange County, covers 34.87 square miles. Aliso Creek, the main tributary, originates in the Santa Ana Mountains in the Cleveland National Forest.

Figure 3-5. Watersheds of Orange County. Source: Orange County Public Works 2008.

Cities within the watershed include portions of Aliso Viejo, Dana Point, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest and Mission Viejo.

The San Mateo Creek Watershed is a mostly unincorporated area in southeastern Orange County that covers 19.16 square miles. Most of San Mateo Creek and its outlet to the Pacific Ocean at San Onofre State Beach are in San Diego County. Portions of San Clemente and the O'Neill Land Conservancy at Rancho Mission Viejo are within the watershed.

The San Clemente Coastal Streams Watershed of approximately 19.16 square miles includes Prima Deshecha Canada, originating near the Prima Deschecha landfill and discharging at Poche Beach, and Segunda Deshecha Canada discharging at North Beach on the Pacific Ocean along with other tributaries and unnamed drainages. Cities in the watershed include portions of San Clemente, San Juan Capistrano and Dana Point.

The Dana Point Coastal Streams Watershed, at 10.28 square miles in southern Orange County, has Salt Creek as its main tributary that drains into the Pacific Ocean. Dana Point and Monarch Beach are located here.

The Laguna Coastal Streams Watershed of approximately 19.35 square miles consists of the Laguna Canyon Creek Watershed and several other smaller watersheds that drain to the Pacific Ocean. The watershed is bound on the west by Emerald Canyon and on the east by the Aliso Creek Watershed. The remaining undeveloped areas are largely within the Laguna Coast Wilderness Park and Aliso and Wood Canyons Regional Parks. The Laguna Coast Wilderness Park covers most of the western half of the watershed, and a small a small portion of the Aliso and Woods Canyon Regional Park is included in the northeastern part. Cities having portions within the watershed include Aliso Viejo, Laguna Beach and Laguna Woods.

The Newport Coastal Streams Watershed covers 7.77 square miles of a largely unincorporated area between Newport Beach and Laguna Beach. Newport Coast and Muddy Creek, the main tributaries, drain the San Joaquin Hills. All streams are seasonal.

Each watershed contains miles of creeks and streams. Many streams, named and unnamed, remain in their natural state for a large part of their lengths, but most streams in the coastal plains have been dammed, drained or channelized. Santiago Reservoir, also known as Irvine Lake, is the largest reservoir in Orange County at 900 acres. It is kept stocked with various species of game fish as is the 85-acre Anaheim Lake. Areas behind Brea Fullerton, Carbon Canyon and Villa Park dams are flood control basins for high surface runoff. Laguna Lakes in central west Orange County is the only natural lake. Lake Forest and Laguna Niguel Lake are important man-made recreation lakes.

The 200-acre San Joaquin freshwater marsh near, and owned by, the University of California - Irvine serves as valuable wildlife habitat.

Ocean waters and three of southern California's 28 estuaries along 42 miles of Orange County coastline provide valuable water resources for recreation, food and commerce.

Groundwater Resources

Orange County has two principal ground basins that underlie Orange County: the Coastal Plain Basin and the San Juan Valley Basin. According to the Orange County Water District, they supply 60- 75**%** of the water delivery for municipal, industrial and agricultural use (Orange County Water District 2010).

The Coastal Plain Basin, 360-square miles underlying 45% of Orange County, is the largest basin in the County. Drained by the San Ana River and Santiago Creek, this basin has a well that yields 600 gallons per minute (gpm) on average to a maximum of 1,000 gpm. Storage capacity is estimated at 40 million acre-feet with recharge estimated at 221,000 acre-feet per year; the useable storage capacity is undetermined. Intensive irrigation and municipal, industrial and domestic use have increased water extraction rates. Water quality problems include high total dissolved solids (TDS) and nitrogen (TDN) concentrations, overdrafting and sea water intrusion. Water basins underlying Los Angeles, north of the County, interchange somewhat with the basin (Orange County Water District 2010).

The San Juan Valley Basin in southern Orange County is an 18-square mile coastal basin that is drained by San Juan and Aliso creeks. Maximum well yields at 450-1,000 gpm are averaged to 500 gpm throughout the basin. The storage capacity of 90,000 acre-feet with an approximate useable capacity of 60,000 acre-feet capacity has an estimated 10,500 plus acre-feet of natural recharge (California Department of Water Resources 2004, Metropolitan Water District of Southern California 2007). Development for the basin has been moderate for municipal and irrigation use and limited for domestic use. Water quality problems include high TDS/TDN, sulfate, chloride and magnesium for domestic use and high TDS/TDN, boron and chloride for irrigation use (California Department of Agriculture 1978). Rising groundwater and ponding are also major problems for the basin.

The San Mateo basin is a small coastal basin located in the southern end of the County.

In 2000, the State Water Resources Control Board initiated the Groundwater Ambient Monitoring and Assessment Program (GAMA) which, in 2001, became mandate under AB 599. The program has identified two areas of Orange County as “Hydrogeologically Vulnerable Areas” in the GAMA Priority Basin Project: Southern California Coastal Plain and the Santa Ana/San Jacinto basins.

3.2.4 WATER QUALITY

Surface and groundwater quality in Orange County are of major concern due to the high concentrations of total dissolved solids and total nitrogen (Santa Ana Regional Water Quality Control Board 2010). Many processes have led to these concentrations and are being addressed by local and federal agencies. The source of surface water is from runoff from the San Ana River, tributaries that drain into and within the County, and allotments from the Colorado River. Groundwater is the County’s major source of water for municipal, industrial and agricultural use; surface water, as available, is also used for the same purposes.

Santa Ana River water is used upstream by the cities of San Bernadino, Chino, Colton and Riverside before entering Orange County. Municipal use combined with heavy agricultural use has greatly

increased salt loads and inorganic nitrogen. The Colorado River's high salt content due to evaporation from storage and irrigation use upstream adds to the increasing TDS concentrations.

Bacterial contamination is another water quality problem for Orange County. Upstream dairies along the Santa Ana River have been major contributors to contamination requiring Department of Water Resources and NPDES permitting processes. They have worked to address contamination issues since the voluntary institution of the California Dairy Quality Assurance Program in 1997, partnered with the 1998 EPA's "Dairy Waste Management: An Integrated Approach to Education and Compliance" (USEPA 1999).

Military bases have contributed to contamination in County waterways and are reported to be responsible for oil wastes in Santa Ana, upper Newport Bay, El Toro, and in marshes and channels near Los Alamitos Naval Air Station. Fish kills reported by residents and local agencies could have multiple causes; large algal growths reported in upper Newport Bay and Bolsa Bay are thought to be caused by runoff of agricultural fertilizers.

A number of water bodies within Orange County have been determined to have impaired water quality and require compliance measures and monitoring of Total Maximum Daily Loads (TMDL) of contaminants by SWRCB (2006). The Santa Ana Regional Water Quality Control Board lists several stream segments and other water bodies with limited water quality that occur in Orange County (SWRCB 2006). These include Anaheim Bay (dieldrin, nickel, PCBs, sediment), Balboa Beach (DDT, dieldrin, PCBs), Bolsa Chica State Beach (copper, nickel), Buck Gully Creek (fecal and total coliform), Huntington Beach State Park (enterococcus, indicator bacteria, PCBs), Huntington Harbor (chlordane, copper, lead, nickel, pathogens, PCBs, sediment), Los Trancos (Crystal Cove) Creek (fecal and total coliform), Lower and Upper Newport Bay (chlordane, copper, DDT, metals, PCBs, sediment), Peters Canyon Channel (DDT, toxaphene), Rhine Channel (copper, lead, mercury, PCBs, sediments, zinc), San Diego Creek reach 1 (fecal coliform, selenium, toxaphene) and reach 2 (metals), Santa Ana River reach 4 (pathogens), Santiago Creek (salinity/TDS/chlorides), Seal Beach (enterococcus, PCBs), Silverado Creek (pathogens, salinity/TDS/chlorides), and Summit Creek (nutrients).

San Diego Regional Water Quality Control Board has also listed several waterways in Orange County with limited water quality (SWRCB 2006). These waterways include Aliso Creek (indicator bacteria, phosphorus), Dana Point Harbor (indicator bacteria), English Canyon (benzo[b]fluoranthene, dieldrin, sediment), Laguna Canyon Channel (sediment), Oso Creek (chloride, sulfates, TDS), Pacific Ocean Shoreline Aliso HSA (indicator bacteria), Pacific Ocean Shoreline Dana Point HSA (indicator bacteria), Pacific Ocean Shoreline Laguna Beach HSA (indicator bacteria), Pacific Ocean Shoreline Lower San Juan HSA (indicator bacteria), Pacific Ocean Shoreline San Clemente HA (indicator bacteria), Pacific Ocean Shoreline San Joaquin Hills HSA (indicator bacteria), Prima Deshecha Creek (phosphorous, turbidity), San Juan Creek (diclorodiphenyldicloroethylene or DDE, indicator bacteria), upper Santa Margarita River (phosphorus), and Segunda Deshecha Creek (phosphorus, turbidity).

Pesticides and Water Quality

Several waterways and water bodies found within both Regional Water Quality Districts' 303 (d) lists of water bodies with limited water quality are classified as having impacts and pollutant stressors that result from potential pesticide use. These pollutant stressors include dieldrin, DDE, DDT, chlordane, toxaphene, and benzo[b]fluoranthene. Any release of these chemicals into listed waterways would add to the cumulative impact on these already compromised systems.

Dieldrin, chlordane, and toxaphene are chemicals once widely used in agriculture and pest control. These compounds are described collectively as chlorinated hydrocarbons or organochlorides. They are carcinogenic and suspected endocrine disruptors. Use of these specific compounds is no longer permitted in the State of California. DDT, also a chlorinated hydrocarbon, was also widely used in agriculture and pest control and was deregistered in 1972. Use of this specific compound is no longer permitted in the State of California. Benzo[b]fluoranthene is a polynuclear aromatic hydrocarbon formed from the incomplete burning of organic compounds such as gasoline. It forms colorless needles through condensation of constituent hydrocarbons such as benzene. It is a carcinogen and mutagen, although no signs or symptoms of acute or chronic exposure in humans have been reported (Occupational Safety and Health Administration 2010). Cumulative contributions in the form of precursors to this chemical are found in vehicle exhaust.

The Regional Water Quality Control Boards are the primary agencies for water quality control in Orange County. The Regional Water Quality Control Boards, in conjunction with the Watershed Management Initiative, provides Water Quality Control Plans for each region, describing water quality objectives and standards to be met. The Santa Ana Region serves most of Orange County, while the southern third of the county is under the jurisdiction of the San Diego Region.

County agencies responsible for water quality management standards in Orange County include the Flood Control District, the independent Sanitation Districts, the Orange County Water District and the Water Pollution Department. The Flood Control District performs water quality studies and water pollution surveillance for the State Water Quality Control Boards. The Sanitation Districts maintain 350 miles of trunk sewers, pumping stations, treatment plants, and ocean outfalls. The Orange County Water District is responsible for protecting the water resources of the Coastal Plain groundwater basin. The Water Pollution Department enforces the County Industrial Waste Ordinance for the County and cities and also performs pollution surveillance for the SWRCB.

3.2.5 AIR QUALITY

The air quality of Orange County has historically been very poor because of the combination of its location in one of the largest urban areas in the U.S. and meteorological conditions unfavorable to the dispersion of pollutants. The warm climate coupled with the marine influence of the ocean creates high moisture surface area that contributes to the formation of smog, acid rain, and inversion layers that trap pollution in the area. Because of onshore winds, air quality is usually better near the coast than in inland portions of the County.

Orange County falls within the South Coast Air Basin (SCAB), a 6,600-square mile area that includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernadino Counties. The SCAB is bounded by the Pacific Ocean and Ventura County on the west, mountains of the San Gabriel, San Bernadino and San Jacinto ranges on the north and east and San Diego County on the south. Ambient air quality is monitored at numerous locations throughout the SCAB including Orange County to determine whether federal and state ambient air quality standards are met. The South Coast Air Quality Management District (SCAQMD) is the regional entity that includes Orange County within its jurisdiction and is responsible for managing air quality within the SCAB. SCAQMD publishes an air quality plan (SCAQMD 2007) that outlines policies and regulations applicable within the district and defines regional emissions thresholds for evaluating the impact of projects through CEQA.

Ambient air quality standards have been set by both federal and state governments to protect public health. Air pollutants emitted into the air by mobile and stationary sources are regulated by both federal and state law and are referred to as "criteria air pollutants." USEPA and CARB have established ambient air quality standards for common criteria air pollutants (See Appendix F for more information). These standards represent safe levels that avoid specific adverse health effects associated with each pollutant. California standards represent levels that may not be exceeded, whereas federal standards (other than those for ozone, particulate matter and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. CARB and SCAQMD monitor concentrations of criteria air pollutants and track whether the air basins are in attainment of federal and state thresholds through designations of attainment or non-attainment. The SCAB was designated non-attainment of federal standards for ozone and PM10 pollution; these designations have additional qualifiers of severity for the state standards (Table 3-1).

Table 3-1. South Coast Air Basin attainment status, 2010. Source: CARB 2010.

Pollutant	Attainment Classification California Standard	Federal Standard
Ozone	Nonattainment/Severe 17	Nonattainment
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Attainment	Attainment
PM10	Nonattainment/Serious	Nonattainment
PM2.5	Nonattainment	Nonattainment
Lead	Attainment	Attainment
Sulfates	Attainment	Unclassified*
Hydrogen Sulfide	Unclassified	Unclassified
Vinyl Chloride	Unclassified	Unclassified
Visibility Reducing Particles	Unclassified	Unclassified

*not enough data to make a determination.

3.2.6 GREENHOUSE GASES

Greenhouse gases (GHG) are gases that trap the heat in the atmosphere and include water vapor, carbon dioxide, methane, ozone, and nitrous oxides, all of which may be produced by natural biological and physical processes, as well as by human activity. Humans have also added various synthetic fluorocarbon compounds and other aerosols to the atmosphere and have increased the rate of release

of carbon dioxide, nitrous oxides and methane. The impact of human activities on the atmosphere began accelerating with the advent of the Industrial Age and continues to increase with development as countries' economies shift from being based predominantly on agricultural to manufacturing. Global climate change—a change in the average weather of the earth that can be measured in wind, storm patterns, precipitation and temperature— is thought to be partly the result of these long-term chemical releases to the atmosphere by humans.

A major contribution to GHG in California is the transportation sector. While modern engines produce significantly lower amounts of greenhouse gases than combustion engines of the past, this decrease has been offset by the large increase in numbers of automobiles on the roads. The transportation sector in 1990 was estimated to emit roughly 38% of California's GHG, or a total of 182.4 million metric tons of carbon dioxide equivalent (CARB 2007). Other sources of GHG include the production of electricity using fossil fuels, wood burning to heat homes, and agricultural burning.

3.3 BIOLOGICAL RESOURCES

3.3.1 HABITATS

The Orange County General Plan Resources Element identifies 16 primary habitat and land cover types including dune, scrub, chaparral, grassland, seasonal wetlands, marsh habitats, riparian, woodland, forest, cliff and rock, marine and estuarine, lakes, reservoirs and basins, watercourses, agriculture, developed and disturbed (County of Orange 2008). These land cover types are further subdivided into subtypes and are described in the land cover and habitat classification system originally created by Gray and Bramlet (1992) and vegetation surveys of Orange County parks and open spaces performed by Jones and Stokes (1993). They are further broken down into major subtypes, and each subtype may be further subdivided into distinct sub-associations based on dominant species. Alternatively, University of California - Irvine biologist, Dr. Peter J. Bryant (2010), describes 12 separate habitats in the County: oceans, islands and offshore rocks, rocky intertidal, bluffs and headlands, beaches, coastal sand dunes, marine terraces, streams and rivers, wetlands, coastal sage scrub, chaparral and coastal mountains. Under either classification scheme, a wide variety of habitats are recognized in Orange County.

While large parts of Orange County are developed and have been classified as either urban or suburban (Figure 3-6), the County is also home to a number of vegetation communities (Table 3-2), many of which are found in close association with one other, such as scrub, chaparral and grassland communities that often form ecotones adjacent to one another. The remaining natural habitats, particularly coastal sage scrub, and associated species within the County have been the focus of preservation efforts undertaken as part of the process of developing multiple large scale HCP/NCCPs.

The HCP process is authorized under Section 10 (1)(b) of the Endangered Species Act, which allows authorization of 'take' of federally listed species when it is 'incidental' to otherwise lawful activity.

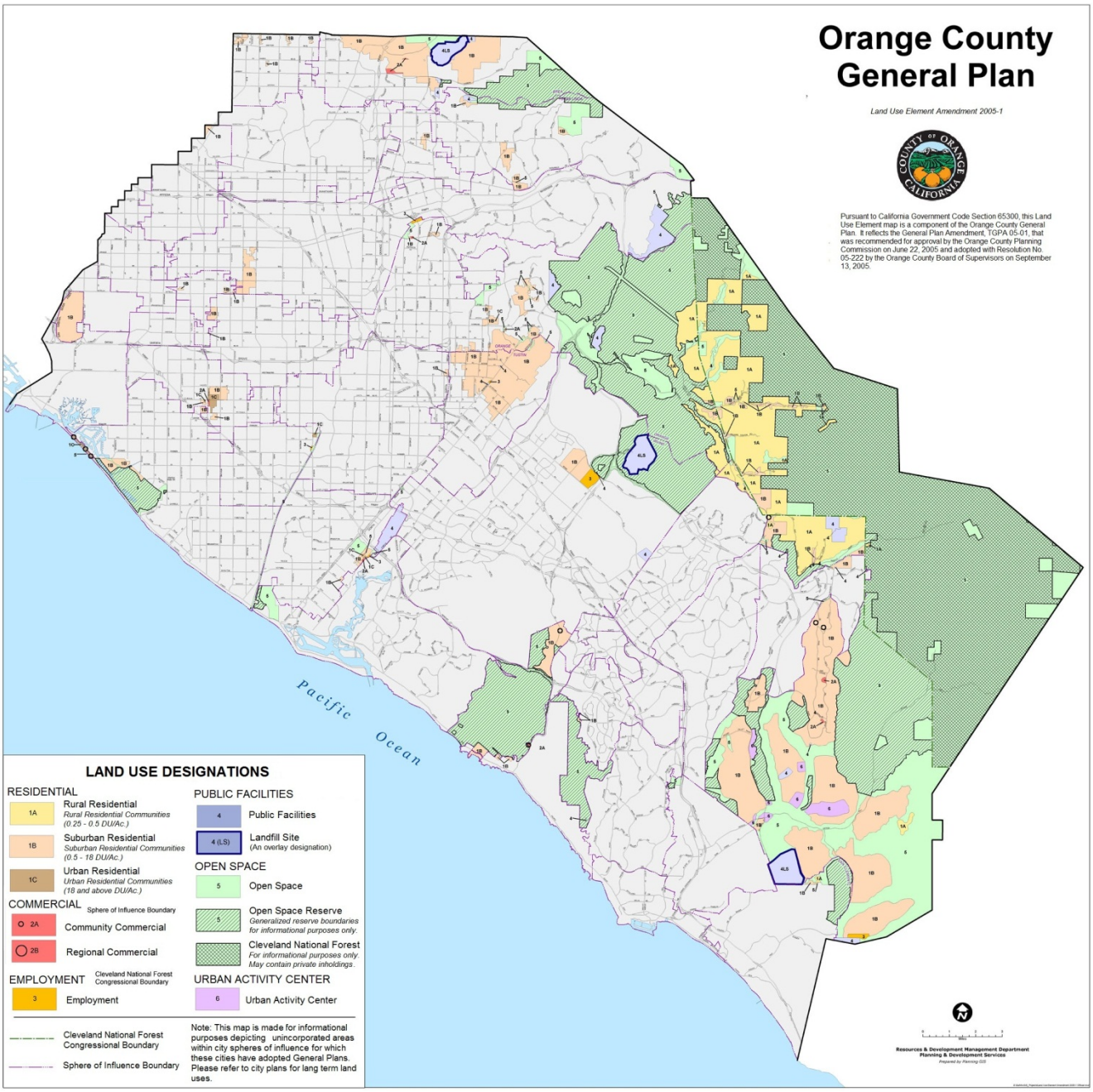

Figure 3-6. Land use designations within Orange County. Source: County of Orange 2008.

Table 3-2. Natural plant communities of Orange County.

Vegetation Community	Characteristics	Location
Sage-Scrub	Characterized by aromatic, semi-woody and semi-deciduous shrubs that are drought tolerant. Also includes an understory of perennial and annual grasses and forbs. Common plants: Agave (*Agave shawii)*, Calflora (*Opuntia prolifera*) and Cunyado (*Bergerocactus emoryi*).	Sage scrub is found on the south facing slopes of coastal and inland mountains. Also on rocky, well-drained slopes away from the immediate coast. Often forms ecotones with chaparral and grassland.
Chaparral	Characterized by woody shrubs that are also hard-leafed and evergreen. Rarely has an understory, though leaf litter can be present. Common plants: Berry manzanita (*Arctostaphylos glauca*), Ceanothus (*Ceanothus species*), Scrub oak (*Quercus berberidifolia*), Chamise (*Adenostoma fasciculatum*), and Silk-tassel bush (*Garrya flavescens*).	Often on rocky, gravelly slopes. Generally at higher elevations than scrub, such as the chaparral habitats of the Santa Ana Mountains. Chaparral often forms ecotones with scrub and grasslands.
Grassland	Consists of grasses, herbs and subshrubs that grow in deep, well developed soils. Annual grasslands are dominated by European species and constitute the most common plant cover in the County. Common grass species: needlegrass (*Stipa species*), wild rye (*Leymus triticoides*), deergrass (*Muhlenbergia rigens*) and mixed perennial grassland types. Savanna-type grasslands can include live oaks (*Quercus agrifolia*).	Mixed in central and eastern parts of the County, often forming ecotones with scrub and grasslands.
Marsh	Permanently or seasonally flooded areas dominated by herbaceous wetland plants. Marshlands, such as the San Joaquin Marsh near Irvine, can be dominated by plant species such as bulrushes (*Schoenoplectus americanus*, *S. californicus* and *Bolboschoenus maritimus*) and cattails (*Typha latifolia*).	Can be interspersed near riparian zones, ponds and mudflats. Salt and brackish marshes are found in bays and estuaries, while alkali and freshwater marshes occur inland, often near ponds and streams.
Riparian	Riparian zones can include various plant types in different stages. These areas can be dominated by herbaceous, scrub or forest communities.	Near rivers and streams.
Woodland	These are multi-layered, non-riparian forests with canopies and tree cover ranging from 20 to 80 percent. Oak woodlands (*Quercus spp*.) are more common than walnut (*Junglans californica*).	Found in areas with favorable moist conditions, such as ravines and north-facing slopes.
Forest	These are multi-layered, non-riparian communities characterized by dense tree canopies. These can include oak and coniferous forests as well as those associated with the Tecate cypress (*Cupressus guadalupensis*).	Found in favorable soil conditions. Prominent at higher altitudes.
Dune	Dune communities are sparse to densely vegetated communities grown in wind-blown sand deposits.	Found primarily along the coast.

(Sources: California Chaparral Institute 2010, World Wildlife Federation 2001, County of Orange 1996)

HCPs are designed by the landowner with the USFWS, and their aim is to allow economic development to occur while continuing to protect the viability of populations of listed species. The NCCP process is a California program that meets requirements of the federal HCP program through the Natural Community Conservation Planning Act of 1991 (Cal FGC § 2800 -2835). This Act allows the California Department of Fish and Game to enter into agreements that allow incidental take of species, provided that the species' future survival is not jeopardized, and it attempts to protect species in advance of listing. An NCCP can be prepared by a local, state or federal agency independently or in cooperation with other persons or jurisdictions.

The first HCP/NCCP within Orange County was the Central and Coastal Subregion HCP/NCCP prepared for the County in 1996 (County of Orange 1996). The focus of this HCP/NCCP was the mosaic of coastal sage scrub habitat occurring in the central part of the County, which also contains substantial chaparral, grassland, riparian, woodland and other types of habitat. Thirty-nine plant and animal species associated with these habitats are covered by the Central and Coastal Subregion HCP, which established a 37,378-acre reserve system for long-term protection of these habitats and species.

A second HCP/NCCP, the Southern Subregional Natural Community Conservation Plan/Master Streambed Alteration Agreement/Habitat Conservation Plan (Southern NCCP/MSAA/HCP) was prepared by the County of Orange in cooperation with the California Department of Fish and Game and the USFWS in 2006. An implementation agreement between the County of Orange and USFWS was signed in 2007 and is effective for 75 years. This second HCP/NCCP provides for the conservation of 32 species (including seven that are federally listed) and 10 vegetation communities currently found within the 132,000-acre Southern NCCP/MSAA/HCP study area, which includes the majority of Orange County, in addition to portions of San Diego, Riverside, San Bernadino, and Los Angeles Counties. It created 32,818-acre permanent habitat reserve in the southern part of the County, which includes the Cleveland National Forest and 16,536 acres of newly dedicated conservation lands (County of Orange 2006).

Orange County also contains important agricultural lands. These agricultural lands have persisted despite growing urbanization and are aided by favorable climatic conditions and soil conditions that contribute to a lengthy growing season. In 1997, County agricultural lands occupied some 45,000 acres, a decrease of more than 12,000 acres from 1987 (County of Orange 2008). In 2009, the County Agricultural Commissioner reported 10,070 acres of field crops, 2,806 acres of fruits and berries, and 1,031 acres of vegetables (County of Orange 2008). Maps produced for the 2008 Orange County General Plan show that prime farmland is concentrated in the central part of the County, with smaller patches scattered in the eastern and western portions (Figure 3-7). Agricultural lands preserved under the Williamson Act of 1965 can be found in the southeastern corner of the County (County of Orange 2008).

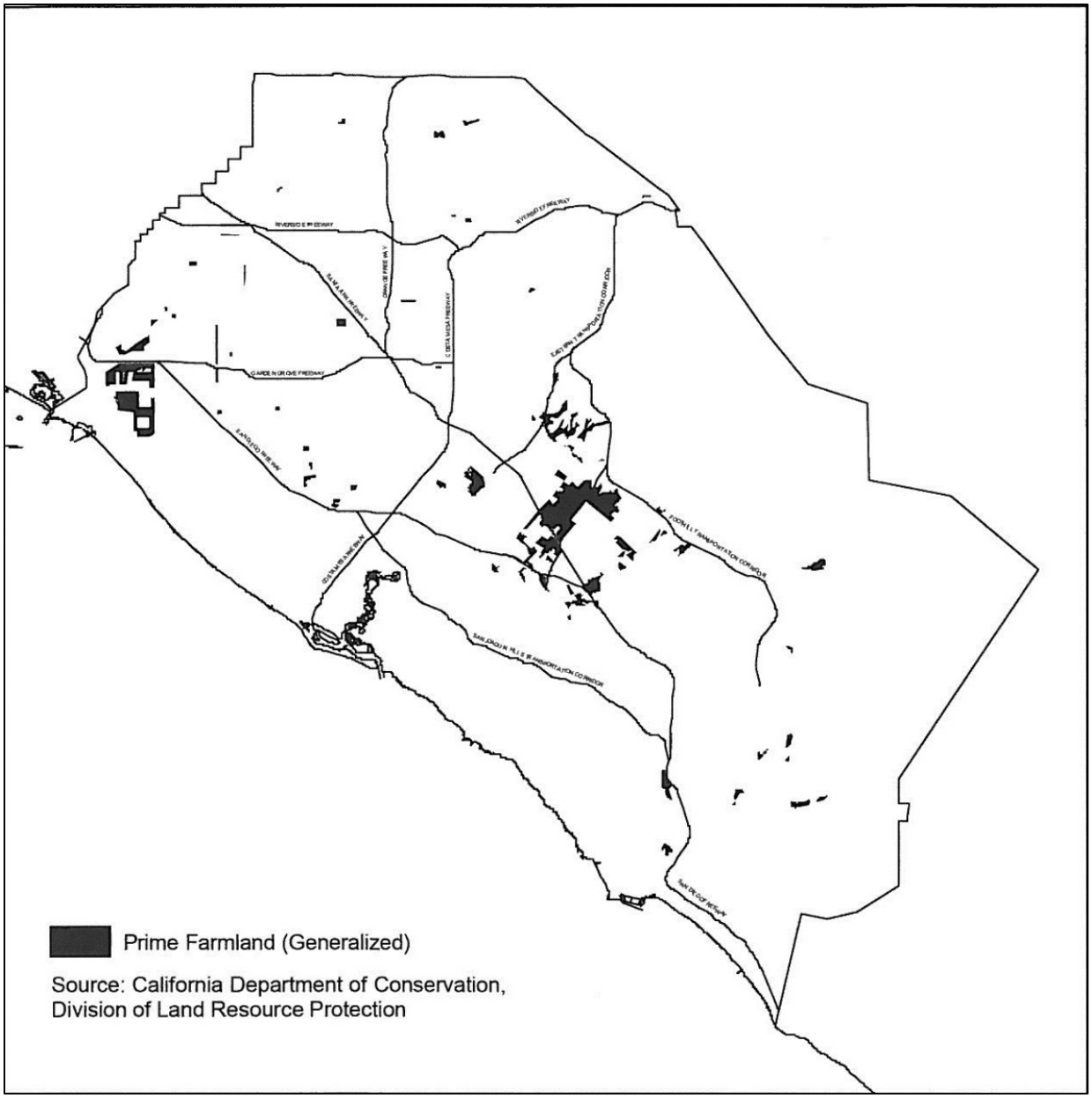

Figure 3-7. Prime farmland in Orange County. Source: County of Orange 1998.

Mosquito breeding habitats

The two main habitats for mosquitoes in Orange County are urban stagnant water and freshwater marsh.

Urban Stagnant Water

Orange County consists of 287,924 acres of urban and built up land, which comprises 56% of the total acreage of the County (California Department of Conservation Division of Land Resource Protection

Farmland Mapping and Monitoring Program 2009). Urban land entails the existence of gutters, storm drains, sewer lines, swimming pools, and a variety of domestic containers that host mosquito larvae. The mosquito of most concern in Orange County is *Culex quinquefasciatus*. It breeds in permanent or semi-permanent foul or polluted waters, allowing it to thrive in urban habitats. *Culex quinquefasciatus* is known to feed on humans and is often found in homes. This species is a vector of encephalitis viruses and is responsible for cases of the disease in southern California. It also hosts the parasite that causes dog heartworm and the viruses responsible for avian pox (Durso 1996).

Freshwater Marsh

The problematic mosquitoes that exist in freshwater marshes, in order of their abundance in District traps in 2009, are *Culex erythrothorax, Culex tarsalis, Culiseta incidens,* and *Anopheles hermsi*. *Culex erythrothorax* is known to feed on humans and is a vector for WNV, two strains of encephalitis, avian malaria, and the Turlock virus. Even though this species is in high abundance, it is not the main threat to public health because it has a flight range of less than two miles from its breeding site. Only humans living in close vicinity of or visiting marshes will be affected by this species. *Culex tarsalis* populations are smaller, but this species is known to feed up to 15 miles from breeding sites. *Culex tarsalis* is also known to feed on humans and is a vector of WNV, two other strains of encephalitis, avian malaria, Turlock, and the Hart Park virus. *Culiseta incidens* is known to feed on humans but does not carry any recognized diseases. *Anopheles hermsi* is a species of concern to vector control because in recent years it was associated with human outbreaks of malaria in San Diego County through the transmission of a protozoal parasite, *Plasmodium vivax* (Durso 1996).

3.3.1 RARE AND ENDANGERED SPECIES

Records maintained by the USFWS, the California Department of Fish and Game's California Natural Diversity Database (CNDDB), and the California Native Plant Society (CNPS) include 47 wildlife species in Orange County listed as threatened or endangered by USFWS or CDFG or as a species of special concern by CDFG. This list includes 16 birds (eight of which are state or federally threatened or endangered species), 13 mammals, seven reptiles, four amphibians, five fish (three federally endangered) and two federally endangered invertebrates (Table 3-3). USFWS has designated critical habitat within Orange County for seven of the federally listed wildlife species: California Gnatcatcher, Western Snowy Plover, Arroyo toad, Santa Ana sucker, Riverside fairy shrimp, San Diego fairy shrimp and Southern Steelhead-Southern California Distinct Population Segment.

Within Orange County, there are also 54 listed plant species; 10 are federally listed as threatened or endangered and one is candidate for federal listing. Two (Thread-leaved Brodiaea and Braunton's Milk Vetch) have designated critical habitat within Orange County. Nine species of plants are listed by CDFG as threatened or endangered or as a species of concern, and all 54 are included on the NPS lists of rare plants (Table 3-4). Populations of both sensitive plants and animals have been reduced predominantly by conversion and fragmentation of natural habitats.

Table 3-3. Wildlife listed as state of federally threatened or endangered or as a CDFG species of special concern in Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status	Habitat Requirements
California Least Tern (*Sternula antillarum browni*)	Endangered	Endangered	Coastal dunes, marsh and swamp, coastal salt marsh
Least Bell's Vireo (*Vireo bellii pusillus*)	Endangered	Endangered	Willow and low shrub thickets typically in association with riparian habitats
Light-footed Clapper Rail (*Rallus longirostris levipes*)	Endangered	Endangered	Coastal wetlands and brackish areas
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	Endangered	Endangered	Riparian habitats
Arroyo toad (*Anaxyrus californicus*)	Endangered	Species of Special Concern	Dry washes and intermittent streams
Pacific Pocket Mouse (*Perognathus longimembris pacificus*)	Endangered	Species of Special Concern	Occurs in variety of habitats including desert scrub, desert riparian areas, desert washes, sagebrush, coastal scrub
Santa Ana sucker (*Catostomus santaanae*)	Endangered	Species of Special Concern	Smaller, shallow permanent cool water streams
Southern Steelhead- Southern CA Distinct population segment (*Oncorhynchos mykiss*)	Endangered	Species of Special Concern	Estuarine, marine, riverine
Tidewater goby (*Eucyclogobius newberryi*)	Endangered	Species of Special Concern	Coastal lagoons, estuaries, and marshes
Riverside fairy shrimp (*Streptocephalus wootoni*)	Endangered	None	Vernal pools
San Diego fairy shrimp (*Brachinecta sandiegonensis*)	Endangered	None	Vernal pools
California Gnatcatcher (*Polioptila californica californica*)	Threatened	Species of Special Concern	Coastal sage scrub
Western Snowy Plover (*Charadrius alexandrinus nivosus*)	Threatened	Species of Special Concern	Edges of freshwater lakes, salt ponds, coastal beaches, and alkaline lakes
Belding's Savannah Sparrow (*Passerculus sandwichensis beldingi*)	None	Endangered	Grasslands, emergent wetland, wet meadow habitats
California Black Rail (*Laterallus jamaicensis coturniculus*)	None	Threatened	Freshwater emergent wetlands, and saline and brackish wetlands
American badger (*Taxidea taxus*)	None	Species of Special Concern	Wide variety of habitats, grasslands

Table 3-3 continued. Wildlife listed as state of federally threatened or endangered or as a CDFG species of special concern in Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status	Habitat Requirements
Arroyo chub (*Gila orcuttii*)	None	Species of Special Concern	Warm streams of the Los Angeles plain
Big free-tailed bat (*Nyctinomops macrotis*)	None	Species of Special Concern	Barren, Desert Scrub, Urban
Black Skimmer (*Rynchops niger*)	None	Species of Special Concern	Estuarine, Lacustrine, Shoreline
Burrowing Owl (*Athene cunicularia*)	None	Species of Special Concern	Annual Grassland, Coastal Scrub, Coastal Terrace Prairie, Desert Scrub, Perennial Grassland, Sagebrush
California mountain kingsnake (*Lampropeltis zonata pulchra*)	None	Species of Special Concern	Mixed Chaparral, Montane Hardwood
Coast horned lizard (*Phynosoma blainvilli*)	None	Species of Special Concern	Chamise-Redshank Chaparral, Coastal Scrub, Mixed Chaparral
Coast patch-nosed snake (*Salvadora hexalepis virgultea*)	None	Species of Special Concern	Chamise-Redshank Chaparral, Coastal Scrub, Mixed Chaparral
Coast Range newt (*Taricha torosa torosa*)	None	Species of Special Concern	Lacustrine, Riverine, Valley-Foothill Riparian
Dulzura pocket mouse (*Chaetodipus californicaus femoralis*)	None	Species of Special Concern	Annual Grassland, Chamise-Redshank Chaparral, Coastal Scrub
Grasshopper Sparrow (*Ammodramus savannarum*)	None	Species of Special Concern	Annual and perennial grassland, pasture
Long-eared Owl (*Asio otus*)	None	Species of Special Concern	Wide variety of habitats
Mexican long-tonged bat (*Choeronycteris mexicana*)	None	Species of Special Concern	Desert Riparian, Desert Scrub, Desert Succulent Shrub, Montane Riparian, Pinyon-Juniper, Urban
Northern Harrier (*Circus cyaneus*)	None	Species of Special Concern	Grasslands and marshlands
Northern leopard frog (*Lithobates pipiens*)	None	Species of Special Concern	Permanent water with abundant aquatic vegetation
Northern red-diamond rattlesnake(*Crotalus ruber ruber*)	None	Species of Special Concern	Annual Grassland, Chamise-Redshank Chaparral, Coastal Scrub, Desert Scrub, Desert Succulent Shrub, Mixed Chaparral
Orangethroat whiptail (*Aspidoscelis hyperythra*)	None	Species of Special Concern	Chamise-Redshank Chaparral, Coastal Scrub, Mixed Chaparral, Valley-Foothill Riparian
Pallid bat *(Antrozous pallidus*)	None	Species of Special Concern	Wide variety of habitats
Pocketed freetail bat (*Nyctinomops fenorosaccus*)	None	Species of Special Concern	Wide variety of habitats
San Diego desert woodrat (*Neotoma lepida intermedia*)	None	Species of Special Concern	Chamise-Redshank Chaparral, Coastal Scrub, Mixed Chaparral

Table 3-3 continued. Wildlife listed as state of federally threatened or endangered or as a CDFG species of special concern in Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status	Habitat Requirements
Santa Ana speckled dace (*Rhinichthys osculus spp* 3)	None	Species of Special Concern	Riverine
South Coast marsh vole (*Microtus californicus stephensi*)	None	Species of Special Concern	Saline emergent wetland
Southern California saltmarsh shrew (*Sorex ornatus salicornicus*)	None	Species of Special Concern	Saline emergent wetland
Tricolored Blackbird *(Agelaius tricolor)*	None	Species of Special Concern	Annual Grassland, Cropland, Freshwater Emergent Wetland, Pasture, Perennial Grassland
Two-striped garter snake (*Thamnopsis hammondii*)	None	Species of Special Concern	Coastal Oak Woodland, Coastal Scrub, Mixed Chaparral, Riverine, Shoreline, Valley-Foothill Riparian
Western Mastiff bat (*Eumops perotis californicus*)	None	Species of Special Concern	Wide variety of habitats
Western pond turtle *(Actinemys marmorata)*	None	Species of Special Concern	Freshwater ponds, marshes, year-round streams
Western red bat (*Lasiurus blossevilli*)	None	Species of Special Concern	Blue Oak-Foothill Pine, Jeffrey Pine, Montane Hardwood-Conifer, Montane Riparian, Orchard and Vineyard
Western spadefoot (*Spea hammondii*)	None	Species of Special Concern	Annual Grassland, Blue Oak-Foothill Pine, Coastal Scrub, Freshwater Emergent Wetland, Mixed Chaparral, Riverine, Vernal Pool
Western yellow bat (*Lasiurus cinereus*)	None	Species of Special Concern	Desert Riparian, Desert Wash, Palm Oasis, Urban, Valley-Foothill Riparian
Yellow-breasted Chat (*Icteria virens*)	None	Species of Special Concern	Desert Riparian, Montane Riparian, Valley-Foothill Riparian
Coastal Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*)	None	Species of Special Concern	Desert succulent shrub and desert wash habitats

spp = species

Table 3-4. Sensitive plant species of Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status; CNPS Status	Habitat
Chaparral Sand-verbena (*Abronia villosa var. aurita*)	None	None; List 1B.1	Chaparral, Coastal scrub, Desert dunes /sandy
Aphanisma (*Aphanisma blitoides*)	None	None, List 1B.2	Chaparral, Coastal scrub, Desert dunes /sandy
Braunton's Milk-vetch (*Astragalus brauntonii*)	Endangered	None; List 1B.1	Chaparral,Coastal scrub, Valley and foothill grassland /recent burns or disturbed areas, usually sandstone with carbonate layers
Ventura Marsh Milk-vetch (*Astragalus pycnostachyus var. lanosissimus*)	Endangered	Endangered; List 1B.1	Coastal dunes, Coastal scrub, marshes and swamps (edges, coastal salt or brackish)
Coulter's Saltbush (*Atriplex coulteri*)	None	None; List 1B.2	Coastal bluff scrub, Coastal dunes, Coastal scrub Valley and foothill grassland /alkaline or clay
South Coast Saltscale (*Atriplex pacifica*)	None	None; List 1B.2	Coastal bluff scrub,Coastal dunes Coastal scrub, Playas
Parish's Brittlescale (*Atriplex parishii*)	None	None, List 1B.1	Chenopod scrub, Playas, Vernal pools /alkaline
Davidson's Saltscale (*Atriplex serenana var. davidsonii*)	None	None, List 1B.2	Coastal bluff scrub, Coastal scrub /alkaline
Malibu Baccharis (*Baccharis malibuensis*)	None	None; List 1B.1	Chaparral,Cismontane woodland, Coastal scrub, Riparian woodland
Thread-leaved Brodiaea (*Brodiaea filifolia*)	Threatened	Endangered; List 1B.1	Chaparral (openings), Cismontane woodland,Coastal scrub,Playas, Valley and foothill grassland,Vernal pools /often clay
Tecate Cypress (*Callitropsis forbesii*)	None	None; List 1B.1	Closed-cone coniferous forest,Chaparral /clay, gabbroic or metavolcanic
Plummer's Mariposa-lily (*Calochortus plummerae*)	None	None; List 1B.2	Chaparral,Cismontane woodland, Coastal scrub, Lower montane coniferous forest,Valley and foothill grassland /granitic, rocky
Intermediate Mariposa-lily (*Calochortus weedii var. intermedius*)	None	None; List 1B.2	Chaparral, Coastal scrub, Valley and foothill grassland /rocky, calcareous
Santa Barbara Morning-glory (*Calystegia sepium ssp. binghamiae*)	None	None; List 1A	Marshes and swamps (coastal)
Southern Tarplant (*Centromadia parryi ssp. australis*)	None	None; List 1B.1	Marshes and swamps (margins), Valley and foothill grassland (vernally mesic),Vernal pools
Orcutt's Pincushion (*Chaenactis glabriuscula var. orcuttiana*)	None	None; List 1B.1	Coastal bluff scrub (sandy), Coastal dunes
San Fernando Valley Spine flower (*Chorizanthe parry var. fernandina*)	Candidate	Endangered; List 1B.1	Coastal scrub (sandy), Valley and foothill grassland
Long-spined Spineflower (*Chorizanthe polygonoides var. longispina*)	None	None; List 1B.2	Chaparral, Coastal scrub, Meadows and seeps, Valley and foothill grassland, Vernal pools /often clay

Table 3-4 continued. Sensitive plant species of Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status; CNPS Status	Habitat
Summer Holly (*Comarostaphylis diversifolia ssp. diversifolia*)	None	None; List 1B.2	Chaparral, Cismontane woodland
Salt Marsh Bird's-beak (*Cordylanthus maritimus ssp. maritimus*)	Endangered	Endangered; List 1B.2	Coastal dunes,Marshes and swamps (coastal salt)
Slender-horned Spineflower (*Dodecahema leptoceras*)	Endangered	Endangered; List 1B.1	Chaparral,Cismontane woodland, Coastal scrub (alluvial fan)/sandy
Blochman's Dudleya (*Dudleya blochmaniae ssp. blochmaniae*)	None	None; List 1B.1	Coastal bluff scrub,Chaparral, Coastal scrub, Valley and foothill grassland /rocky, often clay or serpentinite
Santa Monica Dudleya (*Dudleya cymosa ssp. ovatifolia*)	Threatened	None; List 1B.2	Chaparral,Coastal scrub /volcanic or sedimentary, rocky
Many-stemmed Dudleya (*Dudleya multicaulis*)	None	None; List 1B.2	Chaparral, Coastal scrub, Valley and foothill grassland /often clay
Laguna Beach Dudleya (*Dudleya stolonifera*)	Threatened	Threatened; List 1B.1	Chaparral,Cismontane woodland,Coastal scrub,Valley and foothill grassland /rocky
Sticky Dudleya (*Dudleya viscida*)	None	None; List 1B.2	Coastal bluff scrub, Chaparral, Cismontane woodland, Coastal scrub /rocky
Santa Ana River Woollystar (*Eriastrum densifolium ssp. sanctorum*)	Endangered	Endangered; List 1B.1	Chaparral,Coastal scrub (alluvial fan)/sandy or gravelly
Cliff Spurge (*Euphorbia misera*)	None	None; List 2.2	Coastal bluff scrub, Coastal scrub, Mojavean desert scrub /rocky
Palmer's Grapplinghook (*Harpagonella palmeri*)	None	None; List 4.2	Chaparral,Coastal scrub,Valley and foothill grassland /clay
Los Angeles Sunflower (*Helianthus nuttallii ssp. parishii*)	None	None; List 1A	Marshes and swamps (coastal salt and freshwater)
Mesa Horkelia (*Horkelia cuneata ssp. puberta*)	None	None; List 1B.1	Chaparral (maritime), Cismontane woodland, Coastal scrub /sandy or gravelly
California Satintail (*Imperata brevifolia*)	None	None; List 2.1	Chaparral, Coastal scrub, Mojavean desert scrub, Meadows and seeps often alkali, Riparian scrub /mesic
Coulter's Goldfields (*Lasthenia glabrata ssp. coulteri*)	None	None; List 1B.1	Marshes and swamps (coastal salt), Playas, Vernal pools
Heart-leaved Pitcher Sage (*Lepechinia cardiophylla*)	None	None; List 1B.2	Closed-cone coniferous forest, Chaparral, Cismontane woodland
Robinson's Pepper-grass (*Lepidium virginicum var. robinsonii*)	None	None; List 1B.2	Chaparral, Coastal scrub
Felt-leaved Monardella (*Monardella hypoleuca ssp. lanata*)	None	None; List 1B.2	Chaparral, Cismontane woodland
Hall's Monardella (*Monardella macrantha ssp. hallii*)	None	None; List 1B.3	Broadleafed upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley foothill grassland

Table 3-4 continued. Sensitive plant species of Orange County. Source: CNDDB 2010.

Common Name (*Scientific Name*)	Federal Status	State Status; CNPS Status	Habitat
Mud Nama (*Nama stenocarpum*)	None	None; List 2.2	Marshes and swamps (lake margins, riverbanks)
Gambel's Water Cress (*Nasturtium gambelii*)	Endangered	Threatened; 1B.1	Marshes and swamps (freshwater or brackish)
Prostrate Vernal Pool Navarretia (*Navarretia prostrata*)	None	None; List 1B.1	Coastal scrub, Meadows and seeps, Valley and foothill grassland (alkaline), Vernal pools /mesic
Coast Wolly-heads (*Nemacaulis denudata var. denudata*)	None	None; List 1B.2	Coastal dunes
Peninsular Nolina (*Nolina cismontana*)	None	None; List 1B.2	Chaparral, Coastal scrub /sandstone or gabbro
Allen's Pentachaeta (*Pentachaeta aurea ssp. allenii*)	None	None; List 1B.1	Coastal scrub (openings), Valley and foothill grassland
Santiago Peak Phacelia (*Phacelia suaveolens ssp. keckii*)	None	None; List 1B.3	Closed-cone coniferous forest , Chaparral
White Rabbit-tobacco (*Pseudognaphalium leucocephalum*)	None	None; List 2.2	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland /sandy, gravelly
Nuttall's Scrub Oak (*Quercus dumosa*)	None	None; List 1B.1	Closed-cone coniferous forest, Chaparral, Coastal scrub /sandy, clay loam
Sanford's Arrowhead (*Sagittaria sanfordii*)	None	None; List 1B.2	Marshes and swamps (assorted shallow freshwater)
San Miguel Savory (*Satureja chandleri*)	None	None; List 1B.2	Chaparral, Cismontane woodland, Coastal scrub, Riparian woodland, Valley and foothill grassland /rocky, gabbroic or metavolcanic
Chaparral Ragwort (*Senecio aphanactis*)	None	None; List 2.2	Chaparral, Cismontane woodland, Coastal scrub /sometimes alkaline
Salt Spring Checkerbloom (*Sidalcea neomexicana*)	None	None; List 2.2	Chaparral, Coastal scrub, Lower montane coniferous forest, Mojavean desert scrub, Playas /alkaline, mesic
Estuary Seablite (*Suaeda esteroa*)	None	None; List 1B.2	Marshes and swamps (coastal salt)
San Bernardino Aster (*Symphytotrichum defoliatum*)	None	None; List 1B.2	Cismontane woodland, Coastal scrub, Lower montane coniferous forest, Meadows and seeps, marshes, swamps, Valley and foothill grassland (vernally mesic)/near ditches, streams, springs
Parry's Tetracoccus (*Tetracoccus dioicus*)	None	None; List 1B.2	Chaparral, Coastal scrub
Big-leaved Crownbeard (*Verbesina dissita*)	Threatened	Threatened; List 1B.1	Chaparral (maritime), Coastal scrub

CNPS = California Native Plant Society; List 1A: Presumed extinct in California; List 1B: Plants rare, threatened, or endangered in California and elsewhere; List 2: Plants rare, threatened, or endangered in California, but more common elsewhere; List 4: Plants of limited distribution – Watch List. Note: No List 3 plant species are currently listed in the CNDDB for Orange County, California. ssp = subspecies; var=variety

4 POTENTIALLY SIGNIFICANT ENVIRONMENTAL EFFECTS

4.1 HUMAN HEALTH EFFECTS

The literature covering the potential effects of pesticides upon humans and other non-target species is extensive and has been reviewed in depth by Eco-Analysts for the most current, accurate evaluations of each pesticide. Included are studies by USEPA, the New York State Agricultural Experiment Station (Geneva, New York), the Massachusetts General Environmental Impact Report, the Washington State Department of Public Health, and the California Department of Public Health, among others. Eco-Analysts also searched the literature of activist organizations critical of pesticide use to better define the concerns of these groups and to search for credible instances of poisoning or adverse effects from the use of public health pesticides applied according to label requirements.

The analysis of pesticide effects upon human health is both complex and constantly evolving. Testing on laboratory animals is used to understand potentially harmful effects of pesticides and to set regulatory levels of concern (LOC) for humans. In addition, two other types of studies useful in this analysis are clinical trials based on measurements of small populations of patients with known exposure to pesticides and epidemiological studies based on larger, statistical populations with varying exposure. Both of these approaches are complicated by the facts that: 1) exposure is difficult to measure in individuals or populations and may vary widely, even in a specific geographic area and time period; 2) effects vary widely by the sensitivity of the exposed population (by age, body weight, allergic reaction, etc.); and 3) results of studies are often complex and difficult to interpret.

The OCVCD along with other such districts is charged with protecting the public health. Therefore, the OCVCD must set the probability of effects of illness transmitted to the human population by vectors against the risk of additional adverse health effects of the chemical controls used. When the risk of additional illness equals or exceeds the benefits of utilizing controls to mosquito or other pest population, the OCVCD should cease utilization of such controls and substitute other methods.

4.1.1 REGULATORY BACKGROUND

Both USEPA and the CDPR, a department within the Cal/EPA, evaluate the potential health effects of vector control agents on human health as well as regulate their use in California. The use of pesticides within California by vector control districts is also overseen by the CDPH with compliance inspections by the County Agricultural Commissioners.

4.1.2 CEQA SIGNIFICANCE THRESHOLDS

The effect of pesticide use on human health is primarily addressed by the CEQA checklist under hazards and hazardous materials. A project would be considered to have a significant adverse impact if it would:

> a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, the project would result in a safety hazard for people residing or working in the project area;

f) For a project within the vicinity of a private airstrip, the project would result in a safety hazard for people residing or working in the project area;

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or

h) Expose people or structures to a significant risk of loss, injury or death involving wild land fires, including where wild lands are adjacent to urbanized areas or where residences are intermixed with wild lands.

4.1.3 IMPACT ANALYSIS

District operations do not expose people or structures to loss, injury or death due to wildland fires or impair or interfere with emergency response plans. The District has jurisdiction to conduct vector control operations throughout Orange County, which contains airports, airstrips and hazardous waste sites; however, operations do not increase exposure of people to hazards associated with these locations. District operations could have potential to create a significant hazard to the public through use and routine transport of hazardous materials and/or create a significant hazard to the public or environment through accident conditions involving release of hazardous materials into the environment.

To evaluate the OCVCD's program with respect to these significance criteria, Eco-Analysts summarized information on acute toxicity and carcinogenicity to humans of the chemicals used by OCVCD from USEPA databases, Material Safety Data Sheets (MSDS) and other available databases on toxicity of chemicals (Table 4-1) and reviewed the scientific and medical literature for evidence of health effects from use of these chemicals as applied by the District.

With the exception of the rodenticide (bromadiolone in Contrac® All Weather Cake), the acute toxicity of all the chemicals used by OCVCD are classified by the USEPA as Category III and IV, slightly toxic and relatively non-toxic to humans, based on testing on laboratory animals (see Table 2-5). Most of the chemicals are also non-carcinogenic and non-irritating to skin and eyes.

The most acutely toxic chemical used by the District, the rodenticide bromadiolone, is also commercially available to the public. This product carries a "Caution" label and is applied by the District at a very low dosage rate (0.005%) in bait blocks mounted in a tamper-resistant bait station to avoid accidental poisoning of children, pets, and wildlife. The District does not place this product around schools or near wildlife areas, and when used, is placed within 50 feet of a dwelling. The District also cautions the public about the safety issues regarding the use of these baits and requires anyone receiving one to sign a liability waiver.

The District stores and transports the chemicals it uses in moderate quantities to application sites and applies them with strict adherence to safety guidelines and best management practices (BMPs) designed to protect workers from adverse health effects from these pesticides. The District has a chemical spill response plan (Appendix E) and each vehicle transporting pesticides is equipped with a spill kit to reduce the risk of injury to humans and the environment in the case of accidental spills.

The health impacts of vector control pesticides have been the focus of CDPH (California Department of Health Services 2008) as well as independent risk assessment studies (Macedo et al. 2010, Peterson et al. 2006, Schleier III et al. 2007). These studies have concluded that vector control agencies' use of pesticides to control mosquitoes does not present a significant risk to human health. Macedo et al. 2010 showed both a substantial decrease in mosquito populations due to aerial adulticiding and human health risk level below LOC established by USEPA. This study showed that use of adulticides was effective in breaking the infection cycle of WNV (efficacy) and that concentrations used generated minimal human health risk. Similarly, Peterson et al. (2006) and Schleier III et al. (2007) found the risk of human health effects ULV spraying to be below the regulatory LOC based on EPA standards.

CDPH summarized the human health effects of adulticides and concluded the following about adulticides applied by ULV spraying (California Department of Health Services 2008):

- Adulticides are essentially unstable and will break down in the environment (pyrethrin has a half-life of one hour). PBO has a half-life of four days in soil and up to two days in water (National Pesticide Telecommunication Network, NPTN 2000);
- They contain very low dosage rates of pesticides. Typically less than one ounce per acre is applied either to the ground or air. At an application rate of 0.66 ounces of product per acre (0.0025 pounds per acre; typical rate for pyrethrin products) this concentration equates to 0.000015 ounce per square foot, if one assumes all of the product reaches the ground;
- Mosquito pesticides are poorly absorbed through the skin (pyrethrins and PBO);
- No evidence of exposure has been found following ULV spraying. In a CDC study, researchers found no increase in urine metabolite concentrations of the metabolites of naled, permethrin, or d-phenothrin after ULV spraying compared to a baseline (CDC 2005).

Reports of confirmed illness related to public health mosquito spraying are rare. From 1999-2002, seven states reported a small number of cases (34) of pesticide illness related to pyrethroids used in WNV control (CDC 2003). In New York City, spraying with pyrethroids was not associated with increases in rates of emergency room visits for asthma in 1999-2000 (Karpati et al. 2004). Based on these reports, CDPH has indicated that there is a small risk that people who have been "sensitized" to pyrethrins (i.e., are allergic to lactone a contaminant in flower extracts) may have an allergic reaction, such as contact dermatitis or exacerbation of asthma, if they are re-exposed. The pyrethrin formulations currently used for public health do not contain lactones.

There have been a number of reports of self-diagnosed weakness, dizziness, headaches, heat intolerance, difficulty concentrating, depressed mood and memory loss claimed to be related to pesticide exposure by those experiencing these symptoms. This array of symptoms is currently classified as "idiopathic environmental intolerance." Several investigations have failed to find an immunoglobulin (IgE) response in patients. IgE plays an important role in allergies and asthma, as well as in many parasitic worm infections. In the absence of antibodies, the cause of these complaints may be psychosomatic (Florida Coordinating Council on Mosquito Control 2009). Despite lack of medical confirmation of a link between pesticides and this array of symptoms, some members of the public continue to oppose all pesticide spraying.

Best management practices reduce the risk that vector control pesticides negatively affect human health and should continue to be followed by the OCVCD and the public. CDPH recommends that all individuals, particularly pregnant women, should take simple precautions to avoid exposure to pesticides, including those used in mosquito control. Workers, especially mixers, loaders and applicators of pesticide formulations are at greater risk of exposure to pesticides than the general public. These workers should receive regular training in handling pesticides and follow all instructions on pesticide labels and MSDS sheets. They should also be monitored for any potential health effects including self-monitoring and periodic monitoring by a physician. Application precision yielded by Global Positioning System technology and drift prediction technology should continue to be used and should be upgraded as new, more precise technology becomes available.

In summary, the use of pesticides by the District as in the current vector control program is not found to constitute a significant hazard to the public based on the low acute toxicity of most chemicals and their limited persistence in the environment, the existence of an accidental spill plan and kits, the oversight by USEPA, CDPR and CDPH and the availability of numerous BMPs to avoid human health risks associated with these products.

4.1.4 MITIGATIONS

No mitigations are required based on adequacy of current BMPs and CDPH oversight and lack of scientific and medical evidence for significant effects on human health when the chemicals used by the District area applied in the low concentrations as in the current program and in a manner consistent with label regulations.

Table 4-1. Toxicity information on vector control agents used by OCVCD. Source: MSDS, product labels and PAN Pesticide Database.

Product Name	*Chemical Name*	*oral LD_{50}*	*Inhalation LD_{50}*	*Dermal LD_50*	*Eye Effects*	*Skin Effects*	*Human Carcinogen*
Agnique® MMFG	alcohol ethoxylated surfactant	> 5,000 mg/kg	no data	no data	slight irritation	not irritating	unknown
Agnique® MMF	alcohol ethoxylated surfactant	> 2,000 mg/kg	> 5 mg/l	> 2,000 mg/kg	slight irritation	not irritating	
Altosid Briquets	s -methoprene	> 34,600 mg/kg (rat)	> 5.19 mg/l (rat)	> 5,000 mg/kg(rabbit)	not irritating	not irritating	no
Altosid® XR Briquets	s-methoprene	> 34,000 mg/kg (rat)	not applicable	> 2,000 mg/kg (rabbit)	mild irritant	not irritating	no
Altosid® Pellets	sS-methoprene	>34,000 mg/kg (rat)	> 5.19,mg/l (rat)	>2,000 mg/kg(rabbit)	not irritating	not irritating	no data
BVA-2[2]	petroleum distillate oil	>28,000 mg/kg (rat)	3.9 mg/l (rat)	> 5 g/kg	moderate irritant[1]	mild irritant[1]	
GB-11111	petroleum distillate oil	>28,000 mg/kg (rat) [1]	=3.9 mg/l (rat) [1]	> 5 g/kg (rabbit[1])	moderate irritant[1]	mild irritant[1]	inadequate evidence of carcinogenicity[1]
VectoBac® G	*Bacillus thuringiensis israelensis*	> 5,000 mg/kg (rat)	no lethality	> 5,000 mg/kg (rabbit)	not irritating	not irritating	no
VectoBac® 12AS	*Bacillus thuringiensis israelensis*	> 5,000 mg/kg (rat)	> 5.34 mg/L	> 5,000 mg/kg (rabbit)	mild irritant	mild irritant	no
VectoLex® WDG	*Bacillus sphaericus*	> 5,000 mg/kg (rat)	no lethality	> 5,000 mg/kg (rabbit)	not irritating	not irritating	no
VectoBac® CG	*Bacillus sphaericus*	> 5,000 mg/kg (rat)	no lethality	> 2,000 mg/kg (rabbit)	not irritating	not irritating	no
Aqua Anvil™	Sumithrin, piperonyl butoxide	> 5,000 mg/kg (rat)	no lethality	> 5,000 mg/kg (rat)	mild irritant	irritating	possible carcinogen
Advion®	indoxacarb	> 5,000 mg/kg (rat)	no data	> 5,000 mg/kg (rabbit)	not irritating	not irritating	not likely

Table 4-1 continued. Toxicity information on vector control agents used by OCVCD. Source: MSDS, product labels and PAN Pesticide Database.

Product Name	*Chemical Name*	*oral LD_{50}*	*Inhalation LD_{50}*	*Dermal LD_50*	*Eye Effects*	*Skin Effects*	*Human Carcinogen*
Distance®	pyriproxyfen	> 4,000 mg/kg (rat)	> 3.1 mg/L (rat)	> 2 g/kg (rabbit)	minor irritant	not irritating	not likely
Amdro® Pro	hydramethylnon	> 5,000 mg/kg (rat)	not available	> 2,000 mg/kg (rabbit)	not irritating	mild irritant	possible carcinogen
Extinguish™	methoprene	> 10,000 mg/kg(rat)	> 210 mg/L (rat)	> 2,000 mg/kg (rabbit)	not irritating	not irritating	no
Extinguish™ Plus	methoprene; hydramethylnon	>10,000 mg/kg(rat)	>210 mg/L (rat)	>2,000 mg/kg (rabbit)	not irritating	not irritating	no
Contrac® – All Weather Cake	bromadiolone	> 1.125 mg/kg (rat)	0.43 µ/kg (rat)	>9.4 mg/kg (rabbit)	slight irritant	non-irritant	no evidence
Roundup Pro®	isopropylamine salt of glyphosate	> 5,000 mg/kg (rat)	1.6 mg/L (rat)	>5,000 mg/kg (rat)	slight irritant	moderate irritant	unknown
M-Pede®	Potassium salts of unsaturated aliphatic carboxylic acids	>5,000 mg/kg (rat)	>0.853 mg/L (rat)	>2,000mg/kg (rabbit)	irritant	irritant	no
PT® 565 Plus XLO	pyrethrins, piperonyl butoxide, n-Octyl bicycloheptene dicarboximide, d-trans allethrin	4,590 mg/kg (rat).	> 6.33 mg/L (rat).	2,000 mg/kg (rabbit)	slight irritant	prolonged exposure may cause irritation	no

Table 4-1 continued. Toxicity information on vector control agents used by OCVCD. Source: MSDS, product labels and PAN Pesticide Database.

Product Name	*Chemical Name*	*oral LD_{50}*	*Inhalation LD_{50}*	*Dermal LD_50*	*Eye Effects*	*Skin Effects*	*Human Carcinogen*
Suspend®	deltamethrin	>15,000 mg/kg (rat)	>1.02 mg/l (rat)	>10,000 mg/kg (rabbit)	very slight irritant	slight irritant	not likely
Natular™ 2EC[2]	Spinosad	> 5,000 mg/kg (rat)	> 2.01 mg/l (rat)	~2,000 mg/kg (rat)	temporary irritant	temporary irritant	no
Natular™ T30[2]	Spinosad	> 5,000 mg/kg (rat)	May irritate upper respiratory tract; not likely to be hazardous	> 5,000 mg/kg (rat)	slight temporary irritant	none	no
Natular™ XRT[2]	Spinosad	> 5,000 mg/kg (rat)	May irritate upper respiratory tract; not likely to be hazardous	> 5,000 mg/kg (rat)	slight temporary irritant	none	no
Natular™ XRG[2]	Spinosad	> 5,000 mg/kg (rat)	May irritate upper respiratory tract; not likely to be hazardous	> 5,000 mg/kg (rat)	slight temporary irritant	none	no

[1] Based on a grouped data used in USEPA Revised Registration Eligibility Decision for Aliphatic Solvents (USEPA 2007);[2] Not previously used by OCVCD; Used beginning in 2011.

4.2 WATER QUALITY

Water quality within many streams and water bodies within Orange County is considered impaired (See Section 3.2.2). Any release of chemicals identified as already elevated into these listed waterways may contribute to cumulative impacts on these already compromised water bodies.

4.2.1 REGULATORY BACKGROUND

State and regional water quality control boards are responsible for regulating impacts to water quality in the State of California. Two regional boards have jurisdiction within Orange County. The Santa Ana Regional Water Quality Control Board (Region 8) operates in northern Orange County and includes the cities of Anaheim, Fullerton, Huntington Beach, Irvine, and Santa Ana, among others. The San Diego Regional Water Quality Control Board (Region 9) operates in southern Orange County through San Diego and Riverside Counties and includes the cities of Laguna Beach, Mission Viejo, Rancho Santa Margarita, and Dana Point, among others.

The SWRCB, with the Regional Water Quality Control Boards, periodically lists streams and other water bodies with known contamination that have resulted in limited water quality. Once listed, TMDL levels are identified and a target date for compliance is set. The Regional Water Quality Control Boards work with local jurisdictions and landowners to address contamination problems, develop strategies for achieving TMDL compliance, and issue NPDES and other permits for local projects.

Water Quality Permits

OCVCD has complied with the Vector Control Statewide General Permits for use of larvicides (NPDES permit no. CAG 990004). This permit expired on May 20, 2009, but remained in effect until its replacement order was adopted on March 1, 2011. Application of adulticides were included in the new Statewide NPDES General Permit for residual pesticide discharges to Waters of the United States from vector control applications (Order No. 2011-002-DWQ; General Permit No CAG 990004). The District had applied for a General Permit for mosquito larvicides and adulticides (CAG 990004) and received a Notice of Applicability on October 31, 2011 for discharge of biological and residual pesticides to waters of the U.S. (Water Quality Order No. 2011-0020DWQ).

Monitoring Requirements

New monitoring requirements have been developed for the Statewide NPDES General Permit for vector control districts. These new requirements are specified in the General Permit and include watershed-wide monitoring to be performed for the consortium of mosquito and vector control districts by a third-party consulting firm. Components of the new monitoring program include background monitoring, event monitoring, and post-event monitoring in a watershed-wide setting. OCVCD will implement these requirements when they become finalized as a member of the MVCAC Monitoring Coalition and per conditions of the permit.

Reporting Requirements

As part of the application process, the District prepared and submitted a Pesticide Application Plan for the new permit, which includes expanded requirements in general and annual reporting, including sampling results and recommendations for improving the monitoring program based upon results of monitoring. Reporting protocol shall be determined by the procedure specified in 40 CFR Part 136. Additional reporting and monitoring requirements may be added by the SWRCB's Deputy Director of the Division of Water Quality. The OCVCD Board of Trustees voted to join with the Coalition of Mosquito Districts in the State to coordinate water sampling and testing.

4.2.2 CEQA SIGNIFICANCE THRESHOLDS

A significant adverse effect on hydrology or water quality is found under CEQA if the project would:

a) Violate any water quality standards or waste discharge requirements;

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficient aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

f) Otherwise substantially degrade water quality;

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows;

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam;

j) Inundation by seiche, tsunami, or mudflow.

4.2.3 IMPACT ANALYSIS

Operations of the OCVCD do not rely on substantial water use or development of new structures. They will not substantially deplete groundwater supplies or interfere substantially with groundwater

recharge. Because operations do not require construction within channels, they will not substantially alter the existing drainage pattern of sites in a manner that would result in substantial erosion, siltation, or flooding or place structures that would impede or redirect flood flows within a 100-year flood hazard area. Operations will not expose people or structures to a significant risk of loss, injury, or death involving flooding as a result of the failure of a levee or dam, or expose people or structures to inundation by seiches, tsunami, or mudflow.

The OCVCD applies several different pesticides to both terrestrial and aquatic environments, a practice which has the potential to violate water quality standards by providing a source of pesticides to streams and other natural aquatic environments. However, none of the pesticides used in vector control by the District is a chemical currently contributing significantly to the impaired water quality of the listed regional streams and water bodies that are monitored by the SWRCB and the Regional Water Quality Control Boards. Monitoring specified by the new General Permit will additionally facilitate the evaluation of water quality impacts from vector control practices.

The pesticides currently used by OCVCD in aquatic areas are applied in a manner consistent with current USEPA-approved label requirements and break down relatively rapidly in water. They begin breaking down shortly after reaching the water surface. Adequate control of larval mosquitoes may require longer term persistence of control agents in water bodies. Altosid®, a solid form of s-methoprene is mixed with plaster as a slow release mechanism. Charcoal is added to the plaster to retard degradation due to ultra-violet light. Briquets and pellets with Altosid® may last from 30 to 150 days in water (Wellmark International 2009). Altosid® does bond to many soils but has a low solubility and is considered unlikely to leach into groundwater (Csondes 2004). Photolysis occurs in shallow waters and is the probable cause of dissipation. If it becomes incorporated into sediments, it may persist for long periods.

The surface active agents, BVA-2 and Agnique®, tend to be used in highly polluted waters, including those with floating organic matter. They do not mix with water but gradually breakdown and evaporate. They may persist from a few days to three weeks (Cognis Corporation 2006, Napa County Mosquito Abatement District 2004, Stark 2005).

PBO, the synergist used with pyrethroids, has a low to moderate leaching potential when deposited on wet soils. It has a half-life on soil of 4.3 days and 0.55 to 1.64 days in water (NPTN 2000). The aerosol form has an estimated half-life of 3.4 hours (NPTN 2000). When PBO attaches to soil particles and then is eroded into water ways, it may be incorporated into the sediments and synergize entrapped pyrethroids from agriculture and landscape uses (Weston et al. 2006).

Label safety guidelines and District BMPs avoid the introduction of many of the other pesticides used in the District's control programs into aquatic systems.

In summary, the use of pesticides in the District's program is not found to constitute a significant adverse impact on water quality.

4.2.4 MITIGATION

No significant impacts to water quality are identified as OCVCD complies with the permit requirements set forth by the State Water Quality Control Board through the National Pollution Discharge Elimination System permits. No additional mitigations are warranted.

4.3 AIR QUALITY

4.3.1 REGULATORY BACKGROUND

Air quality within the SCAB is regulated through efforts of federal, state, regional and local government agencies, which work both jointly and independently to improve air quality through legislation, regulations, policies and programs, and education. The Clean Air Act of 1970 (42 USC § 7401 et seq.; amended 1990) requires the USEPA to develop and enforce regulations to protect the general public from exposure to hazardous airborne contaminants. The California Clean Air Act of 1988 (Cal HSC § 44243) outlines and directs California's air quality goals, planning mechanism, regulatory strategies and standards.

CARB is the agency responsible for air quality monitoring, planning and control throughout California. CARB sets the California air quality standards and control measures, approves the regional air quality management/attainment plans, makes area attainment designations, and establishes new standards for vehicles and fuel specifications to reduce vehicle emissions. The South Coast Air Quality Management District is the regional entity that includes Orange County within its jurisdiction.

4.3.2 CEQA SIGNIFICANCE THRESHOLDS

Appendix G of the 2010 CEQA Guidelines specify that a project is considered to have a significant impact on air quality if it would:

a) conflict with or obstruct implementation of an applicable air quality plan;

b) violate any air quality standard or contribute substantially to an existing or projected air quality violation;

c) result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);

d) expose sensitive receptors to substantial pollutant concentrations; and/or

e) create objectionable odors affecting a substantial number of people.

The SCAQMD has set thresholds for emissions related to construction and to operation of projects (Table 4-2; SCAQMD 2011). Projects that exceed any of the following thresholds are considered to have a significant impact on air quality.

Table 4-2. Significance thresholds for operational emissions set by SCAQMD.

Pollutant	Mass Daily Thresholds Construction	Operation
NOx	100 lbs/day	55 lbs/day
VOC	75 lbs/day	55 lbs/day
PM10	150 lbs/day	150 lbs/day
PM2.5	55 lbs/day	55lbs/day
SOx	150 lbs/day	150 lbs/day
CO	550 lbs/day	550 lbs/day
Lead	3 lbs/day	3 lbs/day
Toxic Air Contaminants and Odor Thresholds		
TACS (including carcinogens and non-carcinogens)	Maximum Incremental Cancer Risk ≥ 10 in 1 million Cancer Burden > 0.5 excess cancer cases (in areas ≥ 1 in 1 million Hazard Index ≥ 1.0 (project increment)	
Odor	Project creates an odor nuisance pursuant to SCAQMD Rule 402	
Ambient Air Quality for Criteria Pollutants		
NO2	SCAQMD is in attainment; project is significant if it causes or contributes to an exceedance of the following attainment standards:	
1-hour average	0.18 ppm (state)	
Annual average	0.03 ppm (state)	
PM10		
24-hour average	10.4 µg/m^3 (construction) & 2.5 µg/m^3 (operation)	
Annual average	1.0 µg/m^3	
PM2.5		
24-hour average	10.4 µg/m^3 (construction) & 2.5 µg/m^3 (operation)	
Sulfate		
24-hour average	1 µg/m^3	
CO	SCAQMD is in attainment; project is significant if it causes or contributes to an exceedance of the following attainment standards:	
1-hour average	20 ppm (state)	
8-hour average	9.0 ppm (federal)	

Source: SCAQMD 2011. http://www.aqmd.gov/ceqa/handbook/signthres.pdf

4.3.3 IMPACT ANALYSIS

The project being analyzed in this EIR document is the vector control program of the Orange County Vector Control District. Therefore, for the purposes of the air quality analysis, only operational emissions associated with the vector control procedures (from vehicle trips) and certain characteristics of the pesticides and their application are considered in the impact analysis.

The impact of the vector control operations of the OCVCD on air quality was analyzed using the standard URBEMIS (version 9.2.4) air quality modeling program. At the time of this analysis, OCVCD operated a fleet of 84 light-duty trucks on an average of 185 days per year in the application of chemical for vector

control. The average number of miles driven per vehicle per year between 2007 and 2009 was 6,974 miles. This estimate includes a heavy WNV year in 2008. URBEMIS version 9.2.4 software was used to model the operational emissions generated by the OCVCD fleet, which was composed of 85 light-duty trucks with catalyst engines. The daily trip rate was estimated at 10 trips per vehicle per day and fleet characteristics were set to reflect actual characteristics of the OCVCD fleet. All other URBEMIS settings were set to default values. The results of the air quality analysis (Appendix F) fell well below SCAQMD thresholds, indicating vehicle use associated with District operation does not significantly adversely affect air quality. The number of vehicle miles traveled is a minute fraction of the overall vehicle use within Orange County, indicating this aspect of operations does not contribute significantly to existing air quality violations.

Most of the chemicals used by the District in vector control are non-volatile or of low volatility so remain in the air for short periods, or do not volatilize significantly if applied in solid form, and are broken down rapidly by contact with sunlight. Methoprene, sumithrin, and pyriproxifen exhibit moderate volatilization, but their adsorption to soils and/or rapid environment degradation is expected to attenuate their conversion to vapor in the atmosphere (Csondes 2004, Sullivan 2000, Agency for Toxic Substances and Disease Registry 2005). None of the chemicals used is listed on CARB's list of toxic air contaminants (CARB 2010).

Assessment of the likelihood that sensitive receptors are exposed to significant air pollutants by the vector control program involved consideration of the timing and location of applications as well as properties of the chemicals. Aerosolized chemicals are generally low in odor, applied at ultra-low volumes, near the ground or directly onto water or closed storm drains, away from residential areas and during times the public are usually not active.

In summary, the OCVCD's programs are not found to conflict with or obstruct implementation of an applicable air quality plan, violate any air quality standard or contribute substantially to an existing or projected air quality violation, result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment, expose sensitive receptors to substantial pollutant concentrations or create objectionable odors affecting a substantial number of people.

The results of the above analysis indicate the effects of the OCVCD's program on air quality are less than significant under CEQA.

4.3.4 MITIGATIONS

No significant adverse impacts have been identified with continued compliance with local air quality regulations; no mitigations related to air quality are warranted.

4.4 GREENHOUSE GASES AND CLIMATE CHANGE

4.4.1 REGULATORY BACKGROUND

In 2007 the State of California added Section 21083.05 to the Public Resources Code, which calls for assessment of projects and their possible contribution to greenhouse gases and global warming. The

Global Warming Solutions Act of 2006 (AB 32) requires CARB to determine the statewide level of greenhouse gas emissions in 1990 and set that as a limit to be achieved by 2020. The Climate Change Scoping Plan (CARB 2008) identifies broad policies and a wide array of tools aimed at meeting the requirements of AB 32. On September 23, 2010, CARB adopted GHG emissions targets for 2020 and 2035; for southern California these targets are an 8% and a 13% reduction in GHG emissions, respectively. The Southern California Association of Governments is the metropolitan planning organization that is responsible for preparing a sustainable communities strategy that will be used to achieve these GHG emissions targets. Strategies will likely focus on transportation and housing policies or measures that will reduce vehicle miles traveled. While GHG emissions targets have been set and broad policies to achieve them identified, specific guidance for determining significance in impact analyses and achieving mitigation are still lacking or under development by individual Air Districts. The California Air Pollution Control Officers Association (2008) has recommended various alternatives for evaluating the contribution of various types of CEQA projects to GHG emissions.

4.4.2 CEQA Significance Thresholds for GHG Emissions

A project would be considered to have a significant adverse impact on GHG emissions if it would:

a) Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment;

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHG.

4.4.3 Impact Analysis

Based on the URBEMIS model run for the air quality analysis for this EIR, the OCVCD vector control program operations are predicted to generate approximately 1,417.49 tons of CO_2 emissions per year (1,310.67 metric tons CO_2) at an estimated < 1,000 vehicle trips per day for a fleet of 85 light-duty trucks. Quantitative significance thresholds that can be applied for CEQA analysis of GHG emissions do not currently exist for projects falling under the jurisdiction of SCAQMD. CAPCOA (2008) has proposed several threshold options that can be used in CEQA analysis of GHG production by projects. The GHG emissions of OCVCD were evaluated in terms of the efficiency-based threshold option proposed by CAPCOA. At an approximate total of 3,026,786 persons (Census Bureau 2010) served by vector control programs, the efficiency of this program can be considered extremely high. As the program has been ongoing and has no plans to increase fleet size significantly, there will be no net increase in GHG emissions generated by the program. The District is limited in its ability to reduce vehicle miles traveled as part of vector control operations, but program policies regarding upgrading and converting its fleet to alternative fuels and electric vehicles are consistent with measures adopted by the SCAQMD to reduce air pollutants including greenhouse gases (SCAQMD 2007).

4.4.4 Mitigations

No mitigations related to Greenhouse Gases are warranted based on the prediction of no net increase in GHG emissions, high efficiency of the program and compliance with SCAQMD's measures to reduce air pollutants and greenhouse gases.

4.5 ECOSYSTEM EFFECTS

The following section assesses the potential ecological impact of the District's programs on a range of biological species, including rare and endangered species, through a review of the literature on pesticide impacts and assessment of the conformity of District policies and practices with pertinent state and federal regulations and local policies.

4.5.1 LITERATURE REVIEW BACKGROUND

Types of Studies

The scientific studies consulted used a variety of methods to assess potential impacts of different pesticides on non-target species, including laboratory assays, risk assessment models and field studies. Studies that apply high doses of pesticides to mammals, fish, birds and sometimes invertebrates in laboratory settings are used to evaluate acute (i.e., single dose) and chronic (i.e., multiple doses over a period of time) toxicity of pesticides to major groups of organisms. Such studies are also used to test for a wide array of harmful effects of a pesticide, such as low birth-weight, fetal abortion, endocrine disorders, chromosomal abnormalities and cancers, on the subject species. Results of the laboratory studies are used by USEPA along with other information on pesticide effects in risk assessments to evaluate risk to groups of wild animals compared to regulatory levels of concern (Table 4-3) for major classes of organisms. These laboratory studies point to the potential for environmental harm from pesticides, but the value of generalizing from this research to vector control programs is limited by the difference between the laboratory setting and the field setting in which concentrations of chemicals and the exposure of wild species to them are radically different.

Risk assessment is a method of analysis that combines information about known toxicities (dose-response relationships) of substances to specific species with information on exposure pathways (e.g., ingestion, inhalation and grooming) to estimate potential levels of exposure and characterize the overall risk of a given pesticide application on the species. Risk assessment often uses risk quotients (RQ) to characterize this risk. RQs are derived by dividing an estimated environmental concentration or actual environmental concentration by an estimated toxicity endpoint, such as an LC_{50} (the concentration that is lethal to 50% of subjects) or the "no-observed-effect" concentration. The ratios produced are then compared to regulatory levels of concern (Table 4-3) to quantify the level of risk posed by the pesticide to various groups of organisms.

The strength of risk assessment is its attempt to predict the potential effects of pesticides on species in the natural setting. One weakness is that toxicity endpoints are derived using exposure methods different from those experienced in the field. For example, one method used to calculate an LC_{50} for invertebrates is to place organisms in a test tube coated with known quantities of the potential toxic

substance. Thus, the estimated exposure is often greater than the actual exposure an organism would experience in the natural environment and tends to overestimate risk, as demonstrated for invertebrates in a risk assessment performed for a mosquito control scenario using ground ULV spraying of pesticides by Schleier III and Peterson (2010). A second line of research uses a natural or experimental field studies in which the mortality of organisms exposed to actual spray events are observed and compared to control groups that are not sprayed. These studies more closely approximate the conditions under which species are exposed in natural settings. However, field experiment settings can also diverge from natural conditions when study subjects are placed in cages that restrict their movements for subsequent observation. Furthermore, surrogate species are often used to develop toxicity endpoints and tested in the field experiments to avoid harm to rare or protected species; the sensitivity of the surrogate species compared to the protected species is usually unknown and may not accurately represent the sensitivity of the species of interest (Dwyer et al. 2004). Despite these shortcomings, these methods remain the best available means to assess the impacts of potentially toxic chemicals on wild organisms.

Table 4-3. U.S. EPA risk quotient levels of concern for animals. Source: USEPA 2008.

Levels of Concern	Wild Mammals	Birds	Aquatic animals
Acute risk (Non-endangered species)	0.5	0.5	0.5
Acute risk (restricted use pesticide)	0.2	0.2	0.1
Acute risk (endangered species)	0.1	0.1	0.05
Chronic	1.0	1.0	1.0

Environmental Effects of Mosquito Control

Laboratory Studies and Risk Assessments

Studies applying high doses of pesticides to mammals (predominantly rodents and rabbits) in laboratory settings have frequently demonstrated harmful effects, such as low birth-weight, fetal abortion, endocrine disorders, chromosomal abnormalities and cancers, to the subject species though such effects have not been demonstrated for all pesticides and species (USEPA 2009). Risk assessments of mosquito control applications have generally not found the effects observed in laboratory studies because exposure in natural settings in expected to be much lower than direct exposure in the lab. In a risk assessment examining the potential effect of six mosquito adulticides (d–phenothrin, resmethrin and permethrin, pyrethrins, malathion and naled) on small mammals (shrews, mice, voles and rats), birds (quail, mallard duck and pheasant), fish (bluegill sunfish and rainbow trout) and one amphipod (*Daphnia magna*), the RQs associated with both acute and chronic (10 day) pesticide applications were below USEPA LOCs for all species except for amphipods exposed to organophosphates (Davis et al. 2007); (the District does not apply organophosphates). A similar risk assessment of six pesticides (phenothrin, resmethrin and permethrin, pyrethrin, malathion and naled) on horses also showed RQs below LOCs (Schleier III et al. 2008a).

Ecological risk assessment methods have also been applied to evaluate the potential effect of a biological control method of introducing mosquitofish (*Gambusia affinis*) into Montana watersheds (Schleier III et al. 2008b). Effects in this study were defined as *G. affinis* establishing themselves in a river and potentially out-competing native fish or affecting fauna so as to reduce habitat for native species and were examined across a range of seasonal temperatures and habitat conditions (i.e., whether or not the river had a dam). According to this risk assessment, rivers with the highest temperatures were the most likely locations for the establishment of *Gambusia* populations; however, they were not necessarily the most likely locations for impacts to native minnows or species of concern.

Field Studies

Field studies examining effects of mosquito control treatments on various groups of wild organisms have shown varying results. A field study of the effects of the larvicide GB-1111 on mallard ducklings in Alameda County, California, found no difference in mass changes in the control and treatment ducks, though some oiling of feathers by the pesticide was observed (Miles et al. 2002). Jensen, Lawler and Dritz's (1999) field study of ULV applications of pyrethrin, malathion and permethrin on mosquitofish (*Gambusia affinis*) found that pyrethrin and permethrin were not detected in water samples (detection limit = 0.02 ppm) and none of the sentinel mosquitofish died, likely because of the low concentration of the pesticide used. A French study of House Martins (*Delichon urhicum*) in areas treated with the microbial agent, *Bacillus thuringiensis israelensis* or Bti, versus control areas found that martins consumed significantly fewer Nematocera (midges), Araneae (jumping spiders) and Odonata (dragonflies/damselflies) and more Hymenoptera (flying ants) and experienced lower clutch sizes and fledging rates in treated areas versus controls (Poulin et al. 2010). The authors of this study attributed the lower success of House Martins breeding at treated sites to lower food availability during breeding periods as a result of a decline in the number of invertebrates sensitive to Bti. However, this study was conducted in a major rice growing area of France and neglected to assess the chemical use on rice for pests (Le Goff and Roucaute 2009). It also failed to discuss water management practices, which directly affect aquatic states of insects. In contrast to the study by Poulin et al., Hanowski et al. (2007) did not find evidence of an effect on reproduction, growth or foraging behavior of Red-winged Blackbirds (*Agelaius phoeniceus*) nesting in wetlands in Minnesota treated with Bti and methoprene.

The results of studies testing the effect of actual mosquito control treatments in the field on caged surrogate terrestrial and aquatic invertebrates or indicator species have also been equivocal with some showing harmful effects to small-bodied terrestrial invertebrates (Boyce et al. 2007) or reductions in certain families of insects (primarily Dipterans in the family Chironomidae) within wetlands treated with methoprene and Bti (Hershey et al. 1998), while a number of others have found no difference in terrestrial or aquatic invertebrates between treated plots and untreated controls or showed only short-term effects on invertebrate populations from mosquito pesticides. For example, Davis and Peterson (2008) examined the impact of several common mosquito pesticides (permethrin and d–phenothrin with PBO, Bti and methoprene) at the level of families, orders and functional guilds. A test using a single, ULV spraying found no treatment effect on amphipods (*Gammarus sp*), water boatmen (Hemiptera), beetles (Coleoptera: Dytiscidae), flies (Diptera: Chironomidae and Culicidae) and dragonflies and damselflies (Odonata). In addition, no treatment effect was found for the benthic

sample that included amphipods, beetles, and non-biting midge larvae (Diptera: Chironomidae). Studies of Bti effects on wetlands in Sweden (Lundström et al. 2010a, 2010b; Persson Vinnersten et al. 2010) found no long-term differences in Chironomid species richness or production between wetlands treated with Bti and untreated controls. Lawler et al. (2000) found no difference in control groups of water boatmen and those exposed to Bti, methoprene and sustained-release methoprene in ponded areas and a pothole near saltmarshes. Water boatmen from treatment and control groups also maintained similar sex ratios and similar proportions of females carried eggs in their bodies. Similarly, Miles et al. (2002) examined the impact of the larvicide, GB-1111, on water boatmen placed in cages in a saltmarsh. Counts of water boatmen (*Trichocorixa reticulata*) on two pre- and seven post-spraying days revealed that nearly all water boatmen in treatment areas died in the first three days following spraying; however, no differences were found in water boatmen numbers between control and treatment areas 3-15 days or 15-22 days after spraying.

Lawler et al. (2008) studied the effect of applications of PBO synergized pyrethrin on the survival of the zooplankton, *Daphnia magna,* and the aquatic mayfly, *Callibaetis californicus*. Using mesocosms to simulate a natural setting, they found two ULV applications of synergized pyrethrin by the Colusa Mosquito Abatement District produced no differences in mortality of control and treatment groups for these two species. Jensen et al. (1999) studied the impact of the application of pyrethrin, malathion and permethrin on a range of wetland macroinvertebrates, including beetles (Dystiscidae and Hydrophilidae), snails (Gastropoda), water boatmen (Corixidae), midges (Chronomidae), damselfly and dragonfly nymphs (Odonata) and mayfly nymphs (Ephemeroptera) and found that flying insect abundance decreased on the night of spraying but rebounded within 24 hours.

Lawler et al. (1999) studied the effect of Bti, methoprene and temephos on non-target populations of amphipods (Talitridae) and flying insects in Florida mangrove marshes and found no treatment effect on non-target species. Boyce et al. (2007) studied the impact of pyrethrin synergized with PBO on several non-target arthropod species, including dragonflies (*Sympetrum corruptum*), yellow garden spiders (*Argiope aurantia*), alfalfa butterflies (*Colias eurytheme*) and honeybees (*Apis mellifera*). While mortality of sentinel mosquitoes varied between 10 and 100%, no statistically significant difference was found in the survival of caged butterflies or honeybees between treatment and control areas, and there was 100% survival of dragonflies and spiders.

Very few studies have attempted to examine the effect of synergistic reactions of pesticides within the environment, but one study suggests interactions may occur. Weston et al. (2006) used water and sediment samples from rivers near Sacramento following the application of a 60% PBO and 6% pyrethrin mix by planes over the city in response to a 2005 West Nile virus outbreak. While these authors found no evidence of pyrethrins in the water column 10 hours after spraying, sediment concentrations of pyrethrins increased significantly in the same period. It was not known if these levels of pyrethrins were toxic to the amphipod, *Hyalella azteca*, but the interaction of PBO within sediments in laboratory settings was found to synergize already present bifenthrin to levels toxic to this species. However, the laboratory setting used 10-day exposure to sediments that may not accurately approximate the length of exposure in creeks after spraying and may not have evaluated landscape pest control as a source of the PBO in the sediments.

In summary, most studies investigating the impact of the mosquito pesticides currently applied by the District and other vector control agencies have concluded that these pesticides represent minimal threat to non-endangered species because of the ultra-low concentrations used, lack of bioaccumulation, the limited persistence of these chemicals in the environment and the lack of scientific evidence demonstrating widespread harmful effects when the chemicals are applied in the manner specified by safety labels.

4.5.2 REGULATORY BACKGROUND

Federal - U.S. Endangered Species Act

The U.S. Endangered Species Act of 1973 (7 USC § 136, 16 USC § 1531 et seq.), a comprehensive law designed to protect plant and animal species from extinction, requires federal agencies to ensure actions they carry out, fund or authorize do not jeopardize species listed by the federal government as threatened or endangered or adversely modify habitat critical to their survival. Section 9 of the Endangered Species Act makes it unlawful for any person or private or public entity to "take" any individual of a species that is listed under law as endangered or threatened. According to the Act, to "take" a species means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." The word "harm" has been further defined in federal regulations as any act that "actually kills or injures fish or wildlife." Such an act may include "significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including breeding, spawning, rearing, migrating, feeding or sheltering" (CRF 222.101). While the taking prohibition does not apply to plants, it is illegal under the Act to remove an endangered plant from federal land; the Act also federalizes state laws prohibiting the taking of plants. Some take of listed species is allowed with a federal permit if it is determined not to jeopardize the species and is incidental to otherwise lawful activity requiring a federal permit.

State – California Endangered Species Act

The California Endangered Species Act (Cal FGC § 2050-2069) also prohibits the "take" of listed species. A "take" is defined in state law as meaning to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture or kill." While the state law lacks the "harm" provision of the federal law and allows for take incidental to other projects, it also prohibits the taking of species that are being petitioned for listing. The state law applies to both plants and animals and emphasizes early consultation to avoid negative impacts on listed species (CDFG 2010).

Pesticide Regulation and the Endangered Species Acts

As a federal agency, the USEPA is legally required by Section 7 of the U.S. Endangered Species Act to ensure that its actions do not jeopardize threatened or endangered species or adversely modified their designated critical habitat. USEPA considers effects on non-target and endangered species in its analysis of pesticides during the pesticide registration and re-registration review processes and includes

information relevant to these species when it is available in its registration eligibility decisions for pesticides. If the USEPA finds through these reviews that a pesticide "may affect" a listed species or its critical habitat, the agency must consult with the USFWS. After review of all pertinent information during the formal consultation process, USFWS will produce a biological opinion that details how jeopardy to listed species can be avoided. Pesticide use requirements may be modified or restricted based on information from biological opinions. Since 1998, the USEPA has maintained the Endangered Species Protection Program, an effort that geographically restricts application of certain pesticides within the critical habitat of certain threatened and endangered species. As part of this program, the USEPA maintains an internet bulletin system, "Bulletins Live!" (http://www.epa.gov/espp/bulletins.htm), with which users may access pesticide use limitations by county up to six months prior to the date of pesticide application. The bulletins have constituted enforceable use limitations under FIFRA when referenced on pesticide label since November 2005 when USEPA published the final notice for the Program.

The CDPR is the state agency within California that has the authority to refuse, revoke or suspend the license of any pesticide that harms or is likely to harm endangered species. CDPR has drafted the California State Plan for Protection of Endangered Species from Pesticide Exposure (CDPR 1995) to protect threatened and endangered species in California from effects of pesticides. Pesticide risks to endangered species within California are evaluated by an interagency network that includes CDPR, the CDFG Pesticide Investigation Unit, CDFA, the Pesticide Registration and Evaluation Committee, and the County Agricultural Commissioners as well as the USEPA and USFWS. Under the State Plan, protection strategies and local plans that resolve pesticide use conflicts are developed using information on pesticide use distribution, endangered species distributions and life history information, and USFWS biological opinions relating to pesticide use effects on endangered species. The State Plan is implemented through the USEPA County Bulletins (Bulletins Live!) that incorporate the local plans as needed. Interim Measures Bulletins for California counties are listed under the Endangered Species Project of the CDPR website (http://www.cdpr.ca.gov/docs/endspec/index.htm) and also provide information on pesticide use limitations via the Pesticide Regulation's Endangered Species Custom Realtime Internet Bulletin Engine (PRESCRIBE). The PRESCRIBE database is also accessible through the DPR's California Pesticide Information Portal (CALPIP) available at http://calpip.cdpr.ca.gov. Pesticide use limitations implement limitations specified in USFWS biological opinions, limitations determined by USEPA to preclude a "may affect" determination for pesticide effects on listed species, and limitations developed within local plans as alternatives to USEPA and USFWS use limitations (CDPR 1995).

Pesticide use limitations have been developed by CDPR to protect 57 listed species including 18 threatened or endangered species within Orange County. Use limitations apply on Township, Range and Section basis and vary with chemical product and active ingredient. For example, limitations may require buffers for chemical application, additional drift precautions be observed or that use of the chemical be prohibited within occupied habitat of listed species.

4.5.3 CEQA SIGNIFICANCE THRESHOLDS

The project would be considered to have a significant adverse biological impact if it would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service;

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service;

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

4.5.4 IMPACT ANALYSIS

To examine whether the District's actions could result in significant harm to listed wild species or sensitive habitats or communities, scientific literature on the ecological effects of the different methods of vector control used by the District, including chemical and biological forms, was examined. Practices such as source reduction or removal of vegetation from riparian areas for access were also assessed for the potential to impact protected species adversely and for compliance with regulations governing protection of rare and endangered species and sensitive habitats.

Wildlife species vary in their sensitivity to pesticides based on their taxonomy and ecology (Tiebout 1991). Species with very small body sizes, insectivorous species, and those with aquatic life stages or dependent on aquatic habitats will have greater exposure to the pesticides used in mosquito control and are potentially more sensitive to them than other species. These taxonomic differences are generally reflected in the levels of concern set by USEPA for acute risk (see Table 4.3). Thus, one would expect the insects, shrews and other small-bodied mammalian insectivores such as bats, insect-eating birds and reptiles, amphibians, fish and invertebrates to represent the wildlife taxa with the greatest potential to experience effects of pesticides used in mosquito abatement. For example, amphibians are a group that has experienced global declines in recent decades, and widespread presence of pesticides in the environment and drift of pesticides from agricultural areas are thought to be contributing factors, particularly in California (Davidson et al. 2002, Davidson and Knapp 2007). The magnitude of the impact a pesticides poses to populations of listed wildlife will vary with the taxonomy-dependent toxicity of the pesticide as well as the size and viability of the population, the types of habitats used by the species and the ability of the species to utilize multiple or alternate habitats. Other indirect effects of pesticides,

such as reduced food availability, increased susceptibility to pathogens or disease, or growth retardation or abnormal behavior from exposure to pesticides, could further threaten already stressed populations, though relatively few investigations have measured such indirect effects on endangered wildlife or surrogate species. Because most threatened and endangered wildlife have not been studied thoroughly, specific impacts of a particular pesticide or practice on their populations are poorly understood. In addition, it is not always possible to know the location of habitats occupied by rare and endangered species or to avoid the application of pesticides in the habitat they may inhabit.

District Policy and Guidelines

The District's policy is to strictly follow all label regulations and guidelines developed by USEPA and CDPR to minimize harm to natural ecosystems and wild species. Best management practices for mosquito control include the use of time and place restrictions on the use of pesticides as well as source reduction activities, as outlined in the District's IVM & RP and VRM. The District also has adopted CDFG protocol to avoid spread of aquatic invasive species when accessing habitats for surveillance or control. Time restrictions involve avoiding intrusion into areas with nesting protected birds and avoiding spraying during critical life stages (e.g., reproduction and early development) of listed species. Place restrictions include avoidance of treating certain areas with pesticides, as well as the use of spray drift buffers and wind speed modeling of the distribution of aerosolized pesticides in relation to these buffers to avoid pesticide drift into areas or habitats. The mode of action and application protocols employed by OCVCD for mosquito control minimizes the exposure of non-target species by using the most selective and least toxic materials available and by limiting adulticiding applications to six or fewer locations during the appropriate times of the year. Most larvicidal materials are either biologically-derived or synthetic analogs of juvenile insect hormones applied at rates that specifically impact developing mosquitoes, with minimal effect on other taxa.

In addition, the District has MOUs with, and permits from, the government agencies with which the District is contracted to perform vector control services. These permits may specify additional limitations on District activities to protect listed species and sensitive resources on contract lands. For example, the use of petroleum distillate oils is prohibited within Light-footed Clapper Rail habitat at Seal Beach National Wildlife Refuge by the USFWS. District staff attend regular meetings with USFWS and CDFG personnel regarding sensitive habitats and species on government lands and receive additional training on these resources. The District's Integrated Vector Management and Response Plan indicates the conditions under which vector control inspectors should consult with a supervisor or biologists to avoid take and disturbance of listed species.

Potential Impacts of Mosquito Pesticide Application

Listed species in Orange County with the greatest potential to be affected by mosquito control (i.e., invertebrates, small insectivores, amphibians and fish or other species dependent on aquatic habitats), include mostly bats (six species: Big free-tailed bat, Pallid bat, Pocketed freetail bat, Western mastiff bat, Western red bat, Western yellow bat) and birds (13 insectivorous or aquatic/estuarine species:

California Least Tern, Least Bell's Vireo, Light-footed Clapper Rail, Southwestern Willow Flycatcher, California Gnatcatcher, Western Snowy Plover, Belding's Savannah Sparrow, California Black Rail, Black Skimmer, Grasshopper Sparrow, Tricolored Blackbird, Yellow-breasted Chat, Coastal Cactus Wren) (see Table 3-3). Additionally, the invertebrates (the endangered Riverside fairy shrimp and San Diego fairy shrimp), the amphibians (Arroyo toad, Northern leopard frog, Coast Range newt, Western spadefoot), three insectivorous or aquatic reptiles (Coast horned lizard, Orangethroat whiptail, Western pond turtle), the fish (Santa Ana sucker, Southern steelhead- Southern California Distinct Population segment, arroyo chub, Santa Ana speckled dace, Tidewater goby) and two mammals (Southern California salt marsh shrew, South Coast marsh vole) are considered to have potentially high sensitivity or greater exposure to mosquito pesticides than the other species listed.

Exposure of most birds and bats to mosquito pesticides applied by OCVCD is expected to be lessened by the fact that larvicides are applied directly to storm drains or isolated pools and adulticides are applied at ultra-low volumes and are used only in limited areas within marsh habitat or within underground storm drains. Because insectivorous bats and birds on the list are highly mobile and prey upon a wide variety of insect families, the likelihood that mosquito pesticides will cause food limitation for these species is expected to be low to insignificant. The invertebrates, fish and amphibians and the Southern California salt marsh shrew and South Coast marsh vole, however, are less widely ranging and are confined to much more limited areas of habitat, which may experience greater exposure to vector control pesticides because they are aquatic systems that generate mosquitoes. The District operates within some of these species' designated critical habitat, and many of these habitats are already compromised by flood control practices, invasion by exotic species, and pollution from other sources and practices.

Our literature search revealed little published information specific to the listed species of Orange County beyond general concerns about pesticide impacts in species' recovery plans and status reports to aid evaluation of impacts on these listed species from application of mosquito insecticides by the District or to facilitate development of species-specific mitigation measures. At the time of the analysis, the only mosquito control pesticides used by the District that had CDPR or USEPA pesticide use limitations in Orange County to protect rare and endangered species were products containing Spinosad (i.e., Natular ™ products). The use of products containing Spinosad is prohibited "within occupied habitat" of the listed species protected by the use restrictions (see Appendix G). These use restrictions require the District to identify occupied habitat of rare and endangered species; however, which areas of habitat are occupied by listed species is not obvious nor clearly identified, as many of the species are both secretive or otherwise not easily observed and few in number, so the chances of observing them are very small. The District has developed and adopted an annual rare and endangered species awareness training program for staff. The following mitigation will increase the ability of the District to identify areas that may constitute occupied habitat and will improve the staff training program. This mitigation will reduce the potential for adverse impacts to rare and endangered species from the use of the products containing Spinosad, as well as any other products that may be used in the future that could affect listed species.

Impact Bio-1: The use of certain mosquito control products may adversely affect listed rare or endangered species if used within occupied habitat. The District is required to identify occupied habitat to comply with state and federal pesticide use limitations, yet what habitat is occupied by rare and endangered species is often difficult to determine. The District can improve its ability to recognize potentially occupied habitats of listed species by adopting the following mitigation, thereby reducing the potential for significant adverse impacts to less than significant.

Mitigation Measure Bio-1: Update protected species information annually and incorporate into field staff training.

The OCVCD shall regularly access and update both state and federal sources of listed species occurrence information, including information from CDFG's California Natural Diversity Database, CDPR's Endangered Species Protection Program and Pesticide Use Limitations, USFWS's Critical Habitat Portal for threatened and endangered species and any other reliable source of information accessible to OCVCD staff. The OCVCD shall subscribe to the CNDDB. These duties shall be added to the job description of a qualified biologist or equivalent position to ensure regular (annual) execution. Pesticide application and other work performed in areas known or suspected to support protected species shall be reviewed by supervisory staff prior to initiation to determine if a pesticide's label data or use limitations indicate potential for adverse impacts. If adverse impacts are possible, work shall either be modified to avoid impacts or not initiated in those areas. Information obtained from the above measures shall be incorporated into the District's annual training sessions for field personnel on recognizing protected species and sensitive habitats.

Although no pesticide use restriction exists for the petroleum distillate oils, the use of these products for mosquito control by the District was identified through consultation between the District and the USFWS, Region 1 Office, as a practice likely to adversely affect Light-footed Clapper Rail at Seal Beach National Wildlife Refuge because of the potential for oiling of eggs and young and is prohibited on refuge lands according to the District's Special Use Permit (# 81683-10001SB). Light-footed Clapper Rail occurrences exist outside of the refuge, and there is potential for application of petroleum distillate oils to adversely affect this species elsewhere within the District.

Impact Bio-2: Application of petroleum distillate oils in habitats where Light-footed Clapper Rails are present is likely to significantly adversely affect this species and may impact other species of wetland nesting birds.

Mitigation Measure Bio-2: Prohibit petroleum distillate use within natural wetlands and waterways draining into intertidal areas to protect Light-footed Clapper Rail.

The District shall develop and adopt a BMP that prohibits use of petroleum distillate oils within natural marshes or wetlands that flow into intertidal areas to reduce the impacts to Light-footed Clapper Rail and other marsh nesting birds in these habitats.

There is also potential for disturbance of protected species during inspections and control activities performed by the District. In addition to the presence of vehicles and personnel, some of the spray equipment is motorized and creates noise that may disturb listed species of breeding birds or other animals. The District minimizes such disturbances by using hand tools, when possible, and scheduling as many activities as possible at times when these species are not present or during less critical stages of the life cycle, such as outside of the nesting season of birds. In addition, by following the mitigations specified above, the possibility of disturbance to species will be reduced. Any disturbances that may occur are not expected to constitute significant adverse impacts to rare and endangered species due to their temporary duration and infrequent occurrence.

Disturbances to listed species from the presence of personnel and use of motorized equipment within habitat of listed species or critical habitat is expected to be **less than significant** with current District BMPs to minimize disturbance due to infrequent occurrence and temporary duration of impacts. No mitigation for this impact is required.

Potential Impacts of Biological Control of Mosquitoes Using Mosquitofish

Laboratory and field studies of mosquitofish suggest that they are opportunistic feeders consuming a wide range of food items, including zooplankton, copepods, cladocerans and immature stages of many insect species (Ahmed et al. 1970, Walton and Mulla 1991, Lawler et al. 1999). Mosquitofish in experimental pools have been shown to have significant impacts on endemic fish or amphibians in these settings (Lawler et al. 1999, Swanson et al. 1996, USFWS 1997). Mosquitofish can affect native fauna by competing for food and cover, behaving aggressively toward native species, consuming aquatic species of concern, causing growth retardation of species of concern (through competition for food) and eliminating habitat through over-consumption of food. Two studies in southern California (Gamradt and Kats 1996, Goodsell and Kats 1999) suggest that mosquitofish may have contributed to localized declines of populations of the California newt (*Taricha torosa*) and the Pacific tree frog *(Hyla regilla*).

The release of mosquitofish into natural environments has been identified as a potential threat to vernal pool ecosystems (USFWS 1998, 2005, 2006, 2007). For these reasons, the District uses mosquitofish to control mosquito larvae only in artificial systems, such as unmaintained swimming pools and ornamental ponds, and requires the public to sign an agreement stating that the fish will not be released into natural waterways. Still, it is possible that some mosquitofish may be released by the public or make their way into natural habitats via flooding or overland flow from ponds. Additionally, some artificial systems (such as storm drains) are connected to natural waterways via outflow structures, creating the potential for mosquitofish to enter natural systems via artificial systems. Mosquitofish potentially adversely affect the listed vernal pool invertebrates and immature life stages of listed fish and amphibians. The listed species at potential risk of adverse impacts from mosquitofish include: Riverside fairy shrimp, the San Diego fairy shrimp, Arroyo toad, Northern leopard frog, Coast Range newt, Western spadefoot, Arroyo chub, Santa Ana speckled dace, Santa Ana sucker, Southern Steelhead – Southern California Distinct Population Segment, and Tidewater goby.

Impact Bio-3: Distribution of mosquitofish by OCVCD to the public and subsequent unintended releases into natural environments has potential to adversely affect listed species of invertebrates, amphibians and/or fish in Orange County.

Mitigation Measure Bio-3: Limit mosquitofish release to isolated artificial systems.
Mosquitofish shall only be introduced into isolated systems that are not connected to natural waterways to prevent inadvertent introduction of mosquitofish into natural ecosystems by the District. Determination of whether a system is isolated or not shall be made by OCVCD supervisory personnel, with the assistance of the GIS Mapping Department. If a determination cannot be made regarding the connectivity of a system to natural waterways, the system shall not be treated with mosquitofish.

Potential Impacts of Physical Control of Mosquitoes and Vegetation Management

Physical control of mosquito habitats by the District is limited to vegetation management to maintain access to mosquito breeding sources and/or restore water movement, maintenance of drainage ditches to restore natural water flow in areas, and water removal from artificial containers. Accordingly, vegetation management is not considered to adversely impact protected plant species significantly, nor will it interfere substantially with the movement of any native resident or migratory fish or wildlife species.

Vegetation management in riparian areas to maintain existing access to surveillance and treatment sites by OCVCD could impact nesting habitat of listed birds and/or result in disturbance of listed nesting birds due to presence of humans within occupied habitat. The District schedules as much vegetation maintenance as possible during the fall and winter when listed bird species are not nesting to reduce potential for disturbance of breeding birds.

Maps (Appendix H) of known locations of listed species that were available in the Central and Coastal Subregion HCP/NCCP (County of Orange 1996) and the Southern NCCP/MSAA/HCP (County of Orange 2006) were used to determine if disturbances described above could impact some of the listed wildlife species with better known distributions. The map of the areas potentially requiring vegetation management for access by the District (Figure 2-5) was overlaid on these maps and inspected for overlap. The HCPs do not cover all the listed species present within the areas represented by the plan and the accuracy and resolution of the map analysis was limited by the accuracy and precision of the data layers; for example, the linear segments representing the areas where the District may need to perform vegetation management were not to scale but represented areas within which very localized areas of vegetation might be trimmed or otherwise managed with hand tools. Thus, this analysis should not be construed as a determination of specific adverse impact or lack of impact but was used only to assess the potential for impacts from these activities to exist for some listed species with known distributions. Of the species for which there were maps in the HCPs, the Southwestern Willow Flycatcher, California Gnatcatcher, Least Bell's Vireo, Tricolored Blackbird, and Yellow-breasted Chat were at risk of having occupied habitat coinciding with areas that may require vegetation management.

Impact Bio-4: Vegetation management incidental to surveillance and control operations and intrusion of vector control inspectors into occupied habitat may adversely impact listed shrub-nesting birds if performed during the breeding season or adversely impact their breeding habitat.

Mitigation Measure Bio-4: Survey proposed vegetation maintenance areas for nesting birds.
Should work be required during the nesting season (March – August), the District will have a qualified biologist conduct pre-maintenance surveys for nesting birds. A survey will be conducted (within proposed activity area and the immediate perimeter) no more than 3 days prior to the initiation of the maintenance activity. If an active nest is encountered, maintenance in the vicinity of the nest shall be deferred until the young birds have fledged. A minimum exclusion buffer of 25 feet is required by CDFG for songbird nests, and 200 to 500 feet for raptor nests, depending on the species and location. The perimeter of the nest-setback zone shall be adequately demarcated with staked flagging at 20-foot intervals, and maintenance personnel restricted from the area. A survey report by the qualified biologist verifying that the young have fledged shall be put on file at the District prior to initiation of maintenance in the nest-setback zone. Prior the creation of any new trails for access paths, a qualified biologist will review species lists and conduct and necessary pre-activity surveys for special-status species to avoid them.

Potential Effects of RIFA control

Little research has been performed on the potential environmental impact of using chemical baits to control RIFA. A study (Ipser 2004) of the use of hydramethylnon to combat RIFA in Georgia found that use of bait did not eliminate native ant species and that diversity and abundance of many taxa including beetles (Coleotera), spiders (Aranea), snails (Gastropoda), worms (Annelida), millipedes (Diploda), earwigs (Dermaptera) and centipedes (Chilopoda) were unaffected.

Most of the RIFA baits used by the District are acutely toxic to fish, marine and estuarine organisms but are present in extremely low concentrations in baits, persist for limited time periods in the environment, and label guidelines, pesticide use limitations, and BMPs avoid use in situations that would result in the entry of the bait chemical into aquatic systems (see Section 2.1.5, Red Imported Fire Ant Pesticides).

The potential for adverse impacts to listed species from the use of RIFA baits in accordance with all label guidelines and use limitations is considered to be **less than significant**. No mitigations for the use of RIFA baits are required.

Potential Effects of Rodenticide Usage

Bromadiolone, the compound used by the District in rat control, is a second generation anti-coagulant that can result in direct poisoning of non-target wildlife by consumption of the bait and indirect poisoning through ingestion of rodents or other animals that have fed upon the baits. Secondary exposure of non-target species to anticoagulants has been documented in a range of birds and mammals (Eason and Spurr 1995; Stone et al. 1999, 2002; Hosea 2000; Eason et al. 2002). In southern California, non-target exposure to rodenticides was detected in mountain lions and bobcats (Riley et al.

2007), coyotes (Hosea 2000) and barn owls (Hosea 2000). A study by Riley et al. (2007) suggests anticoagulant exposure is higher for animals closer to urban areas and may predispose individuals to infections or disease.

The government rodenticide use limitations and guidelines are meant to minimize the accidental poisoning of non-target wildlife (as well as children and pets); however, it is difficult to eliminate the likelihood of secondary poisoning because rats are mobile, take several days to die from ingesting the baits and compromised animals may be easy prey for predators. As part of its guidelines and best management practices to minimize impacts to rare and endangered species as well as humans (see Section 2.1.5, Rodenticides), the District does not conduct rat control on federal, state or county lands, commercial properties, parks, rights-of-way, or schools, or on residential properties adjacent to environmentally sensitive areas. Rodenticide bait is distributed only in tamper-resistant bait tubes placed no more than 50 feet from a dwelling in shrubs or trees. However, because many wildlife species often make use of urban and suburban habitats and urban development continues to encroach on wild lands and sensitive habitats, these policies reduce but cannot eliminate the potential for adverse impacts on listed or protected wildlife. The listed species in Orange County at greatest risk from rodenticide applications by the District are Burrowing Owl, Long-eared Owl, San Diego desert woodrat, Pacific pocketmouse, and American badger. Other raptors and scavenging birds that are not listed, as well as protected and common mammalian predators such as coyotes, foxes, and bobcats, are also expected to be at risk of adverse impacts from rodenticide use.

Determining if incidences of wildlife poisoning that might result from OCVCD rat control constitute significant adverse impacts to listed wild species is complicated by several data inadequacies. First, finding and reporting poisoned animal carcasses before they are scavenged or decay is rare, as are studies of levels of the rodenticide chemicals in the blood of wildlife so the degree to which bromadiolone contributes to wildlife deaths or sub-lethal impacts to listed species is virtually unknown. Second, District applications of bromadiolone represent only a small portion of the overall use of anti-coagulant rodenticides by the public and private pest control companies in Orange County (about 11% of reported pesticide use according to CDPR data), but only public health and agricultural use are tracked by the State. The contribution of public health applications of bromadiolone to overall use is, therefore, also very difficult to estimate. These data gaps also hinder assessment of the adequacy of the District's existing best management practices regarding bromadiolone use.

Impact Bio-5: Application of the rodenticide, bromadiolone, has potential to adversely impact some listed wildlife species.

See Mitigation Measure Bio-1. The District's current BMPs help reduce the risk of significant adverse impacts to listed species to bromadiolone. However, the incidence and impact of secondary poisoning is difficult to evaluate because of lack of data. Mitigation Measure Bio-1 increases the ability of the District to avoid areas adjacent to habitat for listed species within Orange County by improving the ability of the District to detect where certain treatments or activities may be less favorable or where more caution is needed because of the presence or likely presence of rare or threatened or

endangered species. This mitigation will also reduce the potential for bromadiolone applications to adversely impact listed species to less than significant.

District programs and policies do not conflict with any local ordinances or policies protecting biological resources or conflict with provisions of an adopted Habitat Conservation Plan or Natural Community Conservation Plan. The District, however, was not a signatory of the two HCP/NCCPs in Orange County that protect a large proportion of the remaining undeveloped lands in the County so its activities are not covered by these agreements.

4.5.5 SUMMARY

As an ongoing public health program, the District's practices involve rotation of a suite of currently available pesticides as well as incorporation of newly developed ones in order to reduce development of resistance in vector species as well as to minimize adverse impacts on health of humans, wild species, and ecosystems. The District also operates throughout the diverse habitats of Orange County that support an array of listed rare and endangered species. The rare and endangered species' list is also continually evolving; more species become added to the list as human activities negatively affect them or their habitats or as new information arises that suggests they are in danger of extinction, while others may reach recovery goals and be removed from the list. Because of this evolving nature of the District's program, the District must maintain an ongoing relationship with the agencies responsible for conserving and managing listed species and their ecosystems and remain abreast of information on listed species' distributions, sensitive habitats, and potential impacts of current and newly developed pesticides to reduce potential adverse impacts to listed species to a level that less than significant.

The OCVCD prepared and adopted a policy of annual environmental awareness training for District staff in 2011. The OCVCD can perform additional measures to minimize the potential for impacts on listed species throughout the District as defined in the mitigation measures in this document. Compliance with the mitigations will ensure that the OCVCD's programs have a less than significant impact on listed rare and endangered species and sensitive habitats in Orange County.

5 CEQA REQUIRED ASSESSMENT CONCLUSIONS

5.1 CUMULATIVE AND GROWTH-INDUCING IMPACTS

None of the OCVCD's operations or policies induces, facilitates or stimulates growth.

The review of cumulative impacts is limited to Orange County and immediately adjacent areas in which the OCVCD may have to practice vector control activities. No major changes in activities or practices are currently being considered that would create additional impacts under the preferred alternative.

OCVCD will continue to use traps and field checks for surveillance, practice source reduction where necessary, apply pesticides to and over mosquito breeding areas, continue distributing baits for red imported fire ants and rats and will continue educational programs. Because the majority of the current

pesticides used by OCVCD are non-persistent compounds that degrade within a few hours to a few weeks when exposed to sunlight, moisture and soil, they do not accumulate or produce known long-term impacts. There will be no cumulative impacts to water quality or the water supply. Based on USEPA and several University studies, there will be no cumulative impacts to human health with continued use of the pesticides at label rates and following all label precautions specified by USEPA.

The use of the mosquitofish, *Gambusia affinis,* for biological control of mosquito larvae in artificial ponds and unmaintained swimming pools will continue. Potential adverse impacts to rare and endangered species from mosquitofish migration into natural environments will be mitigated by the mitigation requiring the District to avoid placing mosquitofish into manmade structures or habitat with connectivity to natural habitats.

The air quality and greenhouse gas impacts will continue at below action threshold levels for the SCAQMD and are not cumulatively considerable.

No potentially significant impacts to urban and rural land uses would result from Alternatives 1 & 2. Any potential impacts associated with Alternative 3 are speculative.

Operations of OCVCD do not have a significantly incremental or cumulative impact upon public services.

Source reduction may result in minor cumulative impacts upon non-target wildlife and plants. The cumulative effects will be less than significant based upon the OCVCD's operational policies, cooperative efforts with the California Department of Fish and Game and the U. S. Fish and Wildlife Service and compliance with mitigations specified in this EIR.

5.2 Significant Unavoidable Adverse Impacts

OCVCD policies and procedures adhere strictly to federal and state requirements for environmental management and pesticide use. The continuing education required to maintain certification for personnel keeps staff current on methods and materials to avoid significant adverse impacts.

5.3 Significant Irreversible Environmental Changes

Limitations placed on source reduction work by the federal Clean Water Act have eliminated the irreversible changes in surface waters that once were a part of mosquito vector control. The current suite of chemical and biological controls used have not been shown to cause irreversible changes to any population of vector or non-target plants or animals when used according to regulations and guidelines established for public health vector control. OCVCD activities do no create any irreversible changes to landforms or land use.

5.4 Effects Not Found To Be Significant

The assessment for the Initial Study eliminated a number of areas of potential environmental effects because the project does not include new construction, any changes in land form or land use, or

significant changes in activities. The project, as proposed, is a continuation of ongoing policies and activities. Areas identified for further review in the Initial Study included the following:

Hazards to Humans and Other Non-Target Species:

Use of chemicals by the OCVCD is regulated by USEPA, Cal/EPA and CDPR and overseen by the CDPH. The majority of chemicals employed by the OCVCD in their programs have been classed as slightly or relatively non-toxic to humans by USEPA. The CDPH, as well as a number of risk assessments performed by university scientists, has concluded that pesticide use as it relates to mosquito control by public health agencies presents minimal threat to human health and non-target organisms. Field studies of pesticides used in vector control on non-target organisms suggest that most of the chemicals applied by OCVCD do not affect non-target organisms significantly when applied at label rates and in accordance with all regulations and best management practices aimed at reducing impacts to humans and non-target organisms. In addition, the CDC finds that instances of confirmed pesticide-related illness due to exposure to mosquito control pesticides are rare. The OCVCD does not apply the most toxic chemical, the rodenticide, near schools and complies with all the requirements to avoid accidental poisonings of children, pets, and wildlife. The District has developed an accidental spill response plan and each vehicle transporting pesticides is equipped with an accidental kit to reduce risk to humans and the environment in the case of accidental spills. Consequently, this PEIR did not find that OCVCD's program presents a significant hazard to human health.

Water Quality: Water quality impacts from public health pesticides were originally considered insignificant under the 2006 USEPA rules when applied at FIFRA label rates. These pesticides were declared not to be pollutants. This was overturned January 1, 2009, by the 6th Circuit U.S. Court of Appeals, which found that biological materials are pollutants and subject to the Clean Water Act and that adulticides applied over water and reaching the water surface and any pesticides applied directly to the water surface that persist as a residue constitute chemical wastes. The Court also decided that applications of pesticides at the moment of application are point source discharges constituting chemical wastes. As a result of this decision, mosquito and vector control districts that had not filed for a NPDES permit for aquatic pesticides in 2001 began filing for larvicide permits in 2009. The State, in coordination with the MVCAC, is finalizing a General Permit for aquatic pesticides. The District has submitted a pesticide application plan and received a Notice of Applicability on October 31, 2011, for discharge of biological and residual pesticides to Waters of the U.S. OCVCD has joined a coalition of mosquito and vector control districts to support third-party monitoring of mosquito pesticides' effects on water quality in California.

The available literature from USEPA, several state, and university research studies in the United States and overseas, suggests that application of the current groups of aquatic pesticides used by OCVCD is unlikely to have a significant effect upon water quality because the ones that are water-soluble break down rapidly with exposure to sunlight and water. Any impacts that may be identified by MVCAC's water quality monitoring will be addressed through the NPDES General Permit.

Air Quality and Greenhouse Gases: The majority of vehicle use by OCVCD occurs during a six month active inspection and control period. An Urbemis 9.2.4 computer model was run for OCVCD vehicle use, which is a minor increment of the 400,000,000 vehicle miles travelled each year in the South Coast Air Basin. The analysis of air pollutant production produced results well below the action thresholds of SCAQMD for air pollutants. While significance thresholds for greenhouse gases are still under development, greenhouse gas emissions from OCVCD operations are very low relative to emissions produced within the action area and vehicle replacement policies are in line with recommended measures for reduction of greenhouse gas emissions. Volatilization of the chemicals used by the District is expected to be insignificant or attenuated by rapid environmental breakdown. The adulticide used by the OCVCVD is water-based and dispersed as an ultra-low volume mist at night or in underground storm water drains and particles do not remain suspended in air for more than a few hours, so exposure of sensitive receptors to these chemicals is minimal to insignificant.

Rare and Endangered Species and Sensitive Habitats: The CNDDB lists 47 wildlife species in Orange County as threatened or endangered by USFWS or CDFG or as a species of special concern by CDFG. There are also 54 listed plant species. The federal list of plant species includes ten threatened or endangered and one candidate for listing. Eight plant species on the CDFG listings as endangered or species of special concern. Federally designated critical habitat for seven wildlife and two plant species exists within Orange County. The OCVCD has special contracts and permits to conduct vector control and disease surveillance on state and federally-owned lands, and District employees undergo annual training sessions with USFWS and CDFG and have adopted numerous best management practices to minimize impacts to rare and endangered species from operations. However, impacts from pesticide use and other activities such as vegetation maintenance for access to application sites on endangered species or critical habitats may evolve as the program evolves to incorporate new pesticides and new data on species become available. Mitigations developed for this document, including a requirement to incorporate annually updated information on rare and endangered species distributions and habitats into annual staff training sessions will reduce adverse impacts on listed rare and endangered species and sensitive habitats to less than significant under CEQA.

REFERENCES CITED BY EIR CHAPTER

This section organizes the references cited within the text by chapter of the PEIR. A full bibliography of references consulted in the preparation of this document is included in the Appendices (Appendix I).

5.5 CHAPTER 1 - INTRODUCTION

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APPENDICES

Appendix A

MVCAC NPDES MONITORING PLAN

FOR MOSQUITO LARVICIDES AND ADULTICIDES

MONITORING PLAN FOR MOSQUITO LARVICIDES AND ADULTICIDES

Prepared by

Mosquito and Vector Control Association of California

March 4, 2011

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ACRONYMS

°F	degrees Fahrenheit
µg/cm^2	micrograms per square centimeter
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
ATVs	all-terrain vehicles
BMPs	Best Management Practices
Bti	*Bacillus thuringiensis*
CAC	County Agricultural Commissioner
CDFG	California Department of Fish and Game
CDPH	California Department of Public Health
CFR	Code of Federal Regulations
DGEIS	Draft Generic Environmental Impact Statement
DPR	Department of Pesticide Regulation
EEC	expected environmental concentrations
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
IPM	Integrated Pest Management
ITUs	International Toxic Units
IVM	Integrated Vector Management
Mg/L	milligrams per liter
MRP	Monitoring and Reporting Plan
MVCAC	Mosquito and Vector Control Association of California
NPDES	National Pollutant Discharge Elimination System
PBO	piperonyl butoxide
ppb	parts per billion
ppm	parts per million
PUR	Pesticide use report
RED	Reregistration Eligibility Decision
RUP	Restricted-use pesticide
SWRCB	State Water Resources Control Board
TIE	toxicity identification evaluation
U.S. EPA	United States Environmental Protection Agency
ULV	Ultra-Low Volume
URS	URS Corporation
USFWS	U.S. Fish and Wildlife Service
UV	Ultraviolet

1.1 INTRODUCTION

Mosquito control agencies in California follow an integrated pest management (IPM) approach that strives to minimize the use of pesticides and their impact on the environment while protecting public health. These agencies determine what is appropriate in their districts, and follow response plans that use surveillance tools to determine the extent of the problem and guide treatment decisions, with an emphasis on source reduction and control of mosquitoes in their immature stages. They have chosen to use the least toxic materials available for control of the larval stages, focusing on bacterial larvicides, growth regulators and surface films rather than organophosphates or pyrethroids. Control of adult mosquitoes may become necessary under some circumstances, such as in the event of a disease outbreak (documented presence of infectious virus in active host-seeking adult mosquitoes), or lack of access to larval sources leading to the emergence of large numbers of biting adult mosquitoes. Current levels of adulticide use are much lower than they were through the 1980s. However, the scope of control for adult mosquitoes in California has increased since 2004, when West Nile virus reached epidemic levels and dispersed to all 58 counties (Armijos et al. 2005; Hom et al. 2005). West Nile virus is a mosquito-borne viral disease, with cases varying from asymptomatic to serious neurological symptoms and death. There is no specific treatment for West Nile virus—prevention is key. Human West Nile virus cases for California counties over the years total 2874 and are shown in Figures 1-1 through 1-6. In 2008, there were 445 reported human cases in the State, which represented 32.8 percent of the total human cases reported in the United States. West Nile virus also adversely impacts many species of birds and can cause serious illness and death in horses. Mosquito control remains the only effective method of limiting the threat of this virus to public health. Control of adult mosquitoes through the application of adulticides is an essential tool in responding to spread of viral diseases (Gubler et al. 2000; Kramer 2005).

1.2 NPDES PERMIT FOR MOSQUITO LARVICIDE AND ADULTICIDE APPLICATIONS

Mosquito larvicide and adulticide applications are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Following the recent decision by the Sixth Circuit Court of Appeals, these applications will also require coverage under the NPDES. The Court's decision held that applications of pesticides to, over, and around waterways that could result in deposition of pesticide residuals into waters of the United States may qualify as pollutants and require NPDES permits. Currently, representatives of mosquito control districts are working with the State Water Resources Control Board (SWRCB) to develop a combined statewide permit that would cover the application of both mosquito larvicides and adulticides. In February 2009, SWRCB staff met with members of MVCAC, which represents the vast majority of governmental mosquito control programs in the state. California Department of Pesticide Regulation (DPR) and California Department of Public Health (CDPH) representatives were also present at the meeting, which was held to discuss MVCAC's need for a mosquito adulticide permit as a result of the Sixth Circuit Court's ruling. Subsequently, representatives of MVCAC, SWRCB, DPR, and DPH formed a technical committee to facilitate drafting the permit.

Representatives of the United States Environmental Protection Agency (U.S. EPA) Region IX joined the technical committee after its initial formation.

Although the SWRCB initially intended to adopt an adulticide permit and later revise the larvicide permit (resulting in two separate permits), representatives of MVCAC encouraged adoption of a combined permit that includes both larvicide and adulticide applications. In February 2010, the SWRCB agreed to prepare a combined permit, and requested that MVCAC propose a monitoring approach that covers both larvicides and adulticides.

1.3 OBJECTIVES OF THIS MONITORING PLAN

The SWRCB identified the following key questions to focus the monitoring program:

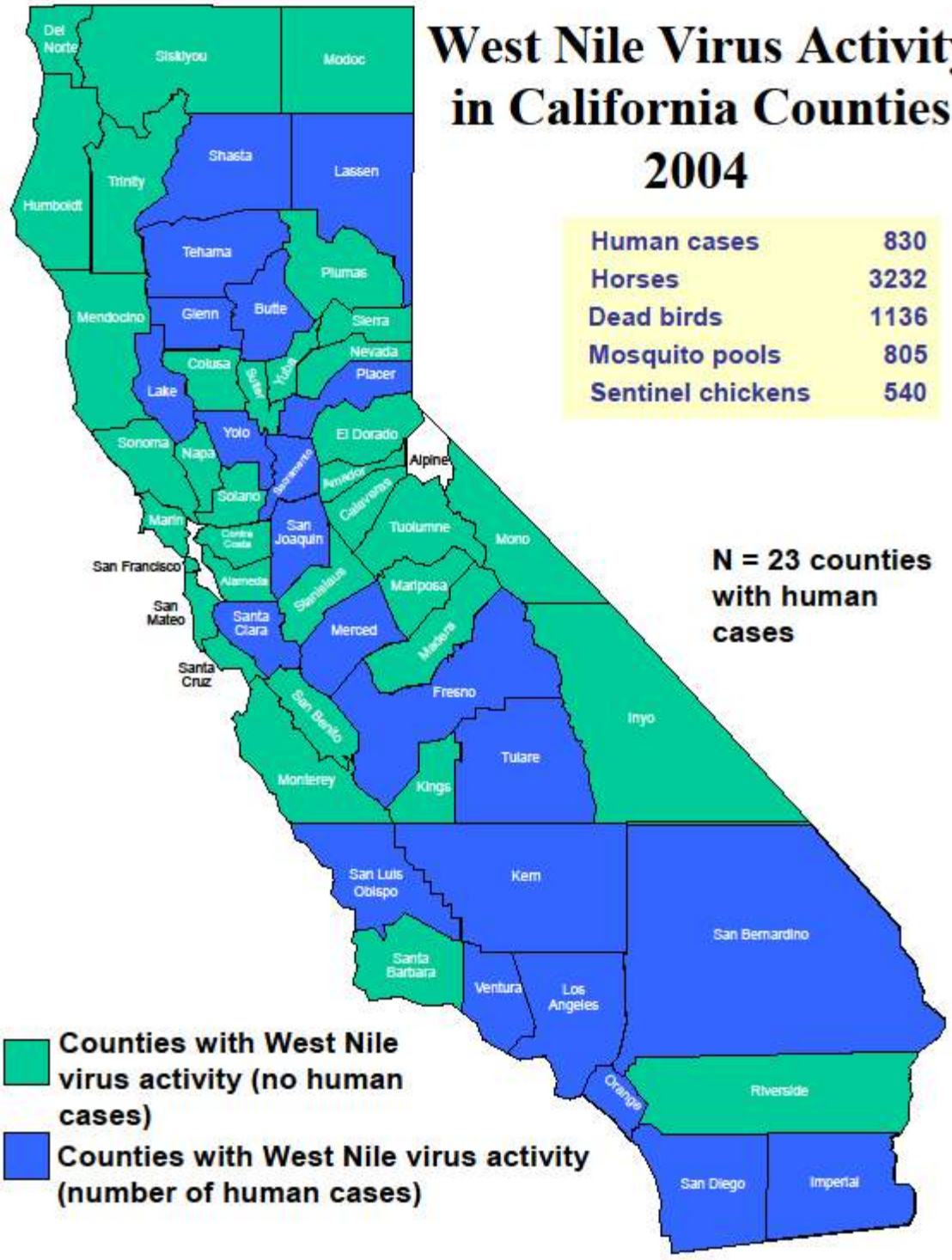
1. Does the pesticide residue from spray applications cause an exceedance of receiving water limitations or monitoring triggers?

2. Does the pesticide residue, including active ingredients, inert ingredients, and degradates, in any combination, cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

To assist in answering these questions, the SWRCB envisions a process that will use existing data, determine the critical gaps in knowledge, and develop a monitoring program to address key areas of uncertainty. Towards this end, the SWRCB has requested that MVCAC review available data and draft a Conceptual Monitoring Program for consideration by the technical committee.

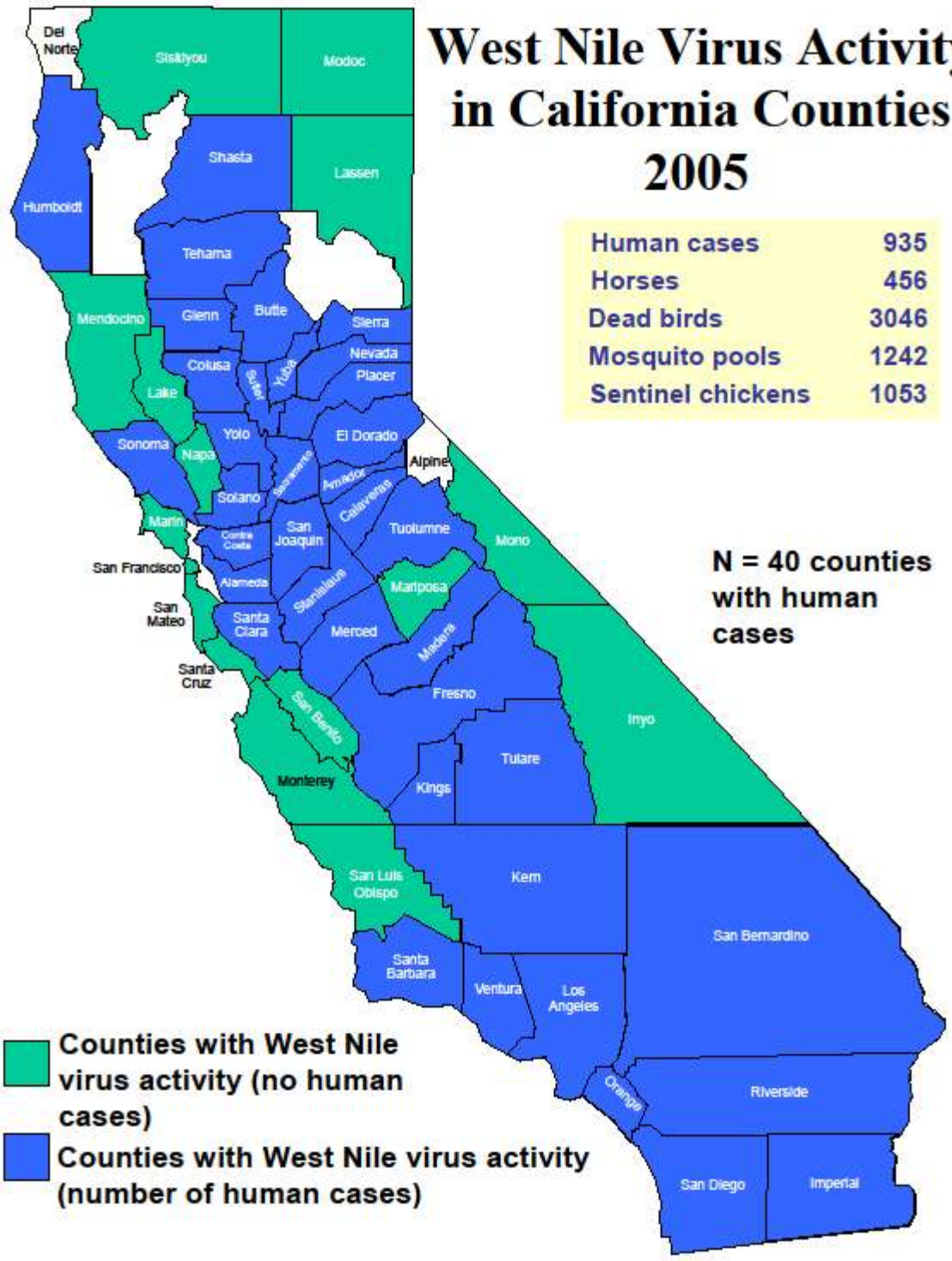
The goals of this Monitoring Program are to:

- Summarize recent data on use of larvicides and adulticides by MVCAC members;
- Summarize the findings of studies addressing the environmental fate of the materials used in mosquito control and their potential impacts on aquatic organisms;
- Identify the data gaps and informational needs to answer the key questions; and
- Develop a monitoring and reporting program (MRP) to collect data to help answer the key questions.



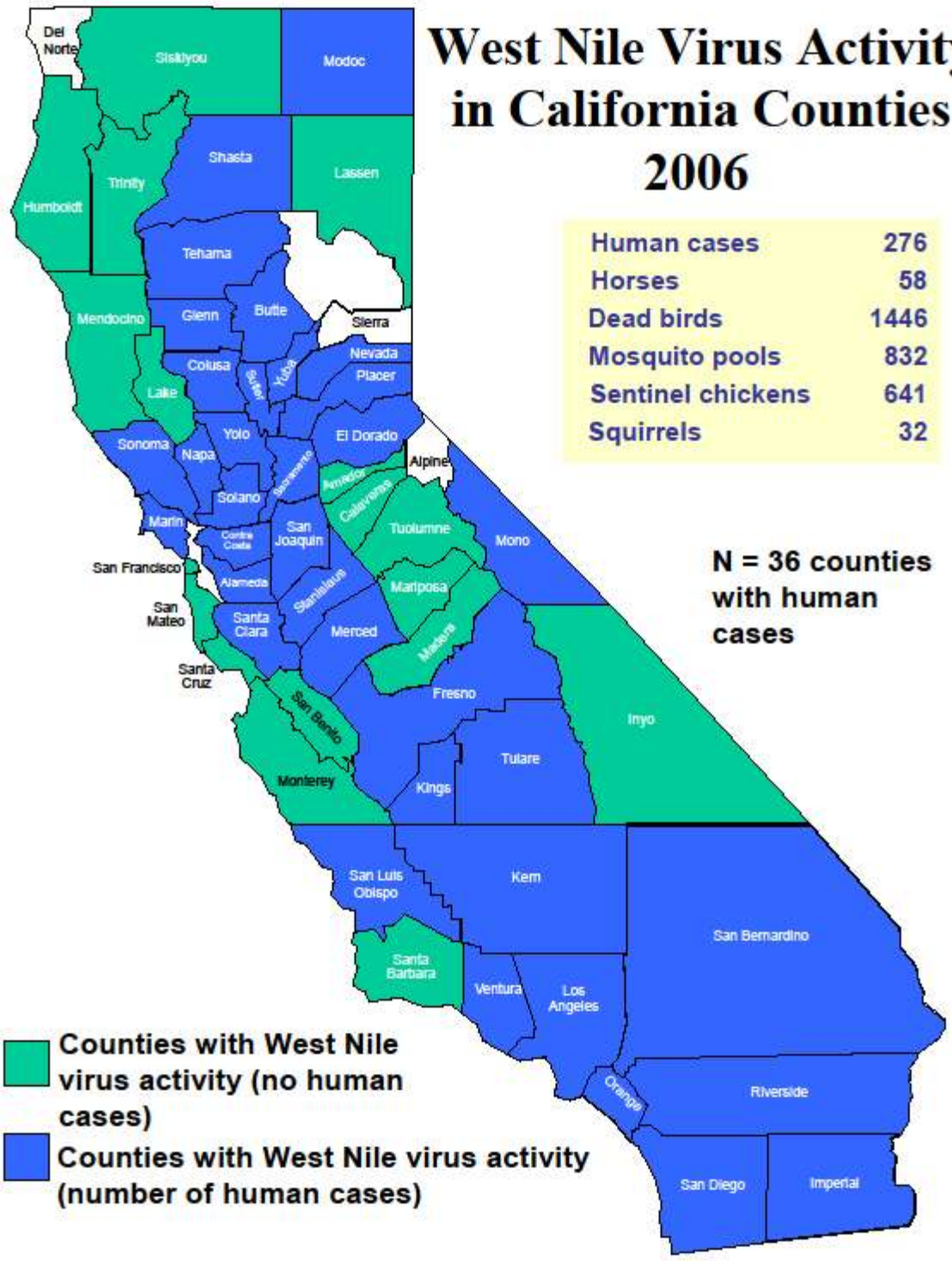
Source: http://www.westnile.ca.gov/

Figure 1-1. 2004 West Nile Virus Cases in California



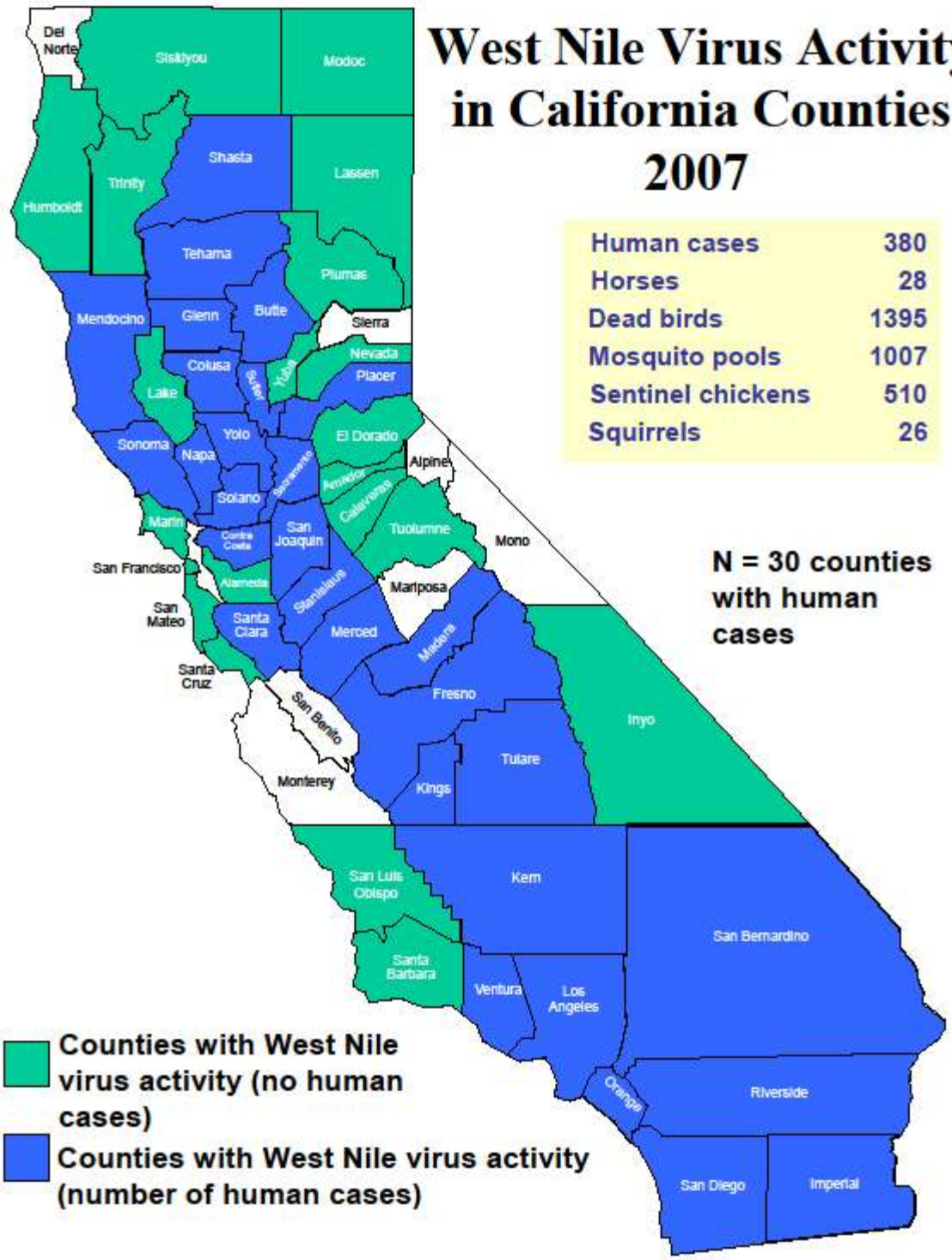
Source: http://www.westnile.ca.gov/

Figure 1-2. 2005 West Nile Virus Cases in California



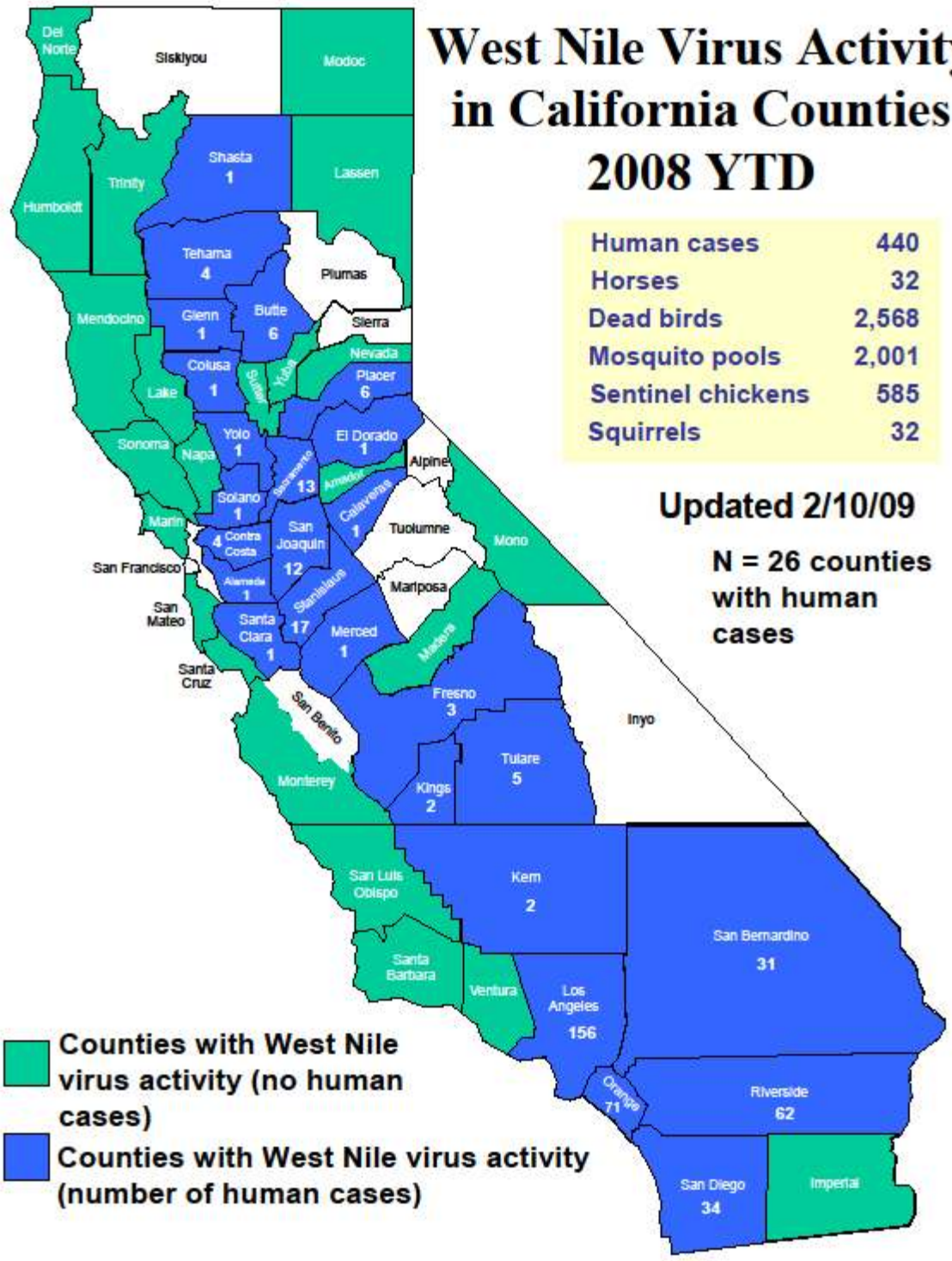
Source: http://www.westnile.ca.gov/

Figure 1-3. 2006 West Nile Virus Cases in California



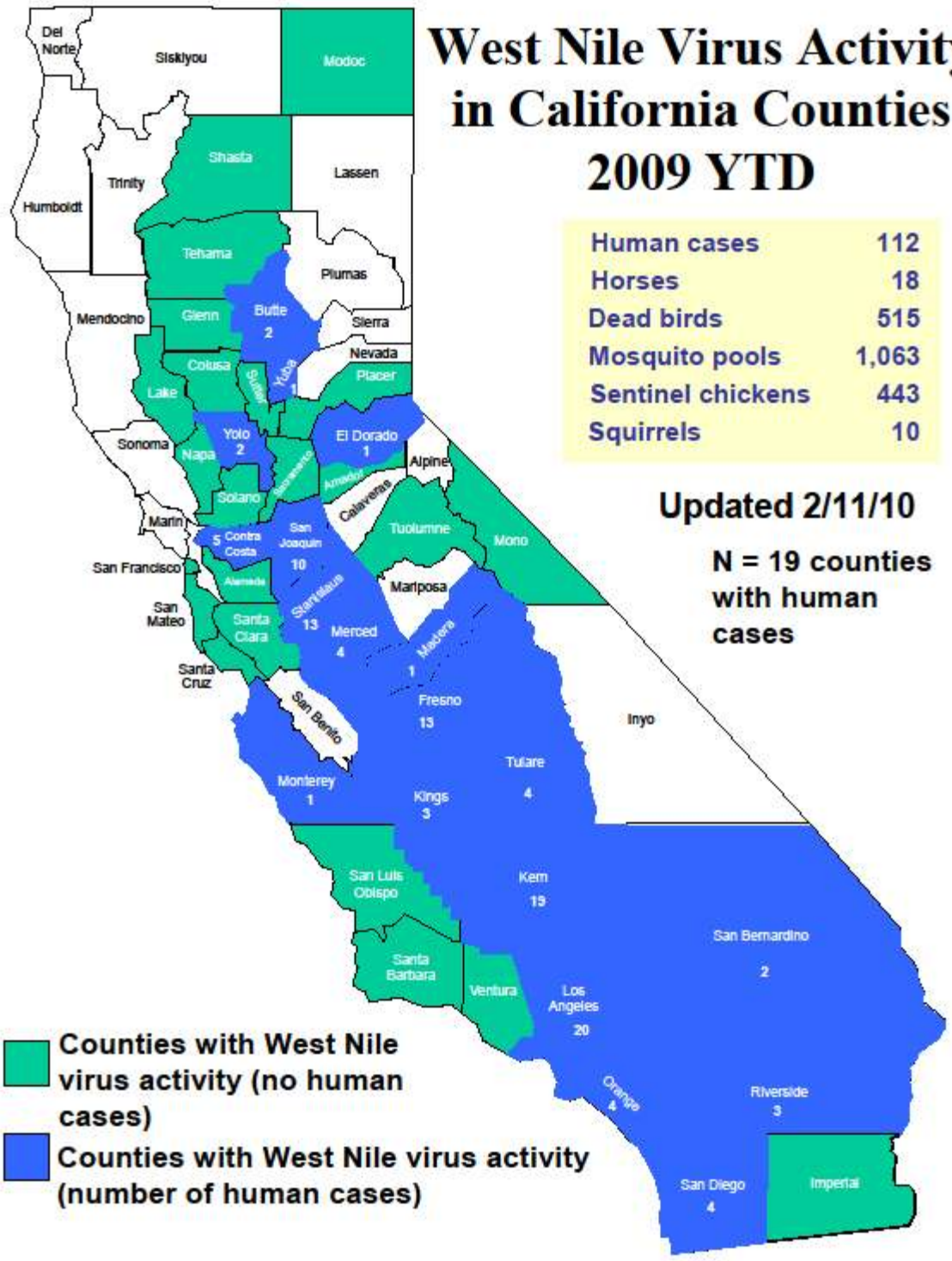
Source: http://www.westnile.ca.gov/

Figure 1-4. 2007 West Nile Virus Cases in California



Source: http://www.westnile.ca.gov/

Figure 1-5. 2008 West Nile Virus Cases in California



Source: http://www.westnile.ca.gov/

Figure 1-6. 2009 West Nile Virus Cases in California

2.1 OVERVIEW OF MOSQUITO CONTROL IN CALIFORNIA

The primary objective of mosquito control is the protection of people from the discomfort and diseases resulting from mosquito bites. The most frequently contracted diseases associated with mosquitoes in California are West Nile fever, West Nile neuroinvasive disease, St. Louis encephalitis, and western equine encephalomyelitis (see Table 2-1).

Table 2-1. Most Important Mosquito-Borne Disease Pathogens in California, the Diseases that Result from Infections, and the Primary Vectors

Pathogen	Disease	Vectors
California encephalitis virus	California encephalitis	*Aedes melanimon*
St. Louis encephalitis virus	St. Louis encephalitis	*Culex tarsalis, Cx. quinquefasciatus*
Western equine encephalomyelitis virus	Western equine encephalomyelitis	*Culex tarsalis*
West Nile virus	West Nile fever, West Nile neuroinvasive disease	*Culex tarsalis, Cx. pipiens, Cx. quinquefasciatus*
Plasmodium vivax, P. falciparum	Malaria	*Anopheles freeborni, An. punctipennis*
Dirofilaria immitis	Dog heartworm	*Aedes* spp.

Source: CDPH 2008

Mosquito control is accomplished through direct or indirect human intervention to eliminate or reduce the size of mosquito populations in a given area. Effective and long-lasting control can be accomplished by scientifically planned management and control strategies that are applied in a timely manner to achieve significant reductions in mosquito populations. These strategies fall into several categories, as described below and summarized in Table 2-2.

- **Physical Control.** Physical control is the preferred method of reducing mosquito populations. Physical control means the modification and management of the environment to discourage production or survival of mosquitoes. Most of these methods involve water management, and are done cooperatively with private landowners, water-rights holders, and/or other agencies charged with protection and management of lakes, ponds, rivers, streams, marshes, and swamps.
- **Chemical Control.** Chemical control is the application of insecticides (including microbial, biochemical, and surface films) to adult or larval habitats of mosquitoes. Generally, chemical control of larvae is preferred over chemical control of adult mosquitoes because larvicides can be applied in a highly directed manner. Larval control also has few effects to non-target organisms, because larvicides in use today by MVCAC members are generally highly selective.
- **Protective Measures.** Personal protective measures are the steps individuals can take for themselves and their families to protect them from mosquito bites. The use of mosquito repellents, the wearing of clothing that minimizes the amount of skin exposed to mosquitoes, window and door screens, and avoidance of situations (e.g., being out-of-doors at dusk) are

all examples of personal protective measures. If similar methods are applied by a mosquito abatement agency (establishment of treated barriers, selective vegetation removal, etc.) then the term "area protective measures" is used.

Table 2-2. Summary of Natural Mosquito Population Limiting Factors and Mosquito Abatement Strategies

NATURAL POPULATION LIMITING FACTORS	
Biological limiting factors	Pathogens, parasitism, predation, competition
Physical limiting factors	Adults – air temperature, relative humidity, protective shelter Larvae – water temperature, dissolved salts/pollutants, currents, habitat
CHEMICAL CONTROL METHODS	
Adulticides	Organophosphates, pyrethrum, synthetic pyrethroids
Larvicides	Microbials, biochemicals, surface films
PHYSICAL CONTROL METHODS	
Aquatic habitats	Water management, vegetation management, physical design
Terrestrial habitats	Field grading, effective building codes, air conditioning
BIOLOGICAL CONTROL METHODS	
Releases of agents	Pathogens, parasites, predators (primarily *gambusia*)
Conservation of agents	Proper water management, use of selective insecticides that leave predator populations intact
AREA PROTECTIVE MEASURES	
Public relations	Literature, public education, mosquito-proofing of public buildings
Area control	Mosquito barrier treatments (very limited areas)
PERSONAL PROTECTIVE MEASURES	
Personal measures	Repellents, protective clothing, staying indoors
Home control	Draining of water, use of mosquitofish
Source: CDPH 2008	

In California, IPM, or integrated vector management (IVM), uses a combination of all the above methods for the most ecologically sound method of mosquito control. Principles of insecticide use in IPM include:

- Use of monitoring to direct control efforts and minimize pesticide applications
- Taking advantage of biological, and physical,factors to control mosquito popuations and minimize pesticide applications
- Utilizing appropriate thresholdsfor pesticide application decisions
- Applying insecticides in a manner that minimizes harm to non-target organisms.
- Choosing control materials with the lowest toxicity to nontarget organisms while still effectively controlling mosquitoes

- Using insecticides to treat specific sites where mosquitoes are being produced and are causing annoyance or creating a public health problem.
- Applying insecticides selectively to the proper life stage of the mosquito (e.g., egg, larva, pupa, or adult).
- Applying insecticides in a manner that will minimize personal hazard to the applicator and other persons in the vicinity.

By definition, an IPM approach involves procedures for minimizing potential impacts to the environment and water quality. Agencies employ these principles by first determining the species and abundance of vectors through evaluation and then use the most efficient, effective, means of control.

In California, tax-supported mosquito-abatement or vector-control districts are tasked with controlling mosquito populations and preventing vector-borne diseases. Most of these districts belong to the MVCAC, which currently has more than 60 members representing mosquito- and vector-control programs. Many of these districts are in the Central Valley of California, where mosquitoes are a particularly serious problem. Approximately 36 million Californians (about 85 percent of the total population of the state) are protected from mosquitoes and associated diseases by the efforts of some type of organized mosquito abatement program (CDHP 2008). Statewide coverage of MVCAC members by county is shown on Figure 2-1, and MVCAC members are listed in Table 2-3.

The State's pesticide regulations provide special procedures for vector control agencies operating under cooperative agreements. The application of pesticides by vector control agencies is regulated by a special arrangement among the CDPH, DPR, County Agricultural Commissioners (CACs), and vector control agencies. Vector control agencies are not directly regulated by DPR. Instead, supervisors or applicators are licensed by CDPH. Pesticide use by vector control agencies is reported to the CAC in accordance with a 1995 Memorandum of Understanding among DPR, DHS, and CACs for the Protection of Human Health from the Adverse Effects of Pesticides, and with cooperative agreements entered into between CDPH and vector control agencies, pursuant to Health and Safety Code Section 116180.

Historically, MVCAC agencies have usually viewed using larvicides as less effective or less economical than physical control, water management, or biological control; and as more effective than using adulticides. However, this view developed long ago, when the values of wetlands were not as widely recognized as they are today, and when relative control costs were different. To some extent, this philosophy has been evolving in recent decades as more selective larvicides have become available, and as physical and biological control have become more constrained by regulatory requirements. Although it can be difficult to compare the relative environmental impacts of different control strategies, it is now increasingly common to primarily use selective larvicides in relatively undisturbed sites, and to emphasize physical control and biological control primarily in man-made or disturbed areas.

2.2 Mosquito Larvicides and Use in California

Vector control agencies regularly inspect areas of standing water for immature mosquitoes to determine the local conditions. The action level or threshold is determined by each mosquito control program and varies according to local conditions. When a threshold is exceeded, control measures are generally determined using a decision process such as that described in Appendix A. When it is determined that use of larvicides are warranted, the most appropriate larvicide is selected taking into account the following factors:

- Selectivity and toxicity to nontarget organisms (whenever possible choose products with least impact to nontarget organisms)
- If the site is difficult to access or to minimize disturbance to sensitive habitat, a slow release product may be selected to minimize application frequency.
- Time release pellets and briquets (similar in form to charcoal briquets) are very expensive and generally not cost-effective to use on large sites).
- Consideration of which mosquito species are present (some products do not work as well on certain species).
- Sensitive habitat such as vernal pools and/or presence of special-status species may limit the use of some larvicides.
- Thick vegetation, tire piles, or log piles may require a heavy granule to deliver the material to the water.
- Rotating products to avoid resistance.

Selecting the proper class of larvicide and the formulation are both important in pesticide resistance management. For example, use of sub-lethal dosages (below the lower end of the label-recommended application rates) may encourage resistance. Insects with inherent tolerances for weakly applied pesticides may survive to produce tolerant offspring. Also, use of extended-release formulations beyond their recommended use period may encourage resistance by exposing mosquitoes to sub-lethal concentrations of active ingredients.

2.2.1 Larvicide Application Methods and Materials Used in California

Because of the wide range of mosquito sources within each member agency, and the variety of pesticide formulations described above, each agency uses a variety of techniques and equipment to apply larvicides, including hand-held sprayers and spreaders with a power backpack; from truck- or all terrain vehicle (ATV)-mounted spray rigs; and in very large or inaccessible areas, from helicopters or other aircraft. Application methods for the various formulations of each active ingredient are described in Table 2-4.

Ground Application Equipment. The larvicides can be applied with pick-up trucks or ATVs. A chemical-container tank, high-pressure, low-volume electric or gas pump, and spray nozzle are mounted in the back of the truck bed, with a switch and extension hose allowing the driver to operate the equipment and apply the larvicide from the truck's cab. The ATVs have a chemical container mounted on the vehicle, a 12-volt electric pump supplying high–pressure, low-volume

flow, and booms and/or hoses and spray tips allowing for application while steering the vehicle. ATVs are ideal for treating areas such as agricultural fields, pastures, and other off-road sites. Additional training in ATV safety and handling is provided to employees before operating these machines.

Additional equipment used in ground applications includes hand-held sprayers and backpack blowers. Hand-held sprayers (hand cans) are standard 1- or 2-gallon garden-style pump-up sprayers used to treat small, isolated areas. Backpack sprayers are gas-powered blowers with a chemical tank and calibrated proportioning slot. Generally, a pellet or small granular material is applied with a backpack sprayer or "belly grinder" machine designed to distribute pellets or granules.

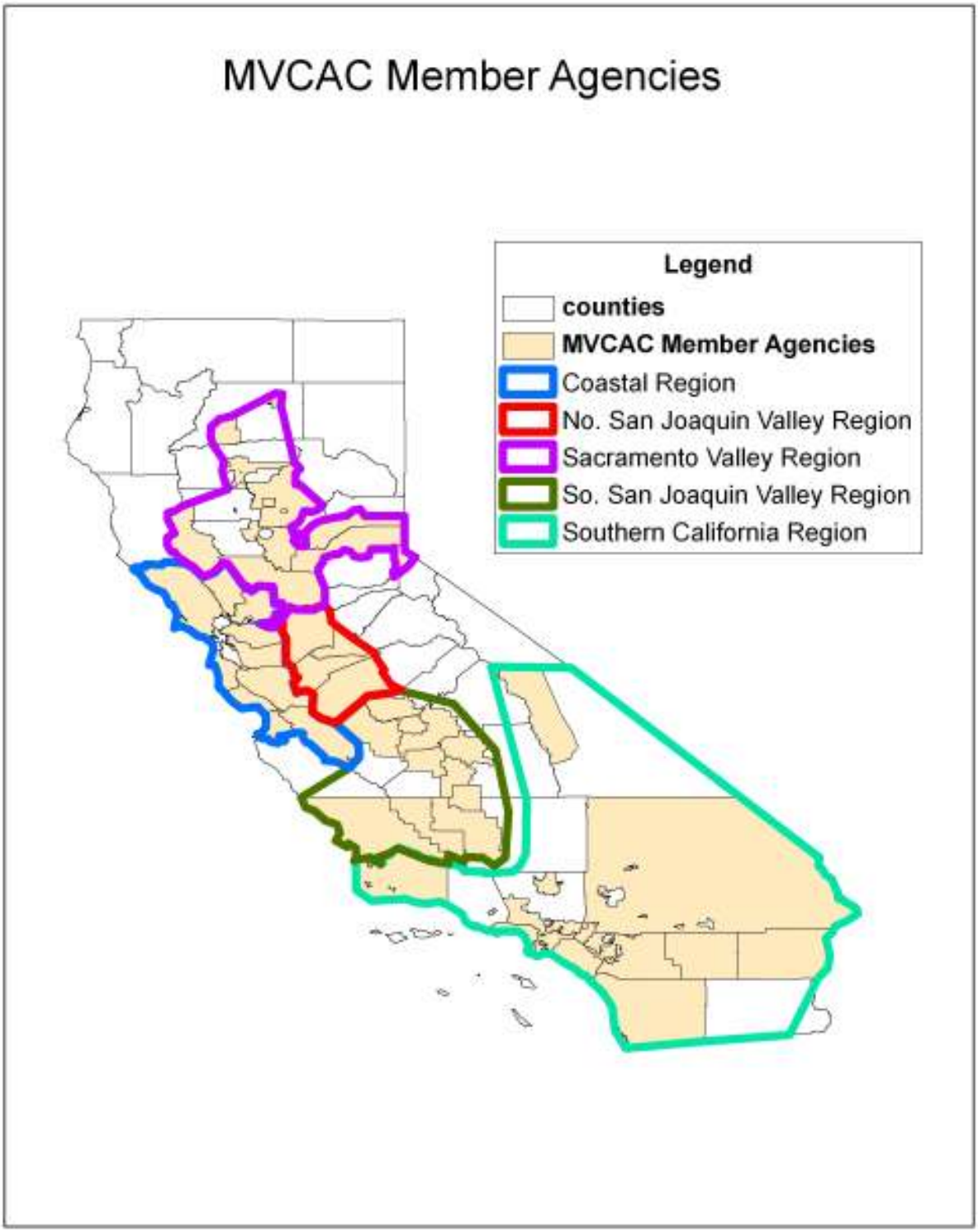


Figure 2-1. MVCAC Member Agencies

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
Coastal	Alameda MAD	10	1	<1	10	1	no	no	yes	wetlands
	Alameda VCD									
	Contra Costa	620 to 18,400	8 to 44	<1	thousands	1 to 3 times (rarely)	no	yes	yes	all
	Marin-Sonoma	8,300	517	<1	few blocks	1 times	no	yes	yes	all
	Napa	22,000	200	3	100	1 to 5 times	no	yes	yes	rural
	North Salinas		5	1		1 to 5 times	no	yes	yes	rural, wetland
	San Benito	5	1 to 5	1	4	1 times	no	yes	yes	agricultural, wetlands, forest (treeholes)
	San Francisco									
	San Mateo			<1	15,000		no	yes	yes	
	Santa Clara	1,600	1 to 2	<1	1,600	1 to 2 times	no	yes	yes	urban
	Santa Cruz									
	Solano	17,871	355	<1	1,000		no	yes	yes	agricultural wetlands, urban

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
Sacramento Valley	Burney Basin	121,065	60	14,000	106,000	weekly to bi-weekly	yes	yes		agricultural, rural
	Butte County	325,000	1,700	1	25,000		yes	yes		agricultural, urban, forest, wetlands
	Colusa	121,062	821	5,000	15,000	1 to 2 times per week for 16 weeks	yes	yes		rice, wetlands, rural
	Durham									
	El Dorado County	10	1 to 3	1		1 times	no	yes	yes	rural
	Glenn County	many	141			1 to 2 times per week all summer	no	yes		rice, rural, cities
	Valley-Wide District	many	169			1 to 2 times per week all summer	no	yes		rice, rural, cities
	Lake County	31,000	800	<1		5 to 8 times	no	yes	yes	treeholes, rice, wetlands, urban, rural
	Nevada County									
	Oroville									
	Pine Grove	205 sq mi	54			weekly	no	yes		pasture, rice, wetlands, treeholes, urban, rural

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
	Placer County	108,664	387	1	7,000		yes	yes		treeholes, rice, wetlands, urban, rural
	Sacramento-Yolo	350,000 to 1 million	300 to 1,000	10	60,000	up to 25	yes	yes	yes	rice and others
	Shasta	164,600	360			1 to 4 times per season	no	yes		mostly urban, also ag and wetlands
	Sutter Yuba	541,180	978	<1	13,000	1 times to weekly	yes	yes	yes	pasture, rice, wetlands, treeholes, urban, rural
	Tehama County	100,000	450			1 to 8 times	no	yes		pasture, rice, wetlands, treeholes, urban, rural
North San Joaquin Valley	East Side	91,685	921			depends	yes	yes		urban, agricultural, pasture, treeholes
	Merced County	94,740	56	600	4,250	depends	yes			pasture, rice, wetlands, treeholes, urban, rural
	Saddle Creek	58,000	12	500 average	880	2 times weekly	no	yes		urban (golf course) wetlands, treeholes

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
	San Joaquin County	780,000	92			6 times	yes	yes		agricultural, urban, golf course
	Turlock	77,954	240	3	4,160	1 to 10 times	yes	yes		urban, agricultural, wetlands
South San Joaquin Valley	Coalinga-Huron									
	Consolidated	20,135	554	0.023	365.8	1 to 13	no	yes	yes	urban, wetlands, rural
	Delano	60	2	20	40	1	no	yes		agricultural
	Delta	10,000	126	0.5	160	1 to 7 times	no	yes	yes	urban, ag
	Fresno	250	25	<1	10	1	no	yes	yes	irrigated pasture
	Fresno Westside	42,119	490				yes	yes	yes	
	Kern	50,000	267	200	200	2 to 3 times per year	no	yes	yes	urban, agricultural
	Kings	5,000	100	<1	50	2 to 3 times in a row	yes	yes	yes	all
	Madera	58,000	907	1	60	2 times per month	no	yes		agricultural, urban
	San Luis Obispo									
	Tulare	17,235	57	20	640	1 to 3 times per season	yes	yes		urban, suburban, agricultural

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
	West side	102	11	1	20	1 to 5 times		yes	yes	urban
Southern California	Antelope Valley	0	0	never fog						
	Coachella Valley	17,596	67	15	150	5 to 10 times, depending on virus and mosquito activity	yes	yes		urban, wetland, agricultural
	Compton Creek	0	0	never fog						
	Greater Los Angeles	<2,480	20	<0.1	1920	2 to 7 times	no	yes		urban, wetlands, mausoleum, rural
	June Lake Pub. Util.	0	0	never fog						
	Long Beach	7,700	4	4	1920	4	no	no	yes	storm drain, urban
	Los Angeles Co West	0	0	never fog						
	Santa Barbara Co.	0	0	never fog						
	Mammoth Lakes	prob don't fog								
	Moorpark	0	0	never fog						

Table 2-3. Typical Mosquito Adulticide Application by District for 2008 (Varies by Year)

Region	District	Acres per year	Number of Applications	Minimum Acres per Site	Maximum Acres per Site	Repeated Applications per Site	Application by Air	Application by Truck	Application by Handheld Device	Sites Treated
	Northwest	7,000	30	5	250	1 to 7 times	no	yes	yes	urban, wetlands, parks, lakes
	Orange County	5,885	211	3.5	111	3 to 4 times (storm drains 2 times/ month)	no	yes	no	urban, wetland, storm drains
	Owens Valley	10,231	92	<1	>500	10 to 12 times	no	yes	yes	mostly agricultural, some urban
	Riverside	100	45	7	20		no	no	yes	urban, rural
	San Bernardino	100	300			3	yes	no	yes	dairy ranch, chicken ranch
	San Gabriel	159.5	2	19.5	95	1 or 2 (not all sites every year)	no	yes	yes	urban, parks
	West Valley	0	0	never fog						
	San Diego									

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
Bacillus Sphaericus (*Bs*)[1]	VECTOLEX CG BIOLOGICAL LARVICIDE	73049-20	7.5	--	5-20 lbs of formulation/acre. Use higher rates (10 to 20 lbs/acre) in areas where extended residual control is necessary, or in habitats having deep water or dense surface cover.	For agriculture/crop sites, apply uniformly by aerial or conventional ground equipment. Reapply as needed after 1 to 4 weeks. Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential for spray drift. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	VECTOLEX WDG BIOLOGICAL LARVICIDE	73049-57	51.2	--	0.5-1.5 lbs formulation/acre (8oz-24oz product/acre). Use higher rates (1 to 1.5 lbs/acre) in areas where extended residual control is necessary, or in habitats having deep water or dense surface cover.	Apply uniformly by aerial or conventional ground equipment. Reapply as needed after 1-4 weeks. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	VECTOLEX WSP BIOLOGICAL LARVICIDE	73049-20	7.5	--	1 pouch/50 sq.ft. Treat on basis of surface area of potential mosquito breeding sites by placing one (1) VectoLex Soluble Pouch for up to 50 square feet of treatment area.	Re-apply as needed after 1 to 4 weeks. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
Bacillus Thuringiensis, Subsp. *Israelensis* (*Bti*)[2]	VECTOBAC TECHNICAL POWDER	73049-13	100	--	0.455 to 0.91 billion ITUs per acre in mosquito habitats and 0.91 to 1.82 billion ITUs per acre in polluted water and sewage lagoons. (Product is equivalent to 2.275 billion ITUs per pound of undiluted powder.)	Powder must be diluted before application by suitable aerial or ground equipment. A 7 to 14 day interval between applications should be employed. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	VECTOBAC-12 AS	73049-38	11.61	--	0.25 to 2.0 pt formulation/acre. Use higher rate in polluted water and when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted, and/or algae are abundant.	Do not apply when weather conditions favor drift from treated areas. Apply in conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	AQUABAC 200G	62637- 3	2.86	--	2.5 - 10.0 lbs formulation/acre. When late third and early fourth instar larvae predominate, larval populations are high, or water is heavily polluted and/or algae are prevalent, use 10-20 lbs product/acre	Uniformly apply AQUABAC (200 G) in conventional aerial and ground application equipment. Use a seven to fourteen-day interval between applications. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	TEKNAR HP-D	73049-404	1.6	--	0.25-1.0 pt formulation/acre; 1.0-2.0 pt product/acre for water polluted with sewage, water with moderate organic content and water with a high level of suspended solids. Use lowest rate when 1st to 3rd instar larvae are predominant and highest rate when late 3rd to early 4th instar larvae are predominant in the mosquito population.	Apply TEKNAR HP-D when larvae are in 1st to early 4th instar. Larvicidal action is expected within 24 hours. Reapply as needed. When using standard spray equipment, use adequate volume of water to insure good coverage and penetration. Avoid spray drift. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	VECTOBAC-G BIOLOGICAL MOSQUITO LARVICIDE GRANULES	73049-10	2.8	--	2.5-10 lbs formulation/acre; 10-20 lbs product/acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.	Apply uniformly by aerial or ground conventional equipment. Avoid spray drift. A 7 to 14 day interval between applications should be employed. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
Bacillus Sphaericus (Bs) and *Bacillus Thuringiensis, Subsp. Israelensis (Bti)*	VECTOMAX CG BIOLOGICAL LARVICIDE	73049-429	2.7 [1]	4.5 [2]	5-20 lbs formulation/acre. Use higher rates (10 to 20 lbs/acre) in areas where 4th instar *Aedes* or *Ochlerotatus* spp. larvae predominate, or very high densities of late instar larvae are present, or under conditions where local experience indicates the need for higher rates to achieve extended residual control.	Avoid spray drift. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	VECTOMAX WSP BIOLOGICAL LARVICIDE	73049-429	2.7 [1]	4.5 [2]	1 pouch/50 sq.ft.	Re-apply as needed. Under typical environmental conditions and treatment areas, re-apply after 1-4 weeks. For storm drains, catch basins, retention, and detention and seepage ponds, re-apply after 6-8 weeks. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.
	VECTOMAX G BIOLOGICAL LARVICIDE/GRANULES	73949-429	2.7 [1]	4.5 [2]	5-20 lbs formulation/acre. Use higher rates (10 to 20 lbs/acre) in areas where 4th instar *Aedes* or *Ochlerotatus* spp. larvae predominate, or very high densities of late instar larvae are present, or under conditions where local experience indicates the need for higher rates to achieve extended residual control.	Avoid spray drift. Do not apply directly to finished drinking water reservoirs or drinking water receptacles when water is intended for human consumption.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
Monomolecular film[3]	AGNIQUE MMF MOSQUITO LARVICIDE & PUPICIDE	53263-28	100	--	0.2 – 1.0 gallons/acre for fresh and brackish water; 0.35 – 1.0 gallons/acre for polluted waters. The lower rate is recommended when only pupae control id desired and in sites with no emergent vegetation and low organic content. Use higher rates when emergent or surface vegetation is present. The more vegetation or the drier the vegetation, the higher the required rate.	This product may be applied by both ground and aerial applications. No dilution is required and a fan spray is recommended. Do not pour or inject a stream spray directly into water. The high end of the dosage rate is recommended when treating habitats where multi-directional winds of 10 mph or greater are expected to persist. If persistent unidirectional winds of 10 mph or greater are expected, the displacement of the surface film may result in poor control.
	AGNIQUE MMF G	53263-30	32	--	7.0-21.5 lbs formulation/acre. The lower rate is recommended when only pupae control is desired and in sites with no emergent vegetation and low organic content. Use higher rates when emergent or surface vegetation is present. The more vegetation or the drier the vegetation, the higher the required rate.	For large areas with dense vegetation, it is recommended that the application is made in several locations.
Petroleum Distillates[4]	BVA 2 MOSQUITO LARVICIDE OIL	70589- 1	97	--	3-5 gallons/acre depending on dense vegetation and weeds	This product is toxic to fish and other aquatic organisms. Do not apply directly to water (except when applied for mosquito larvae control; then only in shallow areas around the border.) Consult your State Fish and Game Agency before applying this product.
	BVA SPRAY 13	55206- 2	100	--	None indicated	This product is toxic to fish. This product is intended for formulation into end-use products for spray use, mosquito larvae control, and for use a diluent in mosquito adulticides.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	MOSQUITO LARVICIDE GB-1111	8329- 72	98.7	--	3 gal/acre or less. Under special circumstances, such as extremely dense vegetation or water of high organic content, rates to a maximum of 5 gal/acre may be used.	Use particular care to avoid damage when spraying over areas containing fish or wildlife. This product is toxic to fish and other aquatic organisms. Do not apply directly to water (except when applied for mosquito larvae control; then only around the borders of these areas and in shallow water).
(S)-Methoprene	ZOECON ALTOSID PELLETS	2724-448	4.25	--	2.5-5 lbs formulation/acre (marshes, pools, ponds, treeholes, ect.) or 5-10 lbs/acre (waste treatment and settling ponds, ditches, storm drains, catch basins, ect.) Use lower application rates when water is shallow, vegetation and/or pollution are minimal, and insect populations are low. Use higher rates when water is deep (>2 ft), vegetation, pollution, and/or organic debris or water flow are high, and insect populations are high.	Apply ALTOSID Pellets up to 15 days prior to flooding, or at any stage of larval development after flooding or in permanent water sites. Fixed wing aircraft or helicopters equipped with granular spreaders may be used. The pellets may also be applied using ground equipment which will achieve good, even coverage. Continue treatment through the last brood of the season.
	ZOECON ALTOSID WSP	2724-448	4.25	--	One pouch per catch basin. For other mosquito breeding sites, one pouch will treat single containers or treatment sites of up to 135 sq ft of surface area.	Continue treatment through the last brood of the season.
	ZOECON ALTOSID BRIQUETS	2724-375	8.62	--	one ALTOSID® Briquet per 100 sq ft in non-(or low-) flow, shallow depressions (up to two ft in depth). Use one additional ALTOSID® Briquet per two feet of water depth in areas deeper than two feet.	Apply ALTOSID® Briquets at the beginning of the mosquito season. Continue treatment through the last brood of the season. Water flow may increase the dissolution of the briquet thus reducing the residual life of the briquet. Inspect areas of water flow to determine appropriate retreatment intervals. If briquets become covered by obstructions such as debris, vegetation, and loose sediment as a result of high rainfall or flow, normal dispersion of the active ingredient can be inhibited.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	ZOECON ALTOSID LIQUID LARVICIDE MOSQUITO GROWTH REGULATOR	2724-392	5	--	3 to 4 fl oz per acre. Formulation contains 0.43 lb/gal (51 .3 g/liter) active ingredient.	For aerial applications, use sufficient water to give complete coverage. Do not apply when weather conditions favor drift from areas treated. For ground application, mix in appropriate volume of water.
	ZOECON ALTOSID XR ENTENDED RESIDUAL BRIQUETS	2724-421	2.1	--	*Aedes, Ochlerotatus,* and *Psorophora* spp.: One briquet per 200 sq ft in in non-(or low-) flow, shallow depressions (< 2 feet in depth). Culex, *Culiseta* and *Anopheles* spp.: Place 1 briquet per 100 sq ft. For storm water drainage areas, place 1 briquet per 100 sq ft of surface area up to 2 ft deep. In areas that are deeper than 2 ft, use 1 additional briquet per 2 ft of water depth.	Place in lowest area of the mosquito breeding sites. Placement of ALTOSID® XR Briquets should be at or before the beginning of the mosquito season and can be applied prior to flooding when sites are dry or on snow and ice in breeding season sites prior to spring thaw.
	ZOECON ALTOSID LIQUID LARVICIDE CONCENTRATE	2724-446	20	--	3/4 to 1 fl oz per acre (55 to 73 ml/hectare). Formulation contains 1.72 lb/gal (205.2 g/l) active ingredient.	For aerial applications, use sufficient water to give complete coverage. Do not apply when weather conditions favor drift from areas treated. For ground application, mix in appropriate volume of water.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	ZOECON ALTOSID XR-G	2724-451	1.5	--	*Aedes, Anopheles,* and *Psorophora* spp.: Apply ALTOSID XR-G® at 5 - 10 lb/acre. *Culex, Culiseta, Coquillettidia,* and *Mansonia* spp.: Apply ALTOSID XR-G® at 10-20 lb/acre. Within these ranges, use lower rates when water is shallow [< 2 feet (60 cm)] and vegetation and/or pollution are minimal. Use higher rates when water is deep [> 2 feet (60 cm)] and vegetation and/or pollution are heavy.	Applications should be continued throughout the entire season to maintain adequate control.
	ZOECON ALTOSID SBG SINGLE BROOD GRANULE	2724-489	0.2	--	*Aedes, Anopheles,* and *Psorophora* spp.: Apply at 5-10 lb/acre. *Culex, Culiseta*: Apply at 10-20 lb/acre. Within these ranges, use lower rates when water is shallow [< 2 feet (60 cm)] and vegetation and/or pollution are minimal. Use higher rates when water is deep [> 2 feet (60 cm)] and vegetation and/or pollution are heavy.	ALTOSID® SBG is designed for single brood mosquito larvae and applications should be made within 3 to 5 days of expected pupation. Rotary and fixed-wing aircraft equipped with granular spreaders may be used. Ground equipment, which will achieve even coverage, may also be used. Apply uniformly and repeat application as necessary. Applications should be continued throughout the entire season to maintain adequate control.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
Temephos	ABATE 2-BG	8329- 71	2	--	2.5-5 lbs/acre (0.05-0.1 lbs a.i./acre) for non-potable water (stagnant, saline and temporary water bodies), moist areas, woodland pools; 10 lbs/acre (0.2 lbs a.i./acre) for swamps, marshes, tidal waters, intertidal zones; 25 lbs/acre (0.5 lbs a.i./acre) for highly polluted water, waters high in organic content, areas demonstrated to have resistant mosquitoes, habitats having deep water or dense surface cover, or where monitoring has confirmed a lack of control at recommended application rates.	This product is toxic to aquatic organisms such as stoneflies, water fleas, and shrimp. Non-target aquatic organisms in waters treated with this product may be killed. Some populations reestablish rapidly, but diversity may be affected. Avoid use of maximum application rate in ecologically sensitive areas. This product may be applied only by public vector control agencies. This product may not be reapplied within 7 days of the date of the initial application unless monitoring indicates that larval populations have reestablished, or weather conditions have rendered initial treatments ineffective. Apply with conventional air or ground equipment. Do not allow this product to drift. Do not apply with a belly grinder.
	5% SKEETER ABATE	8329-70	5	--	2 lbs/acre (0.1 lbs a.i./acre) for non-potable water (stagnant, saline and temporary water bodies), moist areas, woodland pools; 4 lbs/acre (0.2 lbs a.i./acre) for swamps, marshes, tidal waters, intertidal zones; 10 lbs/acre (0.5 lbs a.i./acre) for highly polluted water, waters high in organic content, areas demonstrated to have resistant mosquitoes, habitats having deep water or dense surface cover, or where monitoring has confirmed a lack of control at recommended application rates.	This product is toxic to aquatic organisms such as stoneflies, water fleas, and shrimp. Non-target aquatic organisms in waters treated with this product may be killed. Some populations reestablish rapidly, but diversity may be affected. Avoid use of maximum application rate in ecologically sensitive areas. This product may be applied only by public vector control agencies that have entered into and operate under a cooperative agreement with the California Department of Health Services pursuant to Section 2426 of the Health and Safety Code. This product may not be reapplied within 7 days of the date of the initial application unless monitoring indicates that larval populations have reestablished, or weather conditions have rendered initial treatments ineffective. Do not allow this product to drift. Do not apply with a belly grinder.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	ABATE 4-E INSECTICIDE	8329- 69	44.6	--	0.5 - 1.0 fl oz/acre (0.015 - 0.031 lbs a.i./acre) for non-potable water (stagnant, saline and temporary water bodies), highly polluted water, moist areas, woodland pools, swamps, marshes, tidal waters, intertidal zones; 1.5 fl oz/acre (0.0469 lbs a.i./acre) for waters high in organic content, areas demonstrated to have resistant mosquitoes, habitats having deep water or dense surface cover, or where monitoring has confirmed a lack of control at recommended application rates. (Contains 4 lbs. of Temephos per gallon.)	Avoid use of maximum application rate in ecologically sensitive areas. This product may be applied only by public vector control agencies. This product may not be reapplied within 7 days of the date of the initial application unless monitoring indicates that larval populations have reestablished, or weather conditions have rendered initial treatments ineffective. Apply with a uniform spray in sufficient water for good coverage. Do not allow this product to drift. Do not apply with a belly grinder. The following drift management requirements must be followed to avoid off-target drift movement from aerial applications. 1.) The distance of the outermost nozzles on the boom must not exceed ¾ the length of the wingspan or rotor. 2.) Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.
Spinosad (a mixture of spinosyn A and spinosyn D)	NATULAR G	8329-80	0.5	--	3.5 - 6.5 lb/acre (0.018 - 0.033 lb ai/acre) for temporary standing water, other freshwater sites, and dormant rice fields; 9 lb/acre (0.045lb ai/acre) for freshwater swamps and marshes and marine/costal areas; 6.5 - 9 lb/acre (0.033 - 0.045 lb ai/acre) for stormwater drainage systems and wastewater; and up to 20 lb/acre in waters high in organic content, deep-water mosquito habitats or those with dense surface cover, and where monitoring indicates a lack of kill at typical rates.	This product is toxic to aquatic invertebrates. Non-target aquatic invertebrates may be killed in water where this pesticide is used. Do not apply when weather conditions favor drift from treated areas. Drift from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not re-apply within 7 days of the initial application unless monitoring indicates that larval populations have reestablished or weather conditions have rendered initial treatments ineffective. Do not apply to water intended for irrigation.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	NATULAR 2EC	8329-82	20.6	--	1.1 - 2 fl oz/acre (0.018 - 0.033 lb ai/acre) for temporary standing water and other freshwater sites; 2.8 fl oz (0.045lb ai/acre) for freshwater swamps and marshes and marine/costal areas; 2 - 2.8 fl oz (0.033 - 0.045 lb ai/acre) for stormwater drainage systems and wastewater; and up to 6.4 fl oz/acre in waters high in organic content, deep-water mosquito habitats or those with dense surface cover, and where monitoring indicates a lack of kill at typical rates.	This product is toxic to aquatic invertebrates. Non-target aquatic invertebrates may be killed in water where this pesticide is used. Do not apply when weather conditions favor drift from treated areas. Do not re-apply within 7 days of the initial application unless monitoring indicates that larval populations have reestablished or weather conditions have rendered initial treatments ineffective. Do not apply to water intended for irrigation. NATULAR 2EC should be diluted with water. The following spray drift management requirements must be followed to avoid off-target drift movement from applications. 1.The boom width must not exceed 75% of the wingspan or 90% of the rotor blade. 2.Nozzles must always point backward, parallel with the air stream, and never be pointed downward more than 45 degrees. 3.Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind. 4.Do not apply when wind speed favors drift beyond the treatment area.
	NATULAR XRG	8329-83	2.5	--	5 to 20 lb per acre (5 to 20 g/100 sq ft of water surface). Within this range, use lower rates when water is shallow, vegetation and/or pollution are minimal, and mosquito populations are low. Use higher rates when water is deep, vegetation and/or pollution are high, and mosquito populations are high.	This product is toxic to aquatic invertebrates. Non-target aquatic invertebrates may be killed in water where this pesticide is used. Apply prior to flooding as a prehatch application to areas that breed mosquitoes, or at any stage of larval development after flooding. Do not apply to water intended for irrigation. Do not allow this product to drift onto neighboring crops or non-crop areas. Fixed wing aircraft or helicopters equipped with granular spreaders or conventional ground application equipment can be utilized. Reapply after 30 days.
	NATULAR T30	8329-84	8.33	--	1 tablet per 100 sq ft in non- or low-flow, shallow depressions (up to 2 feet in depth). 6 g/tablet	This product is toxic to aquatic invertebrates. Non-target aquatic invertebrates may be killed in water where this pesticide is used. Natular T30 can be applied prior to flooding, on snow and ice in breeding sites prior to spring thaw, or at anytime after flooding in listed sites. Continue treating through the last brood of the season.

Table 2-4. Label Requirements and Label Application Rates by Formulation

Active Ingredient	Formulation Trade Name	EPA Reg. No.	% AI	% AI (2nd)	Label Application Rates for Mosquito Control	Label Requirements Relevant to Mosquito Control/Surface Water
	NATULAR XRT	8329-85	6.25	--	1 tablet per 100 sq ft in non- or low-flow, shallow depressions (up to 2 feet in depth). 40 g/tablet	This product is toxic to aquatic invertebrates. Non-target aquatic invertebrates may be killed in water where this pesticide is used. Natular XRT tablets can be applied prior to flooding, on snow and ice in breeding sites prior to spring thaw, or at any time after flooding in listed sites. Do not apply to water intended for irrigation.

There are several advantages of using ground application equipment, both when on foot and when conveyed by vehicles. Ground larvicide application allows applications while in proximity to the actual treatment area, and consequently treatments to only those microhabitats where larvae are actually present. This also reduces both the unnecessary pesticide load on the environment and the financial cost of the amount of material used, as well as its application. Both the initial and maintenance costs of ground equipment are generally less than those for aerial equipment. Ground larvicide applications are less affected by weather conditions than are aerial applications.

Ground larvicide application is impractical for large or densely wooded areas. There is also a greater risk of chemical exposure to applicators than there is during aerial larvicide operations. Damage may occur from the use of a ground vehicle in some areas. Ruts and vegetation damage may occur, although both conditions are reversible and generally short-lived. Technicians are trained to recognize sensitive areas and to use good judgment to avoid significant impacts.

Aerial Application Equipment. When several large areas are simultaneously producing mosquito larvae at densities exceeding treatment thresholds, then helicopters or other aircraft may be used to apply any of the larvicides discussed above. Many agencies contract with independent flying services to perform aerial applications, with guidance to the target site provided by MVCAC agency staff. A few agencies make applications with their own aircraft. The number and extent of serial application of larvicides differs among agencies, from only a few times each year, covering a few hundred acres, to more frequent or extensive operations in districts in the central valley.

There are three advantages to using fixed- or rotary-wing (helicopter) aerial larvicide application equipment compared to ground application. First, it can be more economical for large target areas with extensive mosquito production. Second, by covering large areas quickly, it can free staff to conduct other needed surveillance or control. Third, it can be more practical for remote or inaccessible areas, such as islands and large marshes, than ground larvicide application. However, maintaining aircraft or contracting for aerial applications is expensive; and, in addition to the timing constraints inherent in most larvicide use, the potential application window can be very narrow for aerial activities due to weather conditions.

2.2.2 Larvicide Active Ingredients Used in California

Eight active ingredients are registered for use as mosquito larvicides in California: *Bacillus thuringiensis israelensis (Bti)*; *Bacillus sphaericus* (*B. sphaericus*); alpha-isooctadecyl-omega-hydroxypoly(oxyethylene); petroleum distillates; spinosad, diflubenzuron, methoprene, and temephos. For these active ingredients, multiple formulations are available for use in mosquito control. Table 2-5 gives a list of the products used for control of mosquito larvae by MVCAC member agencies.

Microbial larvicides are bacteria that are registered as pesticides for control of mosquito larvae in outdoor areas such as irrigation ditches, flood water, standing ponds, woodland pools, pastures, tidal water, fresh- or saltwater marshes, and stormwater retention areas (U.S. EPA 2007a). The

Table 2-5. Reported Pesticide Use of Larvicides for Public Health Pest Control by Formulation

Active Ingredient	Formulations	EPA Reg. No.	2008	
			Active Ingredient (pounds)	Percentage Use by Formulation
Bacillus Sphaericus (Bs)[1]	VECTOLEX CG BIOLOGICAL LARVICIDE	73049- 20	8525	41.3%
	VECTOLEX WDG BIOLOGICAL LARVICIDE	73049- 57	3107	15.1%
	VECTOLEX WSP BIOLOGICAL LARVICIDE	73049- 20	309	1.5%
	VECTOLEX CG BIOLOGICAL LARVICIDE	275- 77	1452	7.0%
	VECTOLEX WDG BIOLOGICAL LARVICIDE	275- 135	7130	34.6%
	VECTOMAX CG BIOLOGICAL LARVICIDE	10324- 99	93	0.5%
	VECTOMAX G BIOLOGICAL LARVICIDE/GRANULES	71532- 22- 55146	6	0.03%
	VECTOMAX WSP BIOLOGICAL LARVICIDE	1839- 190- 56952	9	0.04%
Bacillus Thuringiensis, Subsp. *Israelensis* (Bti)[2]	VECTOBAC TECHNICAL POWDER	73049- 13	6523	10.8%
	VECTOBAC 12AS BIOLOGICAL LARVICIDE	73049- 38	37337	62.1%
	AQUABAC 200G	62637- 3	412	0.7%
	TEKNAR HP-D	73049- 404	80	0.1%
	VECTOBAC G BIOLOGICAL LARVICIDE GRANULES	73049- 10	14108	23.4%
	BMP 144 (200G) MOSQUITO BIOLARVICIDE GRANULE	62637- 3	105	0.2%
	SUMMIT BTI BRIQUETS	6218- 47	15	0.03%
	TEKNAR HP-D LARVICIDE	2724- 365- 64833	9	0.02%
	TEKNAR HP-D LARVICIDE	70051- 51	310	0.5%
	VECTOBAC 12AS AQUEOUS SUSPENSION BIOLOGICAL LARVICIDE	275- 102	133	0.2%
	VECTOBAC TECHNICAL POWDER	275- 54	61	0.1%
	VECTOBAC WDG BIOLOGICAL LARVICIDE	73049- 56	212	0.4%
	VECTOBAC-12 AS	275- 66	612	1.0%
	VECTOBAC-G BIOLOGICAL MOSQUITO LARVICIDE GRANULES	275- 50	54	0.1%
	VECTOMAX CG BIOLOGICAL LARVICIDE	10324- 99	156	0.3%
	VECTOMAX G BIOLOGICAL LARVICIDE/GRANULES	71532- 22- 55146	9	0.02%
	VECTOMAX WSP BIOLOGICAL LARVICIDE	1839- 190- 56952	15	0.02%
	ZOECON TEKNAR HP-D	2724- 365- 50809	13	0.02%
	ZOECON TEKNAR HP-D LARVICIDE	2724- 365- 64833	5	0.01%
Monomolecular film[3]	AGNIQUE MMF MOSQUITO LARVICIDE & PUPICIDE	53263- 28	11652	91.3%
	AGNIQUE MMF G	53263- 30	666	5.2%
	AGNIQUE MMF MOSQUITO LARVICIDE AND PUPICIDE	2302- 14	363	2.8%
	AROSURF MSF	42943- 8	80	0.6%
Petroleum Distillates[4]	BVA 2 MOSQUITO LARVICIDE OIL	70589- 1	26707	2.0%
	BVA SPRAY 13	55206- 2	--	--
	MOSQUITO LARVICIDE GB-1111	8329- 72	1335326	90.8%
	MOSQUITO LARVICIDE GB-1111	8898- 16	99801	6.8%
	MOSQUITO LARVICIDE GB-1111	71236- 1	7283	0.5%
	MOSQUITO LARVICIDE GB-1356	8898- 16	164	0.0%
	PYRETHRINS/PIPERONYL BUTOXIDE CONCENTRATE 5%-25%	432- 612	17	0.0%
Diflubenzuron	DIMILIN 25W COTTON	37100- 8- 400	0.97	3.5%
	DIMILIN 25W INSECT GROWTH REGULATOR	400- 465	26.34	96.3%
	DIMILIN 25W INSECT GROWTH REGULATOR	37100- 8- 400	0.05	0.2%
Methoprene[5]	ZOECON ALTOSID PELLETS	2724- 448	717	12.4%
	ZOECON ALTOSID PELLETS WSP	2724- 448	195	3.4%
	ZOECON ALTOSID BRIQUETS	2724- 375	47	0.8%
	ZOECON ALTOSID LIQUID LARVICIDE MOSQUITO GROWTH REGULATOR	2724- 392	52	0.9%
	ZOECON ALTOSID XR EXTENDED RESIDUAL BRIQUETS	2724- 421	77	1.3%
	ZOECON ALTOSID LIQUID LARVICIDE CONCENTRATE	2724- 446	1178	20.4%
	ZOECON ALTOSID XR-G	2724- 451	555	9.6%
	ZOECON ALTOSID SBG SINGLE BROOD GRANULE	2724- 489	23	0.4%
	ALTOSID PELLETS	2724- 448- 64833	174	3.0%
	AQUAPRENE BRIQUETS	75318- 9	15	0.3%
	AQUAPRENE TOSSITS	75318- 10	2	0.0%
	AQUAPRENE XL GRANULES	75318- 7	4	0.1%
	EXTINGUISH PLUS	2724- 496	55	0.9%
	RF-9805	2724- 489	50	0.9%
	ZOECON 9010 GR	2724- 451	179	3.1%
	ZOECON ALTOSID PRO-G INSECT GROWTH REGULATOR	2724- 451	1	0.0%
	ALTOSID BRIQUETS	2724- 375	119	2.1%
	ALTOSID LIQUID LARVICIDE	2724- 392	263	4.6%
	ZOECON ALTOSID PELLETS	2724- 448- 50809	6	0.1%
	ZOECON ALTOSID PELLETS	2724- 448- 64833	585	10.1%
	ALTOSID XR EXTENDED RESIDUAL BRIQUETS	2724- 421- 50809	46	0.8%
	ALTOSID XR EXTENDED RESIDUAL BRIQUETS	2724- 421- 64833	2	0.0%
	ZOECON ALTOSID BRIQUETS	2724- 375- 64833	31	0.5%
	ZOECON ALTOSID LIQUID LARVICIDE CONCENTRATE	2724- 446- 64833	70	1.2%
	ZOECON ALTOSID LIQUID LARVICIDE MOSQUITO GROWTH REGULATOR	2724- 392- 64833	82	1.4%
	ZOECON ALTOSID XR ENTENDED RESIDUAL BRIQUETS	2724- 421- 64833	192	3.3%
	ZOECON RF-292 BRIQUET	2724- 421	79	1.4%
	ZOECON RF-330 ALTOSID PELLETS	2724- 448	894	15.5%
	ZOECON RF-437 MOSQUITO GROWTH REGULATOR SR-20	2724- 446	87	1.5%
Temephos	ABATE 2-BG	8329- 71	601	87.9%
	5% SKEETER ABATE	8329- 70	77	11.3%
	ABATE 4-E INSECTICIDE	8329- 69	5	0.8%

Source: DPR PUR Database

Notes:

[1] Bacillus Sphaericus, Serotype H-5A5B, Strain 2362

[2] Reported as Bacillus Thuringiensis (Berliner); Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14; or Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14

[3] Alpha-Isooctadecyl-Omega-Hydroxypoly(Oxyethylene)

[4] Reported as either Petroleum Distillates or Refined Petroleum Distillates

[5] Reported as either Methoprene or S-Methoprene

Formulations in red are included in the NPDES permit material list.

microbial larvicides concentrates registered for use in California contain *Bacillus sphaericus* (*B. sphaericus*) and *Bti*. These concentrates include fermentation solids, bacterial spores, and insecticidal toxins. Their mode of action requires that they be ingested to be effective.which means they cannot be used to control mosquitoes at some life stages (late 4th instar larvae and pupae). .

Bti concentrates are made up of the dormant spore form of the bacterium and an associated pure toxin. The toxin disrupts the gut in mosquito larvae by binding to receptor cells (U.S. EPA 2007a). *Bti*. organisms produce five different microscopic protein pro-toxins packaged inside one larger protein container or crystal. The crystal is commonly referred to as delta (d-) endotoxin. This toxin consist of five proteins that are released only under extremely alkaline conditions. Mosquitoes are unique in having very alkaline conditions within the midgut (the stomach of vertebrates contains acid). When a mosquito larva ingests the d-endotoxin, the five proteins are released in the alkaline environment of the insect larval gut. The five proteins are converted into five different toxins by specific enzymes present in the gut of mosquito larvae. Once converted, these toxins destroy the gut wall, which leads to paralysis and death of the larvae. *Bti* is toxic to larval stages of all genera of mosquitoes, and to black flies (Simuliidae). Black flies are vicious biters that feed on the blood of humans and other mammals. They are a vector of river blindness (*Onchocerca volvulus*) in Africa and a serious pest inflicting painful bites in other parts of theworld. The dependence on alkaline conditions and the presence of specific enzymes gives this material a high degree of specificity for mosquitoes and black flies. Bti is also used for control of chironimids, but much higher levels are needed for effective control.

Bti concentrates account for 3.4 percent by mass of the material applied (Figure 2-2), and 65.6 percent by acreage covered (Figure 2-3) for larvicide applications by California vector control districts in 2008.

B. sphaericus spores contain a protein that damages and paralyzes the gut of mosquito larvae that ingest the spores, thus starving the larvae (U.S. EPA 1999). *Culex* species are the most sensitive to *Bacillus sphaericus*, followed by *Anopheles* and some *Aedes* species. In California, *Culex* spp. and *Anopheles* spp. may be effectively controlled. Several species of *Aedes* have shown little or no susceptibility, and salt marsh *Aedes* species are not susceptible. *B. sphaericus* differs from *Bti* in being able to control mosquito larvae in highly organic aquatic environments, including sewage waste lagoons, animal waste ponds, and septic ditches.

B.sphaericus concentrates accounts for 1.3 percent by mass of the material applied for larval mosquito control in California by vector control districts (Figure 2-2), and 9.3 percent of the acreage covered by larvicide applications in 2008 (Figure 2-3: note that acreage is counted repeatedly for multiple applications made at the same locations).

Spinosad was first registered for use in California in 1996 for use as an agricultural insecticide, and more recently, registration has been approved for the use of mosquito control in California in areas such as dormant rice fields, wastewater, and temporary standing water (DPR 2010a). Spinosad is a biologically derived insecticide produced from the fermentation of *Saccharopoly spora spinosa*, a naturally occurring soil organism. Spinosad is a mixture of spinosyn A and spinosyn D; commercial formulations contain a spinosyn A to spinosyn D ratio of approximately

85:15. Spinosad activates the central nervous system of insects through interaction with neuro-receptors and causes continuous stimulation of the insect nervous system (Kollman 2002, Clarke Mosquito Control 2009). The U.S. EPA has classified spinosad as a "reduced risk" compound because it is an alternative to more toxic, organophosphate insecticides (DPR 2002).

Water surface film larvicides spread across water surfaces and disrupt larval respiration, killing mosquitoes and some other classes of air-breathing aquatic insects. These are the only currently registered larvicides used by member agencies that are effective against mosquito pupae. Therefore, when timely larval control is not possible or not successful, pupal control can usually be achieved using these products. This reduces the need for applications of adulticides.

There are two types of water surface films available for control of immature mosquitoes in California: monomolecular films, and petroleum distillates. Monomolecular films are low-toxicity pesticides that spread a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae, and emerging adults to attach to the water's surface, and cause them to drown (U.S. EPA 2007a). The monomolecular film used in California for the control of mosquito larvae is alpha-isooctadecyl-omega-hydroxypoly(oxyethylene) This chemical accounts for a relatively small portion of the mosquito larvicide use both by mass and by acreage in 2008 (0.8 and 0.6 percent, respectively; Figures 2-2 and 2-3).

Specially-derived petroleum distillates are mineral oils that are used to form a coating on top of water to drown larvae, pupae, and emerging adult mosquitoes. Petroleum distillates have been used for many years nationwide to kill aphids on crops and orchard trees, and to control mosquitoes (U.S. EPA 2007a). Petroleum distillates account for 13.9 percent of the acreage treated for immature mosquitoes. These products are heavier than other control materials and therefore account for a larger proportion of the total (94.1 percent) mass of materials applied. (Figures 2-2 and 2-3).

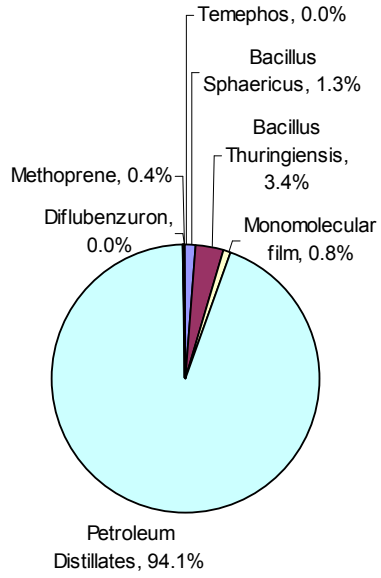
Methoprene and diflubenzuron are insect growth-regulating compounds that are added to water to disrupt the normal maturation process of mosquito larvae. Methoprene products used in mosquito control are applied as briquets, pellets, sand granules, and liquids. The liquid and pelletized formulations can be applied by helicopter and fixed-wing aircraft or ground-based equipment (U.S. EPA 2007a). Methoprene is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for 4 months or longer if a site has limited accessibility and has regularly produced immature mosquitoes in the past.

Diflubenzuron is a restricted-use pesticide because it is potentially toxic to aquatic invertebrates (the sale and use of this compound is restricted to certified pesticide applicators or person under their supervision) (U.S. EPA 1997). Methoprene was used as a larvicide more extensively than diflubenzuron (9.1 percent by acreage in contrast to 0.4 percent in 2008 (Figure 2-3). This is because methoprene has a much lower toxicity for nontarget invertebrates. Diflubenzuron is not proposed for future use under the new permit.

Temephos is an organophosphate pesticide registered by the U.S. EPA to control mosquito larvae, and it is the only organophosphate with larvicidal use. Although temephos is labeled for use in areas of standing water, shallow ponds, swamps, marshes, and intertidal zones (U.S. EPA 2007a), MVCAC member agencies primarily apply temephos to manmade sources such as tire

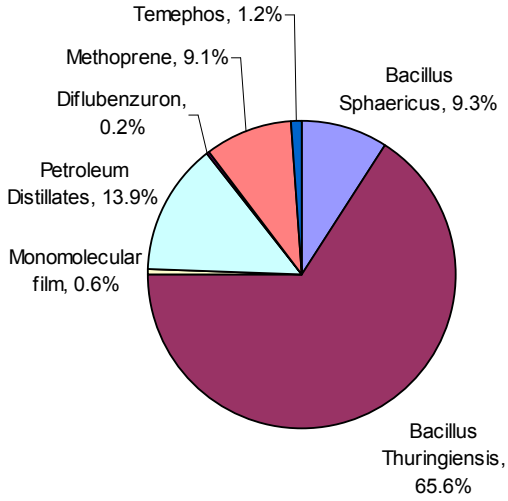
piles, utility vaults, and cemetery urns. Mosquito control products containing temephos are not labeled for application to agricultural lands or pasture and are not used in such sites. Temephos is also used to help prevent mosquitoes from developing resistance to the bacterial larvicides. Temephos provides effective control of mosquito larvae in highly polluted water (containing high levels of decaying organic matter, such as rotting leaves or manure) (Clarke Mosquito Control, n.d.). Temephos is applied in either liquid or granular form and, is applied by backpack sprayers (U.S. EPA 2007a). Temephos accounts for a small percentage of larvicide use by both mass and acreage in 2008 (0.04 and 1.2 percent, respectively; Figures 2-2 and 2-3), and only 11 of the 62 MVCAC member districts applied temephos in 2008. Individual applications averaged less than 10 acres each.

Figure 2-2. Reported Use for Public Health Pest Control for Larvicide, 2008 Statewide



Note: Based on pounds of active ingredient.

Figure 2-3. Acreage Treated for Public Health Pest Control for Larvicides, 2008 Statewide



Notes: Acreage estimated based on at maximum label application rate.
Acreage is counted each time repeated applications are made at the same site.

2.2.3 Larvicide Application Locations and Frequency

Mosquito larvicides may be applied in a variety of locations, including irrigation ditches, roadside ditches, flood water, standing pools, woodland pools, snowmelt pools, pastures, stock ponds, duck ponds, catch basins, stormwater retention areas, tidal water, creeks, marshes, and rice fields. Locations may be urban, suburban, agricultural, recreational, or wildlife refuge areas, and application sites may vary in size from a fraction of an acre to several thousand acres. In some cases, treatment may be limited to the edge of water bodies or tidal marshes; in other cases treatment would occur over entire water bodies. Treatment frequency for larvicides can be weekly (for hot weather and liquid formulations that have little or no residual) to once every 3 months (for moderately small sites that are hard to reach like a heavily vegetated marsh treated with pellets or granules). Types of locations, frequency, and size of application sites vary by region.

This section provides a description of typical larvicide applications by region. It should be noted that typical applications made in the past may not be representative of those made in the future, and that patterns may change based on factors such as climate, disease surveillance, resistance, and cost-effectiveness. Information in this section is based on the DPR pesticide use data by county for 2008 (the most recent currently available year). West Nile virus activity and the availability of emergency control funds may also be factors in the amounts used from year to year. As shown in Table 2-5, many different formulations are used for each active ingredient.

Coastal Region

MVCAC agencies within the Coastal Region are shown in Figure 2-1. Larvicides used in this region in 2008 include *B. sphaericus, Bti,* monomolecular film, petroleum distillates, and methoprene, according to the California Department of Pesticide Regulation, Pesticide Use Report data (Table 2-6). Temephos was generally not applied. *B. sphaericus* was applied in relatively large quantities, while films and oils were applied in relative low quantities. Overall larvicide use, by mass, was less in the Coastal Region in comparison to other regions.

Sacramento Valley Region

MVCAC agencies within the Sacramento Valley Region are shown in Figure 2-1. Larvicides used in this region include *B. sphaericus, Bti,* monomolecular film, petroleum distillates, methoprene, and temephos (Table 2-6). Diflubenzuron was generally not applied. Most of the temephos used by MVCAC agencies was applied in the Sacramento Valley Region. *Bti* and methoprene were also used in larger-than-average quantities.

Northern San Joaquin Valley

MVCAC agencies within the Northern San Joaquin Valley Region are shown in Figure 2-1. Larvicides used in this region in 2008 include *B. sphaericus, Bti,* monomolecular film, petroleum distillates, methoprene, and temephos (Table 2-6). Diflubenzuron was applied in trace quantities. Monomolecular film was applied relatively rarely, while petroleum oils were applied in larger quantities.

Table 2-6. Regional Use of Larvicides for Public Health Pest Control

Year	Active Ingredient	Sacramento Valley[1]		Coastal[2]		North San Joaquin Valley[3]		South San Joaquin Valley[4]		Southern California[5]	
		lbs of ai	% for Region	lbs of ai	% for Region	lbs of ai	% for Region	lbs of ai	% for Region	lbs of ai	% for Region
2008	*Bacillus Sphaericus*	2,428	11.8 %	6,372	30.9%	4,127	20.0%	1,268	6.1%	6,405	31.0%
	Bacillus Thuringiensis, Subsp. Israelensis[6]	22,475	37.4 %	2,146	3.6%	15,619	26.0%	15,698	26.1%	4,220	7.0%
	Monomolecular film	1,257	9.9%	245	1.9%	108	0.8%	5,893	46.2%	5,211	40.8%
	Petroleum Distillates	47,299	3.2%	108,523	7.4%	452,739	30.8%	800,878	54.4%	62,307	4.2%
	Diflubenzuron	1	3.7%	--	--	9	31.2%	8	29.7%	10	35.4%
	Methoprene	2,009	34.8 %	1,053	18.2%	1,341	23.2%	577	10.0%	794	13.7%
	Temephos	625	91.5 %	0.05	0.0%	34	5.0%	19	2.8%	5	0.7%

Source: DPR PUR Database

Notes:

[1]Counties of Shasta, Tehama, Butte, Lake, Glenn, Colusa, Sutter, Yuba, Placer, El Dorado, Yolo, Sacramento, and Nevada
[2]Counties of Sonoma, Marin, Napa, Solano, Contra Costa, Alameda, San Mateo, Santa Clara, Santa Cruz, Monterey, and San Benito

[3]Counties of San Joaquin, Stanislaus, Merced, and Calaveras

[4]Counties of Madera, Fresno, Kings, Tulare, Kern, and San Luis Obispo

[5]Counties of Mono, Inyo, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, Riverside, and San Diego
[6] Reported as Bacillus Thuringiensis (Berliner); Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14; or Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14

ai = active ingredient
lbs = pounds
% = percent

Southern San Joaquin Valley

MVCAC agencies within the Southern San Joaquin Valley Region are shown in Table 2-3. Larvicides used in this region in 2008 include *B. sphaericus, Bti,* monomolecular film, petroleum distillates, methoprene, and temephos (Table 2-6). Diflubenzuron was applied in trace quantities. Petroleum distillates and monomolecular films were applied in much larger quantities relative to other regions.

Southern California

MVCAC agencies within the Southern California Region are shown in Table 2-3. Larvicides used in this region in 2008 include *B. sphaericus, Bti,* monomolecular film, petroleum distillates, diflubenzuron, and methoprene (Table 2-6). Temephos was also applied in trace quantities. Monomolecular films were applied in larger-than-average quantities.

2.2.4 Methods to Control Adverse Effects to Surface Water

- BMPs are practices employed to control potential adverse effects to surface waters. Generally, the BMPs used are determined by the label requirements, although additional measures may be used.

For spinosad formulations, the following practices are recommended to minimize the potential for resistance development in insects:

  - Base insecticide use on comprehensive IPM programs.

- Do not use less than the labeled rates.
- Routinely evaluate applications for loss of effectiveness.
- Rotate with other labeled effective mosquito larvicides that have a different mode of action.
- Use insecticides with a different mode of action (different insecticide group) on adult mosquitoes so that both larvae and adults are not exposed to products with the same mode of action.
- In dormant rice fields, standing water within agricultural/crop sites, and permanent marine and freshwater sites, do not apply more than a maximum label application frequency.

Additional requirements specified by formulation on product labels are shown in Table 2-4.

2.2.5 Other Uses of the Active Ingredients in Mosquito Larvicides

Many pesticides used as larvicides can be used for other purposes in California, which is important to consider when developing a monitoring program. When an active ingredient is detected in the water, it may be difficult to determine whether it came from a mosquito control application, an unrelated application, or from multiple sources. Temephos is the only mosquito larvicide that was used in California during 2008 solely for public health purposes.

Residential pesticide sources are especially difficult to determine, because their use is not reported to or quantified by DPR. DPR estimates that approximately two-thirds of pesticide use

in California is unreported. Note that total reported use does not include use by homeowners, which may comprise the majority of the use for certain pesticides, especially in urban and suburban areas (Moran 2005).

Table 2-7 shows the proportion of each active ingredient that is used for vector control, as a percentage of total reported use in California during 2007 and 2008. Although vector control uses may include uses other than mosquito larvicide, it is assumed that the vast majority of public health use of the formulations shown in Table 2-5 is to control mosquito larvae.

B. sphaericus was first registered by the U.S. EPA in 1991 for use against mosquito larvae. *B. sphaericus* is used on rice, fruit trees, walnuts, almonds, corn, asparagus, cotton, dates, and other crops. It is also applied to alfalfa, pastures, agricultural drainage systems, animal drinking water, fodder grasses, irrigation systems, swimming pools, ornamental ponds and fountains, catch basins, wastewater, bilge water, industrial processing water, industrial waste disposal systems, solid wastes sites, garbage dumps, and on tidal areas, swamps, marshes, bogs, intermittently flooded areas, standing water, and by mosquito abatement districts (DPR 2010b).

An isolate of *Bacillus thuringiensis* was first registered by the U.S. EPA in 1961 for use as an insecticide (U.S. EPA 1998). The subspecies *israelensis (Bti)* was first registered as an insecticide in 1983. One formulation of *Bti* is used in California for controlling knats on primarily in greenhouse crops, including peppers, tomatoes, celery, cabbage, leafy vegetables, cauliflower, walnuts, almonds, dates, corn, asparagus, bananas, fruit trees, and other crops. It is applied for mosquito control on rice, alfalfa, pastures, animal drinking water, ornamental nurseries, ornamental ponds, irrigation systems, swimming pools, drainage systems, lakes, streams, swamps, marshes, tidal areas, standing water, polluted or stagnant water, sewage systems, intermittently flooded areas, catch basins, domestic dwellings, and by mosquito abatement districts and by ULV application (DPR 2010b).

Spinosad was first registered for use in California in 1996 for use as an agricultural insecticide (DPR 2002). Spinosad is used on a variety of crops, ornamental plants, greenhouses, ornamental lawns, and gardens; rangeland, pastures, animal husbandry premises, dairy barns, silos, and cattle; industrial sites, cracks and crevices, rights-of-way, recreation areas, golf courses, outdoor buildings and structures, and household or domestic dwellings (DPR 2010b).

Monomolecular films are used on ornamental ponds, pastures, irrigation systems, drainage systems, drinking water systems, intermittently flooded areas, catch basins, lakes, ponds, reservoirs, tidal areas, marshes, and standing water, industrial waste disposal systems, polluted and stagnant water, and sewage systems (DPR 2010b).

Specially refined petroleum distillates or mineral oils are applied to a wide variety of crops, trees, and ornamental plants; to swamps, marshes, and intermittently flooded areas; are used as an adjuvant for pesticides; and are applied by mosquito abatement districts (DPR 2010b). Dormant oils are widely used in the Central Valley on tree crops.

Methoprene was first registered by the U.S. EPA in 1975 (U.S. EPA 2007a). Methoprene is used indoors and outdoors at domestic dwellings, in flea and tick treatments for cats and dogs, for crack and crevice treatments, and on outdoor buildings and structures, recreation areas,

swimming pools, golf courses, ornamental lawns, ornamental ponds, and shrubs. Methoprene is used at animal husbandry premises, on cattle, barnyards, rangeland, pastures, fallow land, and in animal drinking water. It is used at industrial sites, on highway rights-of-way, industrial waste disposal systems, industrial/commercial ponds, wastewater, and bilge water. Methoprene can be

Table 2-7. Total Reported Pesticide Use and Public Health Pest Control Use of Larvicides, Statewide

Active Ingredient	2008		
	Total Reported Use (lbs of ai)	Reported Use for Vector Control	
		lbs of ai	% of Total Use
Bacillus Sphaericus[1]	21,442	20,630	96%
Bacillus Thuringiensis, Subsp. *Israelensis*[2]	62,573	53,057	85%
Monomolecular film[3]	12,878	12,761	99%
Petroleum Distillates[4]	2,949,383	1,472,021	50%
Diflubenzuron	31,349	27	0.1%
Methoprene[5]	6,152	5,607	91%
Temephos	684	684	100%

Notes:

[1] Bacillus Sphaericus, Serotype H-5A5B, Strain 2362

[2] Reported as Bacillus Thuringiensis (Berliner); Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14; or Bacillus Thuringiensis (Berliner), Subsp. Israelensis, Serotype H-14

[3] Alpha-Isooctadecyl-Omega-Hydroxypoly(Oxyethylene)

[4] Reported as either Petroleum Distillates or Refined Petroleum Distillates

[5] Reported as either Methoprene or S-Methoprene

applied to irrigation systems, orchards, crops, berries, fruit trees, and rice. It is also used in drainage systems, swamps, marshes, intermittently flooded areas, catch basins, polluted stagnant water, sewage systems, and applied by mosquito abatement districts (DPR 2010b).

Temephos was registered by the U.S. EPA in 1965 to control mosquito larvae (U.S. EPA 2007a). Temephos is used on lakes, ponds, reservoirs, swamps, marshes, tidal areas, intermittently flooded areas, catch basins, drainage systems, irrigation systems, ornamental ponds, wastewater, polluted and stagnant water, and is applied by mosquito abatement districts (DPR 2010b).

2.3 MOSQUITO ADULTICIDES AND USE IN CALIFORNIA

Chemical control of adult mosquitoes is implemented when mosquito populations reach a level that is thought by health officials to represent an unacceptable increase in the risk of disease transmission to humans or domestic animals, or when biting mosquitoes become intolerable to the local population. The action level or threshold is determined by each mosquito control program and varies according to local conditions. When a threshold is exceeded, control measures are generally determined using a decision process such as that described in Appendix B. The threshold for adult mosquito control is variable and depends on several local factors, including (CDPH, 2005):

- The presence and intensity of mosquito-borne disease in the region;
- The abundance of vector species populations.
- The tolerance of local citizens to nuisance mosquito populations;

This section describes the application methods used for adulticides in California, the materials applied, and the measures taken to prevent adverse impacts to the water quality and beneficial uses of surface water bodies.

2.3.1 Application Methods

There are two basic techniques used by MVCAC members for applying mosquito adulticides:

1. **Barrier Application.** Adulticides are sprayed onto vegetation or other surfaces to leave a residue of adulticide intended to kill mosquitoes that land on that surface. Barrier application is typically done with backpack sprayers that produce large droplets that immediately fall out of the air onto the intended surface. Barrier-type applications kill mosquitoes and some "non-target" insects only where directly applied. Barrier applications are not made over or adjacent to water bodies; therefore, the barrier applications are not considered application of an aquatic pesticide, and are not the focus of this monitoring program.

2. **Ultra-Low-Volume (ULV) Application.** Adulticides are sprayed into the air with the intent of killing mosquitoes that are flying in the sprayed area. ULV application is typically done with truck-mounted sprayers, but can be done with handheld sprayers or

aircraft. ULV produces very small droplets that typically hang in the air for up to an hour. Effective droplet sizes range from 5 to 30 microns, but a typical droplet spectrum produces a larger range of droplet sizes. The small droplet size maximizes the surface area available to impact mosquitoes in flight, and keeps the material suspended in the atmosphere for long periods of time (up to an hour) with minimal deposition. The amount of material applied is typically less than 2 ounces of total product per acre, and contains less than 0.04 to 0.1 ounce of active ingredient. Aerial movement of the product is an essential part of the application. Applications are made when environmental conditions ensure their effectiveness (ideally, a slight breeze of 2 to 10 miles per hour; temperature great than 50 degrees Fahrenheit [°F]; and presence of a temperature inversion). ULV applications are made with truck-mounted equipment or aerially, from helicopters or fixed-wing aircraft. Adulticides are typically applied from aircraft when the area in which adult mosquitoes need to be controlled cannot be covered adequately and quickly enough with ground-based equipment. Localized ULV applications (such as tree holes) may also be made with a backpack or handheld sprayer. According to CDPH, spray drift may occur for a distance generally up to a half mile via truck-mounted applications, and more than a mile for aerial applications from the path or point of application (distances are highly variable depending on climatic conditions and topography). Most spray applications occur in the evening or early morning, when female mosquitoes are seeking a blood meal, and many other arthropods, particularly pollinators, are inactive. By definition, ULV uses the smallest possible amount of adulticide that will kill adult mosquitoes.

Thermal fogging has been used in the past by MVCAC member agencies, but is no longer used. In this method, the insecticides are usually mixed in oil and applied in late evening, at night, or early morning when the air is calm.

For the remainder of this document, all references to adulticide applications and adulticides, refer to ULV mosquito control applications unless otherwise specified.

2.3.2 Materials Used in California for Control of Adult Mosquitoes

Six active ingredients are commonly used as mosquito adulticides: pyrethrins, permethrin, resmethrin, phenothrin, malathion, and naled. Two additional ingredients have been registered for use as adulticides in California: prallethrin and etofenprox. For most of these active ingredients, multiple formulations are available for use in mosquito control (Table 2-8).

As shown in Table 2-8, some formulations have been used for mosquito adulticide for many years, while other formulations expected to be used in 2010 have only more recently become available.

Pyrethrins are naturally occurring products distilled from the flowers of Chrysanthemum species. The six individual pyrethrins compounds are pyrethrin I, pyrethrin II, cinerin I, cinerin II, jasmolin I, and jasmolin II. Pyrethrins account for 21.9 percent by mass of the material applied for adult mosquitoes in California by vector control districts in 2008 (Figure 2-4), and 79.4 percent of the acreage covered by adulticide applications (Figure 2-5: note that acreage is counted repeatedly for multiple applications made at the same locations).

Pyrethroids are synthetic compounds that are chemically similar to the pyrethrins, but have been modified to increase their stability and activity against insects, while minimizing their effect on nontarget organisms. Pyrethrins and pyrethroids act by causing a persistent activation of the sodium channels on insect neurons. These materials are relatively non-toxic to mammals and birds, but may be toxic to fish and invertebrates. The pyrethroids most used for adult mosquito control in California include sumithrin (phenothrin), resmethrin, and permethrin (see Figures 2-4 and 2-5).

Deltamethrin is a mosquito adulticide that is used to a limited extent in California, but is used as a barrier application and not a ULV application; therefore, deltamethrin is not included in tables and figures associated with this section. Public health uses also include other vectors such as yellow jackets; therefore, it is not possible to distinguish from the DPR PUR database how much is used for mosquito control. However, the total amount used is negligible relative to other mosquito adulticides and it is not used over or adjacent to water bodies. Formulations used for mosquitoes include Suspend SC Insecticide (primarily used), and K-Othrine SC Insecticide.

Insecticides containing pyrethrins and pyrethroids usually also contain piperonyl butoxide (PBO) as a synergist. PBO interferes with the insect's ability to detoxify pyrethrins and pyrethroids, thus enhancing the product's effectiveness. MGK-264 may also be used as a synergist in formulations with pyrethrins and synthetic pyrethroids. MGK-264 is known to inhibit microsomal enzymes in insects by binding directly to these enzymes, and thereby inhibiting the breakdown of other pesticides such as pyrethrins and pyrethroids.

Etofenprox is a synthetic pyrethroid-like chemical, differing in structure from pyrethroids in that it lacks a carbonyl group and has an ether moiety, whereas pyrethroids contain ester moieties.

Naled and malathion are organophosphate insecticides, and are used in rotation with pyrethrins or pyrethroids to avoid the development of resistance. Naled is the most commonly used material for this purpose. Because application rates are high relative to other adulticides, naled accounts for a large proportion of adulticide use by mass (66.8 percent), but a much smaller proportion by acreage (6.1 percent) (see Figures 2-4 and 2-5). Malathion use has declined over the past several years and accounted for 4.3 percent of adulticide application by mass in California in 2008 (Figure 2-4), and 0.2 percent of the acreage covered by adulticide applications (Figure 2-5).

Table 2-8. Reported Pesticide Use for Public Health Pest Control by Formulation

Active Ingredient	Formulations	U.S. EPA Reg. No.	2008		2007		2006		2005	
			Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation
Pyrethrin	Aquahalt Water-Based Adulticide	1021-1803	1,071.6	9.7%	263.8	3.0%	28.6	0.2%	--	--
	Evergreen Crop Protection EC 60-6	1021-1770	6,205.4	56.4%	4,516.2	51.6%	7,746.6	59.0%	3,433.6	38.1%
	Prentox Pyronyl Crop Spray	655-489	135.0	1.2%	6.5	0.1%	9.0	0.1%	8.9	0.1%
	Prentox Pyronyl Oil Concentrate #525	655-471	46.6	0.4%	34.6	0.4%	79.0	0.6%	201.2	2.2%
	Prentox Pyronyl Oil Concentrate Or-3610-A	655-501	2.8	0.0%	5.0	0.1%	4.5	0.0%	--	--
	Pyrenone 25-5 Public Health Insecticide	432-1050	1,477.7	13.4%	1,730.7	19.8%	1,856.1	14.1%	670.8	7.4%
	Pyrenone Crop Spray	432-1033	206.3	1.9%	167.5	1.9%	444.7	3.4%	428.0	4.7%
	Pyrocide Concentrate 7394	1021-1572	--	--	107.2	1.2%	--	--	--	--
	Pyrocide Mosquito Adulticide 7453	1021-1803	--	--	--	--	--	--	--	--
	Pyrocide Mosquito Adulticiding Concentrate For ULV Fogging 7395	1021-1570	662.0	6.0%	844.9	9.7%	1,225.3	9.3%	1,736.9	19.3%
	Pyrocide Mosquito Adulticiding Concentrate For ULV Fogging 7396	1021-1569	1,133.8	10.3%	1,026.0	11.7%	1,402.5	10.7%	2,256.9	25.0%
	Drione Insecticide*	432-992	2.5	0.0%	2.5	0.0%	28.9	0.2%	15.8	0.2%
	Evergreen Emulsifiable 60-6*	1021-1091	0.4	0.0	--	--	147.7	1.1%	--	--
	Haymaker II Fogging Insecticide*	40208-5	--	--	--	--	--	--	1.8	0.02%
	Permanone Ready-To-Use Insecticide*	4816-755	--	--	--	--	--	--	1.0	0.01%
	Prentox Exciter*	655-489	2.6	0.0%	13.9	0.2%	45.8	0.3%	143.7	1.6%
	Pyrenone*	9319-50046	--	--	--	--	27.5	0.2%	43.9	0.5%
	Pyrenone 25-5 M.A.G.C.*	4816-514	26.2	0.2%	29.8	0.3%	77.5	0.6%	52.9	0.6%
	Pyrenone Crop Spray Insecticide*	4816-490	4.9	0.0%	2.1	0.0%	1.8	0.0%	21.8	0.2%
	Pyrocide Mosquito Adulticiding Concentrate For ULV Fogging, F-7088*	1021-1185	15.3	0.1%	--	--	--	--	--	--
Permethrin	Allpro Aqualuer 20-20	769-985	368.8	19.7%	--	--	--	--	--	--
	Allpro Evoluer 4-4 ULV	769-982	14.8	0.8%	50.5	5.8%	--	--	--	--
	Aqua-Kontrol Concentrate	73748-1	--	--	--	--	--	--	--	--
	Aqua-Reslin	432-796	57.0	3.0%	22.2	2.6%	0.8	0.1%	38.2	3.2%
	Biomist 4+12 ULV	8329-34	198.7	10.6%	139.1	16.0%	147.9	15.9%	154.0	13.0%
	Biomist 4+4 ULV	8329-35	5.8	0.3%	54.3	6.3%	33.4	3.6%	23.1	2.0%
	Kontrol 2-2	73748-3	--	--	--	--	--	--	--	--
	Kontrol 4-4	73748-4	237.5	12.7%	--	--	--	--	--	--
	Kontrol 30-30 Concentrate	73748-5	--	--	--	--	--	--	--	--
	Permanone 31-66	432-1168	847.0	45.1%	391.4	45.2%	468.3	50.4%	585.4	49.5%
	Permanone Ready-To-Use Insecticide	432-1277	3.5	0.2%	--	--	--	--	--	--
	Prentox Perm-X UL 4-4	655-898	--	--	49.4	5.7%	57.1	6.2%	--	--
	Dragnet FT Termiticide*	279-3062	100.3	5.3%	148.4	17.1%	180.5	19.4%	269.2	22.8%
	Dragnet SFR Termiticide/Insecticide*	279-3062	38.5	2.1%	--	--	--	--	--	--
	Permanone Insect Repellant*	432-1112	1.1	0.1%	--	--	--	--	--	--
	Permanone Ready-To-Use Insecticide*	432-1182	--	--	11.3	1.3%	18.9	2.0%	112.5	9.5%

Table 2-8. Reported Pesticide Use for Public Health Pest Control by Formulation

Active Ingredient	Formulations	U.S. EPA Reg. No.	2008		2007		2006		2005	
			Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation	Active Ingredient (pounds)	Percentage Use by Formulation
Permethrin (continued)	Permethrin 10% Rapid Kill Insecticide Concentrate*	47000-103	3.3	0.2%	--	--	--	--	--	--
	Prentox Perm-X 1E*	655-898	--	--	--	--	20.5	2.2%	--	--
	Zoecon RF-191 Fogger*	2724-292	--	--	--	--	0.7	0.1%	--	--
Resmethrin	Scourge Insecticide With Resmethrin/Piperonyl Butoxide 18%+54% Mf Formula II	432-667	--	--	28.7	13.8%	--	--	--	--
	Scourge Insecticide With Resmethrin/Piperonyl Butoxide 4%+12% Mf Formula II	432-716	1.0	0.8%	--	--	--	--	--	--
	Prentox Resmethrin 0.5% RTU*	655-779	1.3	1.0%	--	--	0.4	0.1%	--	--
	Sbp-1382/Piperonyl Butoxide Insecticide Concentrate 18% + 54% Mf Formula II*	432-667	12.3	9.8%	16.6	8.0%	0.2	0.1%	44.7	5.9%
	Scourge Insecticide With Sbp-1382/Pb 18% + 54% MF Formula II*	432-667	5.7	4.6%	0.8	0.4%	--	--	20.6	2.7%
	Scourge Insecticide With Sbp-1382/Pb 4%+12% MF Formula II*	432-716	--	--	5.0	2.4%	3.3	0.7%	1.2	0.2%
	Scourge Insecticide With Sbp-1382/Piperonyl Butoxide 4% + 12% MF Formula II*	432-716	104.3	83.1%	155.4	74.7%	216.2	47.9%	548.2	72.2%
	Scourge Insecticide With Sbp-1382/Piperonyl Butoxide 18% + 54% MF Formula II*	432-667	--	--	--	--	--	--	1.5	0.2%
	Scourge Insecticide With Sbp-1382/Piperonyl Butoxide 18% + 54% MF Formula II*	432-667	0.8	0.7%	1.5	0.7%	231.5	51.3%	135.8	17.9%
Phenothrin (Sumethrin)	Anvil 10+10 ULV	1021-1688	917.3	60.8%	184.8	34.1%	471.3	97.1%	349.8	54.3%
	Anvil 2+2 ULV	1021-1687	69.8	4.6%	36.8	6.8%	13.5	2.8%	294.3	45.7%
	Aqua Anvil Water-Based Adulticide	1021-1807	165.0	10.9%	18.2	3.4%	--	--	--	--
	Duet Dual-Action Adulticide	1021-1795	354.9	23.5%	302.0	55.7%	--	--	--	--
	Multicide Fogging Concentrate 2798*	1021-1795	--	--	0.4	0.1%	--	--	--	--
	Multicide Fogging Concentrate 2807*	1021-1807	0.8	0.1%	--	--	--	--	--	--
Prallethrin	Duet Dual-Action Adulticide	1021-1795	71.0	100.0%	60.4	99.9%	--	--	--	--
	Multicide Fogging Concentrate 2798*	1021-1795	--	--	0.1	0.1%	--	--	--	--
Etofenprox	Zenivex E20	2724-791	--	--	--	--	--	--	--	--
Naled**	Trumpet EC Insecticide	5481-481	30,415.5	90.6%	42,349	100.0%	19,659	99.7%	26,600	100.0%
	Dibrom Concentrate*	5481-480	3,149.1	9.4%	--	--	54	0.3%		
Malathion	Fyfanon ULV Mosquito	67760-34	--	--	--	--	--	--	--	--
	Prentox Malathion 50% Emulsifiable Insecticide	655-598	230	10.7%	117	5.4%	8	0.2%	6	0.1%
	Clean Crop Malathion ULV Concentrate Insecticide*	34704-18	204	9.6%	26	1.2%	20	0.6%	457	4.8%
	Cythion Insecticide "The Premium Grade Malathion"*	241-208	--	--	94	4.4%	29	0.9%	109	1.2%
	Cythion ULV Insecticide*	241-208	--	--	--	--	--	--	4	0.0%
	Fyfanon ULV*	67760-34	907	42.4%	1,654	77.0%	2,758	84.6%	7,424	78.6%
	Fyfanon ULV*	4787-8	423	19.8%	--	--	--	--	911.4	9.6%
	Malathion 8EC*	51036-214	197	9.2%	77	3.6%	24	0.7%	--	--
	Red-Top Malathion 8 Spray*	2935-83	--	--	--	--	325	10.0%	345	3.7%
	Wilbur-Ellis Malathion 8 Spray*	2935-83	176	8.2%	179	8.4%	96	2.9%	190	2.0%

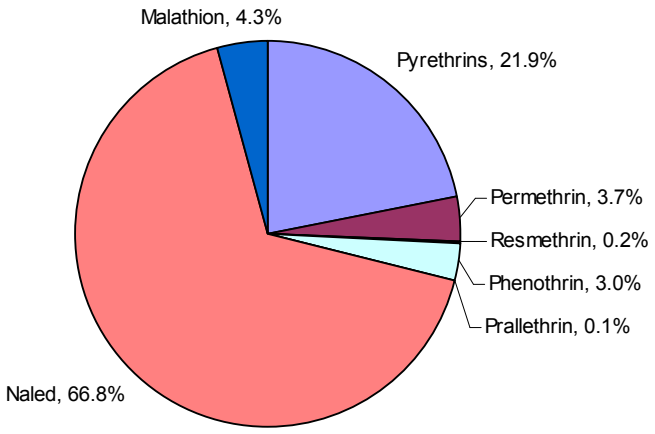
Source: DPR PUR Database

Notes:

* Formulation is not expected to be used after permit is adopted.

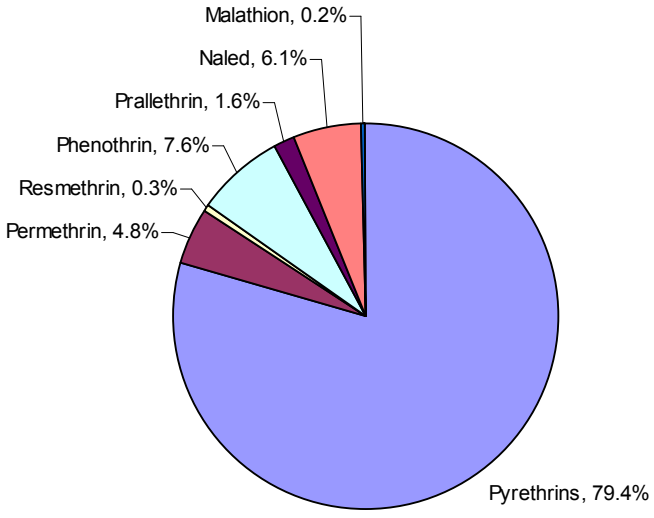
** Naled use for 2008 adjusted for San Joaquin County per personnal comm. Eddie Lucchesi (2010)

Figure 2-4 Reported Use for Public Health Pest Control by Active Ingredient, 2008 Statewide



Note: Based on pounds of active ingredient.
Naled use adjusted for San Joaquin County per personnal comm. Eddie Lucchesi (2010)

Figure 2-5 Acreage Treated for Public Health Pest Control by Active Ingredient, 2008 Statewide



Notes: Acreage estimated based on at maximum label application rate.
Acreage is counted each time repeated applications are made at the same site.
Naled use adjusted for San Joaquin County per personnal comm. Eddie Lucchesi (2010)

The active ingredients currently used for control of adult mosquitoes have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied at label rates for ULV mosquito control. Formulation is a major factor in determining a pesticide's persistence in the environment, and products used for agriculture or forestry are sometimes formulated to increase their longevity. The products applied as ULV sprays for adult mosquito control are not formulated for persistence, because their purpose is to kill active adult mosquitoes in flight.

Table 2-9 shows the current list of products to be permitted.

2.3.3 Adulticide Application Locations and Frequency

Mosquito adulticides may be applied in a variety of locations, including ditches, storm drains, wetlands, tidal marshes, woodlands, rice fields, neighborhoods, tree holes, overgrown areas, and golf courses. Locations may be urban, suburban, agricultural, recreational, or wild refuge areas, and application sites may vary in size from a fraction of an acre to several thousand acres. In some cases, treatment may be limited to the edge of water bodies or tidal marshes; in other cases treatment would occur over entire water bodies. Types of locations, frequency, and size of application sites can vary significantly by region. Typically, larger areas are covered by adulticide application, and more frequent applications are needed in the Sacramento and San Joaquin Valleys, where mosquito problems tend to be worse.

This section provides a description of typical adulticide applications by region. It should be noted that typical applications made in the past may not be representative of those made in the future, and that patterns may change based on factors such as climate, disease surveillance, resistance, and cost-effectiveness. Information in this section is based on surveys of individual districts for 2009 applications (Table 2-8), as well as the DPR pesticide use data by county for 2007 and 2008 (the most recent currently available years). Years 2007 and 2008 were relatively dry; therefore, data for 2005 and 2006 (wet years) were also reviewed to determine whether there were significant differences in usage. West Nile virus activity and the availability of emergency control funds may also be factors in the amounts used from year to year. As shown in Table 2-8, although there were some differences in the amounts used, the general trends were similar between years.

Coastal Region

MVCAC agencies within the Coastal Region are listed in Table 2-3. Adulticides that MVCAC agencies reported used in this region in 2009 include pyrethrins, permethrin, resmethrin, and phenothrin. Marin-Sonoma also applied etofenprox in 2009. However, in 2007-2008 only use of pyrethrins adulticides was substantial, according to the DPR PUR data (Table 2-10). In 2008, resmethrin was applied at relatively low quantities, and permethrin, phenothrin, and prallethrin were applied in trace amounts during both years. Organophosphate adulticides are generally not applied. Many agencies do not apply adulticides every year, and at most application sites, adulticides are not typically applied more than once a year. At some application sites, adulticides may be applied up to five times a year under certain conditions. Unlike other regions, adulticide applications in this region include tidal marshes. Applications are made by truck or handheld equipment; aerial applications generally are not used in this region for adult mosquito control.

Table 2-9. Label Requirements and Label Application Rates by Formulation for Adulticides

Active Ingredient	Formulation Trade Name	U.S. EPA Reg. No.	% A.I.	% PBO	% MGK-264	Label Application Rates	Label Requirements Relevant to Mosquito Control/Surface Water
Pyrethrins	Pyrocide Mosquito Adulticiding Concentrate For ULV Fogging 7396	1021-1569	5	25	--	Max: 0.0025 lb of pyrethrins and 0.0125 lb of PBO per acre.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Pyrocide Mosquito Adulticiding Concentrate For ULV Fogging 7395	1021-1570	12	60	--	Max: 0.0025 lb of pyrethrins and 0.0125 lb of PBO per acre.	Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Evergreen Crop Protection EC 60-6	1021-1770	6	60	--	Max: 0.0025lb of pyrethrins per acre. Recommended: 0.002 to 0.0025 lb of pyrethrins per acre.	Except as specified in the directions for use, do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply when wind speed favors drift beyond the area intended for treatment.
	Aquahalt Water-Based Adulticide	1021-1803	5	25	--	Max: 0.0025 lb a.i./acre per day and 0.0625 lb a.i./acre per year. Recommended: 0.0009 to 0.0025 lb of pyrethrins and 0.0045 to 0.0125 lb of PBO per acre.	Application during the cool hours of the night or early morning is usually preferable, with a minimum application temperature of 50°F. Apply only when ground wind speed is greater than 1 mph.
	Pyrocide Mosquito Adulticide 7453	1021-1803	5	25	--	Max: 0.0025 lb a.i./acre per day and 0.0625 lb a.i./acre per year.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Pyrenone Crop Spray	432-1033	6	60	--	Max: 0.05 lb of pyrethrins per acre. Max for control of mosquitoes: 0.0025 lb of pyrethrins per acre.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Pyrenone 25-5 Public Health Insecticide	432-1050	5	25	--	Max: 0.0025 lb of pyrethrins per acre in any given 24-hour period and 0.0625 lb of pyrethrins per acre in any given season.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Apply when ground wind speed is greater than 1 mph.
	Prentox Pyronyl Oil Concentrate #525	655-471	5	25	--	Max: 0.0025 lb of pyrethrins and 0.0125 lb of PBO per acre.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Prentox Pyronyl Crop Spray	655-489	6	60	--	Max: 0.05 lb of pyrethrins per acre. Max amount for control of adult mosquitoes: 0.002 to 0.0025 lb of pyrethrins per acre.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
	Prentox Pyronyl Oil Concentrate OR-3610-A	655-501	3	6	10	Max: 0.0025 lb of pyrethrins per acre. Recommended: 0.0021 to 0.0025 lb of pyrethrins per acre.	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark.
Permethrin	Permanone 31-66	432-1250	31.28	66	--	Max: 0.007 lb of permethrin per acre per application and a total of 0.18 lb of permethrin per acre in any given season. Recommended: 0.0035 to 0.007 lb permethrin per acre.	For best results, treat when mosquitoes are most active and weather conditions are most conductive to keeping the fog in the air column close to the ground; for example, when temperatures are cool, and wind speeds are equal to or greater than 1 mph.
	Permanone Ready-To-Use Insecticide	432-1277	3.98	8.48	--	Max: 25 applications at 0.007 lb of permethrin per acre (not to exceed a total of 0.18 lb of permethrin per acre) in any given season. Recommended: 0.0035 to 0.007 lb permethrin per acre.	Application during the cooler hours of the night or early morning is recommended. Best results are expected by application when weather conditions favor an inversion of temperatures in the area treated. For best results, treat when mosquitoes are most active and weather conditions are conducive to keeping the fog in the air column close to the ground; for example, when temperatures are cool, and wind speeds are equal to or greater than 1 mph.
	Aqua-Reslin	432-796	20	20	--	Max: 25 applications at 0.007 lb of permethrin per acre (not to exceed a total of 0.18 lb of permethrin per acre) in any given season.	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.
	Prentox Perm-X Ul 4-4	655-898	4	4	--	Max: 0.007 lb of permethrin per acre in a 24 hour period. Do not apply more than 0.18 lb of permethrin per acre per year to any site.	Application during the cooler hours of the night or early morning is recommended. Best results are expected by application when weather conditions favor an inversion of temperatures in the area treated. For best results, treat when mosquitoes are most active and weather conditions are conducive to keeping the fog in the air column close to the ground; for example, when temperatures are cool, and wind speeds are equal to or greater than 1 mph.

Table 2-9. Label Requirements and Label Application Rates by Formulation for Adulticides

Active Ingredient	Formulation Trade Name	U.S. EPA Reg. No.	% A.I.	% PBO	% MGK-264	Label Application Rates	Label Requirements Relevant to Mosquito Control/Surface Water
Permethrin	Aqua-Kontrol Concentrate	73748-1	20	20	--	Max: 0.18 lb of permethrin per acre per year to any site. Recommended: from 0.00175 to 0.007 a.i./acre.	Both ground and aerial applications should be made when meteorological conditions are conducive to keeping the spray cloud close to the ground, such as when an air temperature inversion is present. Applications during the cool hours of early morning or evening are preferable. Air temperatures should be greater than 50°F when conducting all types of applications. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Do not apply when wind speed exceeds 10 mph. Do not re-treat a site more than once in 12 hours.
	Kontrol 2-2	73748-3	2	2	--	Max: 0.18 lb of permethrin per acre per year to any site. Recommended: from 0.00175 to 0.007 a.i./acre.	Both ground and aerial applications should be made when meteorological conditions are conducive to keeping the spray cloud close to the ground, such as when air temperature inversion is present. Applications during the cool hours of early morning or evening are preferable. Air temperatures should be greater than 50°F when conducting all types of applications. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Do not apply when wind speeds exceed 10 mph. Do not re-treat a site more than once in 12 hours.
	Kontrol 4-4	73748-4	4.6	4.6	--	Max: 0.18 lb of permethrin per acre per year to any site. Recommended: from 0.00175 to 0.007 a.i./acre.	Both ground and aerial applications should be made when meteorological conditions are conducive to keeping the spray cloud close to the ground, such as when air temperature inversion is present. Applications during the cool hours of early morning or evening are preferable. Air temperatures should be greater than 50°F when conducting all types of applications. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Do not apply when wind speeds exceed 10 mph. Do not re-treat a site more than once in 12 hours.
	Kontrol 30-30 Concentrate	73748-5	30	30	--	Max: 0.18 lb of permethrin per acre per year to any site. Recommended: from 0.00175 to 0.007 a.i/acre.	Both ground and aerial applications should be made when meteorological conditions are conducive to keeping the spray cloud close to the ground, such as when air temperature inversion is present. Applications during the cool hours of early morning or evening are preferable. Air temperatures should be greater than 50°F when conducting all types of applications. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Do not apply when wind speeds exceed 10 mph. Do not re-treat a site more than once in 12 hours.
	Allpro Evoluer 4-4 ULV	769-982	4	4	--	Recommended: 0.001 to 0.007 lb of permethrin per acre.	Both aerial and ground applications should be made when the wind is less than 10 mph. Do not apply this product within 100 feet (30 meters) of lakes and streams. For best results, treat when mosquitoes or insects are most active and weather conditions are conductive to keeping the fog close to the ground (e.g., cool temperatures and wind speed are not greater than 10 mph). Applications during the cool hours of night or early morning are usually preferable.
	Allpro Aqualuer 20-20	769-985	20.6	20.6	--	Max: 0.007 lb of permethrin per acre. Max for application using backpack or truck-mounted mist blower equipment: 0.1 lb permethrin per acre.	Both aerial and ground applications should be made when the wind is less than 10 mph. Do not apply this product within 100 feet (30 meters) of lakes and streams. For best results, treat when mosquitoes or insects are most active and weather conditions are conductive to keeping the fog close to the ground (e.g., cool temperatures and wind speed are not greater than 10 mph). Applications during the cool hours of night or early morning are usually preferable.
	Biomist 4+12 ULV	8329-34	4	12	--	Max: 0.007 lb of permethrin per acre in a 24-hour period; 0.18 lb of permethrin per acre per year. Ground ULV application: 0.0017 to 0.007 lb of permethrin and 0.005 to 0.021 lb of PBO per acre.	For best results treat when mosquitoes are most active and weather conditions are conducive to keeping the spray cloud close to the ground. An inversion of air temperatures and a light breeze is preferable. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperatures should be greater than 50°F when conducting all types of applications.
	Biomist 4+4 ULV	8329-35	4	4	--	Max: 0.007 lb of permethrin per acre in a 24-hour period; 0.18 lb of permethrin per acre per year. Ground ULV application: 0.00175 to 0.007 lb of permethrin per acre.	For best results apply when mosquitoes are most active and weather conditions are conducive to keeping the spray cloud close to the ground. An inversion of air temperatures and a light breeze is preferable. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperature should be greater than 50°F when conducting all types of applications.

Table 2-9. Label Requirements and Label Application Rates by Formulation for Adulticides

Active Ingredient	Formulation Trade Name	U.S. EPA Reg. No.	% A.I.	% PBO	% MGK-264	Label Application Rates	Label Requirements Relevant to Mosquito Control/Surface Water
Phenothrin	Anvil 2+2 ULV	1021-1687	2	2	--	Max: 0.0036 lb of Sumithrin™ per acre in a 24-hour period; 1.0 lb of Sumithrin™ per acre in any site in any year. Ground ULV application: 0.0012 to 0.0036 lb a.i./acre	IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only. For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperature should be greater than 50°F when conducting all types of applications. Use a clean, well-maintained, and properly calibrated fogger. Fog downwind.
	Anvil 10+10 ULV	1021-1688	10	10	--	Max: 0.0036 lb of Sumithrin™ per acre in a 24-hour period; 1.0 lb of Sumithrin™ per acre in any site in any year. Ground ULV application: 0.0012 to 0.0036 lb a.i./acre	IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only. For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperature should be greater than 50°F when conducting all types of applications. Use a clean, well-maintained, and properly calibrated fogger. Fog downwind.
	Aqua Anvil Water-Based Adulticide	1021-1807	10	10	--	Max: 0.0036 lb of phenothrin per acre in a 24-hour period. Do not exceed 1.0 lb of Sumithrin® per acre in any site in any year. Ground ULV application: 0.0012 to 0.0036 lb of Sumithrin® and PBO per acre.	IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only. For best results, apply when mosquitoes are most active and weather conditions are conducive to keeping the fog close to the ground. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperature should be greater than 50°F when conducting all types of applications.
Phenothrin and Prallethrin	Duet Dual-Action Adulticide	1021-1795	5 / 1	5	--	Max: 0.0036 lb of Sumithrin® or 0.0008 lb of prallethrin per acre in a 7-day period; 0.094 lb of Sumithrin® or 0.021 lb of prallethrin in any site in a year. Ground ULV application: 0.0003 to 0.0008 lb of Prallethrin and 0.0012 to 0.0036 lb of Sumithrin® and PBO per acre.	IN CALIFORNIA: This product is to be applied by County Health Department, State Department of Health Services, Mosquito and Vector Control or Mosquito Abatement District personnel only. For best results, apply when mosquitoes are most active and meteorological conditions are conducive to keeping the spray cloud close to the ground. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than 1 mph. Air temperature should be greater than 50°F when conducting all types of application.
Resmethrin	Scourge Insecticide With Resmethrin/Piperonyl Butoxide 18%+54% MF Formula II	432-667	18	54	--	Max: 0.007 lb of resmethrin per acre; 0.18 lb of resmethrin per acre in any given season. Application rates: 0.001 to 0.007 lb of resmethrin per acre	All types of applications should be conducted at temperatures of 50°F or higher. Apply when ground wind speeds are equal to or greater than 1 mph. Do not exceed 25 applications at 0.007 pound of resmethrin per acre (not to exceed a total of 0.18 pound of resmethrin per acre) in any given season. More frequent applications may be made to prevent or control a threat to public and/or animal health determined by a state, tribal, or local health or vector control agency on the basis of documented evidence of disease-causing agents in vector mosquitoes, or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.
	Scourge Insecticide With Resmethrin/Piperonyl Butoxide 4%+12% MF Formula II	432-716	4	12	--	Max: 0.007 lb of resmethrin per acre; 0.18 lb of resmethrin per acre in any given season. Application rates: 0.00117 to 0.007 lb of resmethrin per acre	For best results, apply when insects are most active and meteorological conditions are conducive to keeping the spray cloud in the air column close to the ground. An inversion of air temperatures and a light breeze is preferable. Application during the cooler hours of the night or early morning is recommended. Do not exceed 25 applications at 0.007 pound of resmethrin per acre (not to exceed a total of 0.18 pound of resmethrin per acre) in any given season. More frequent applications may be made to prevent or control a threat to public and/or animal health determined by a state, tribal, or local health or vector control agency on the basis of documented evidence of disease-causing agents in vector mosquitoes, or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.

Table 2-9. Label Requirements and Label Application Rates by Formulation for Adulticides

Active Ingredient	Formulation Trade Name	U.S. EPA Reg. No.	% A.I.	% PBO	% MGK-264	Label Application Rates	Label Requirements Relevant to Mosquito Control/Surface Water
Etofenprox	Zenivex E20	2724-791	20	0	--	Max: 0.007 lb of etofenprox per acre. Recommended: 0.00175 to 0.0070 lb of etofenprox per acre.	Apply when wind is greater than 1 mph. Do not apply when wind speeds exceed 10 mph. A temperature inversion is preferable to keep the fog close to the ground, and applications should be made when labeled insects are most active. Conduct applications when temperatures are between 50 and 95°F. Do not re-treat a site more than once in 3 days; make no more than two applications to a site in any one week, or 25 applications in one year. More frequent treatments may be made to prevent or control a threat to public and/or animal health determined by a state, tribal, or local health or vector control agency on the basis of documented evidence of disease-causing agents in vector mosquitoes, or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.
Malathion	Prentox Malathion 50% Emulsifiable Insecticide	655-598	50	0	--	Not listed	For terrestrial uses, do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not apply where weather conditions favor drift from areas treated. Do not contaminate water when disposing of equipment washwaters.
	Fyfanon ULV Mosquito	67760-34	96.5	0	--	Max: 0.23 lb a.i./acre per day.	Do not contaminate water, food, or feed by storage or disposal. Do not re-treat a site more than 3 times in any one week Apply only when weather conditions are favorable. Wind and rising air currents may cause undesirable spray drift.For enhanced knock-down effects against mosquitoes, Fyfanon ULV Mosquito can be mixed with a synergized pyrethrins emulsifiable concentrate (6 percent pyrethrins + 60 percent PBO) in accordance with the most restrictive of label limitations and precautions indicated on both this and the tank-mixed product.
Naled	Trumpet EC Insecticide	5481-481	78	0	--	Max: 0.59 lb per acre of naled within a 7-day period; 10.73 lb per acre of naled a.i./acre) per year. Adult Mosquito Control Ultra Low Volume (ULV) Aerial Application: 0.05 to 0.1 lb a.i./acre (recommended) Adult Mosquito control ULV Ground Application: 0.02 lb a.i./acre (recommended). In conditions of high pest pressure and/or heavy foliage, a maximum of 0.1 lb a.i./acre may be applied.	Before making the first application in a season, consult with the primary State agency responsible for regulating the pesticides to determine if permits are required or regulatory mandates exist. Do not apply over bodies of water (e.g., lakes, swamps, rivers, permanent streams, natural ponds, commercial fish ponds, 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. Spray during periods when wind speed is between 1 and 15 mph, at ground level and when thermal activity is low. Do not apply when ambient temperature is less than 50ºF. Do not apply when it is raining in the treatment area. Do not treat any site more than 1 time per day.

Notes:
°F = degrees Fahrenheit
lb = pound
mph = miles per hour
A.I. = Active Ingredient
BMPs = Best Management Practice
MGK-264 = N-Octyl bicycloheptene dicarboximide
PBO = Piperonyl Butoxide
ULV = Ultra Low Volume

Table 2-10. Regional Use for Public Health Pest Control during 2007 and 2008

Year	Active Ingredient	Sacramento Valley[1]		Coastal[2]		North San Joaquin Valley[3]		South San Joaquin Valley[4]		Southern California[5]	
		lbs of a.i.	% for Region	lbs of a.i.	% for Region	lbs of a.i.	% for Region	lbs of a.i.	% for Region	lbs of a.i.	% for Region
2008	Pyrethrins	3,825	34.8%	158	1.4%	5,969	54.3%	966	8.8%	76	0.7%
	Permethrin	1,177	62.7%	0.2	0.0%	504	26.9%	88	4.7%	65	3.5%
	Resmethrin	33	26.2%	4	3.2%	--	--	2	1.3%	87	69.3%
	Phenothrin	850	56.3%	0.07	0.0%	438	29.0%	98	6.5%	118	7.8%
	Prallethrin	65	92.1%	< 0.01	0.0%	0.6	0.8%	5	7.1%	--	--
	Naled[6]	22,959	68.4%	--	--	10,605	31.6%	--	--	--	--
	Malathion	1,331	62.2%	--	--	176	8.2%	197	9.2%	434	20.3%
2007	Pyrethrins	5,390	61.6%	102	1.2%	2,707	30.9%	463	5.3%	26	0.3%
	Permethrin	825	95.1%	0.1	0.0%	--	--	3	0.3%	39	4.5%
	Resmethrin	69	32.9%	--	--	0.4	0.2%	0.8	0.4%	137	66.1%
	Phenothrin	439	80.9%	0.1	0.0%	8	1.5%	22	4.0%	74	13.6%
	Prallethrin	59	97.3%	< 0.01	0.0%	2	2.6%	0.09	0.1%	--	--
	Naled	32,128	75.9%	--	--	10,221	24.1%	--	--	--	--
	Malathion	1,774	82.6%	--	--	172	8.0%	84	3.9%	117	5.4%

Source: DPR PUR Database

Notes:

[1]Counties of Shasta, Tehama, Butte, Lake, Glenn, Colusa, Sutter, Yuba, Placer, El Dorado, Yolo, Sacramento, and Nevada

[2]Counties of Sonoma, Marin, Napa, Solano, Contra Costa, Alameda, San Mateo, Santa Clara, Santa Cruz, Monterey, and San Benito

[3]Counties of San Joaquin, Stanislaus, Merced, and Calaveras

[4]Counties of Madera, Fresno, Kings, Tulare, Kern, and San Luis Obispo

[5]Counties of Mono, Inyo, Santa Barbara, Ventura, Los Angeles, San Bernardino, Orange, San Diego and Riverside

[6]Naled use for 2008 adjusted for San Joaquin County (Lucchesi 2010)

ai = active ingredient

lbs = pounds

% = percent

Sacramento Valley Region

MVCAC agencies within the Sacramento Valley Region are listed in Table 2-3. Adulticides that MVCAC agencies reported using in this region include pyrethrins, permethrin, phenothrin, prallethrin, malathion, and naled. In 2007 and 2008, the DPR PUR data also included applications of resmethrin in this region (Table 2-10). Because mosquito problems tend to be more severe in this region, all districts in this region apply adulticides every year, and multiple applications are made at many sites (typically weekly, sometimes twice a week or every 2 weeks for about 4 months during the summer). About half of the agencies use aerial applications in addition to applications by truck or handheld sprayers. Sites in this region where adulticide applications are made include rice fields, which is not typical of other regions.

Northern San Joaquin Valley

MVCAC agencies within the Northern San Joaquin Valley Region are listed in Table 2-3. Adulticides that MVCAC agencies reported using in this region in 2009 include pyrethrins, permethrin, and phenothrin. In 2007, permethrin use was not included in the DPR PUR data, but a small amount of phenothrin, prallethrin, and resmethrin were included (Table 2-10). In 2008, permethrin was applied, as well as a more significant quantity of phenothrin. Organophosphate adulticides are generally not applied in both years, except in San Joaquin County, where naled use was reported, and in Stanislaus County, where malathion use was reported. As with the Sacramento Valley Region, this region tends to have severe mosquito problems. As such, all districts in this region apply adulticides every year, and multiple applications are made at many sites (typically weekly, sometimes twice a week or every 2 weeks for about 4 months during the summer). Most of the agencies use aerial applications in addition to applications by truck or handheld sprayers.

Southern San Joaquin Valley

MVCAC agencies within the Southern San Joaquin Valley Region are listed in Table 2-3. Adulticides that MVCAC reported using in this region in 2009 include pyrethrins, permethrin, and phenothrin. Organophosphate adulticides are generally not applied; however, Kings Mosquito Abatement District did report applying naled. In 2007, the DPR PUR data included a very small amount of resmethrin and prallethrin in this region (Table 2-10). No use of naled was reported to DPR in 2007, but use of malathion was reported in this region (Table 2-10). In 2008, resmethrin, prallethrin, and malathion were also applied. Most districts in this region apply adulticides every year, and multiple applications may be made (up to 13 times per year at some sites). Most agencies use only truck and handheld applications, but some also use aerial application.

Southern California

MVCAC agencies within the Southern California Region are listed in Table 2-3. Adulticides that MVCAC reported used in this region in 2009 include pyrethrins, permethrin, resmethrin, and phenothrin. Malathion was the only organophosphate adulticide reported for use in this region in

2007 and 2008 (Table 2-10). Most districts in this region apply adulticides every year, and multiple applications may be made (up to five times per year at some sites). Applications are made by truck or handheld equipment, although Coachella Valley also uses aerial application.

2.3.4 Methods to Control Adverse Effects to Surface Water

BMPs are used to control adverse effects to surface waters. Generally, the BMPs used are determined by the label requirements, although additional measures may be used. For mosquito adulticide formulations, control measures include the following:

- Application over bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes, or estuaries) is avoided, except when necessary to target areas where adult mosquitoes are present, and when weather conditions facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body. Application is avoided when wind speed favors drift beyond the area intended for treatment.
- Both ground and aerial applications are made when mosquitoes are most active and when meteorological conditions are conducive to keeping the spray cloud close to the ground, such as when an air temperature inversion is present. Applications during the cool hours of early morning or evening are preferred, with a minimum application temperature of 50 degrees °F. Application in calm air conditions (<1 mph) or high winds (per label instructions) is avoided.
- For terrestrial uses, application is avoided: directly to water; to areas where surface water is present; or to intertidal areas below the mean high water mark.

Additional BMPs specified by formulation on product labels are shown in Table 2-9.

2.3.5 Other Uses of the Active Ingredients and Synergists in Mosquito Adulticides

Most pesticides used as adulticides are also used for a wide variety of other purposes in California, which is important to consider when developing a monitoring program. When an active ingredient is detected in the water, it may be very difficult to determine whether it came from a mosquito control application, an unrelated application, or from multiple sources. Residential pesticide sources are especially difficult to determine, because their use is not reported to or quantified by DPR. DPR estimates that approximately two-thirds of pesticide use in California is unreported.

Table 2-11 shows the proportion of each active ingredient that is used for vector control, as a percentage of total reported use in California for 2005, 2006, 2007, and 2008. Although vector control uses may include uses other than mosquito adulticides, it is assumed that the vast majority of public health use of the formulations shown in Table 2-8 is to control adult mosquitoes. Note that total reported use does not include use by homeowners, which may comprise the majority of the use for certain pesticides, especially in urban and suburban areas (Moran 2005).

Table 2-11. Reported Pesticide Use, Statewide

Year	Metric	Pyrethrins	Permethrin	Resmethrin	Phenothrin	Prallethrin	Naled*	Malathion
2008	Total Reported Use (lbs of a.i.)	18,782	344,204	269	1,601	100	155,046	478,103
	Reported Use for Vector Control (lbs of a.i.)	10,995	1,876	125	1,509	71	33,565	2,138
	% Use of Total for Vector Control	59%	1%	47%	94%	71%	22%	0%
2007	Total Reported Use (lbs of a.i.)	17,357	418,224	448	587	60	132,929	470,195
	Reported Use for Vector Control (lbs of a.i.)	8,751	867	208	543	60	42,349	2,146
	% Use of Total for Vector Control	50%	0.2%	46%	92%	100%	32%	0.5%
2006	Total Reported Use (lbs of a.i.)	19,560	669,445	656	533	0.009	196,143	410,320
	Reported Use for Vector Control (lbs of a.i.)	13,128	928	452	485	0.0001	19,713	3,259
	% Use of Total for Vector Control	67%	0.1%	69%	91%	0.6%	10%	0.8%
2005	Total Reported Use (lbs of a.i.)	14,218	554,619	958	696	1.5	225,863	426,218
	Reported Use for Vector Control (lbs of a.i.)	9,017	1,182	759	645	--	26,600	9,446
	% Use of Total for Vector Control	63%	0.2%	79%	93%	--	12%	2.2%

* Naled use for 2008 adjusted for San Joaquin County (Lucchesi 2010).

Pyrethrins were first registered in the United States for use as an insecticide in the 1950s. Pyrethrins are used on many agricultural crops; on livestock and animal husbandry premises; for treatment of commercial and industrial facilities and storage areas where raw and processed food/feed commodities are stored or processed; and for wide-area mosquito abatement in areas that include aquatic habitats. They are also used on outdoor household areas, pastureland, aquatic area or standing water, and for hospitals, recreational areas, ULV applications, and mosquito abatement programs (U.S. EPA 2006a; DPR 2009).

Permethrin has been registered by the U.S. EPA since 1979, and is currently registered and sold in a number of products such as household insect foggers and sprays, tick and flea sprays for yards, flea dips and sprays for cats and dogs, termite treatments, agricultural and livestock products, and mosquito abatement products. Permethrin is also used at urban areas, household gardens, recreation areas, golf courses, hospitals, zoos, pastureland, and animal husbandry areas (DPR 2009).

Resmethrin has been registered by the U.S. EPA since 1967, and is used to control flying and crawling insects in the home, lawn, garden, and industrial sites. It can also be used to control insects on ornamental plants (outdoor and greenhouse use), on pets and horses, and as a mosquitocide. Resmethrin is also used at commercial and industrial areas, warehouses, urban areas, and golf courses, and on aquatic areas or standing water, and selected agricultural crops. Because of its toxicity to fish, resmethrin is a restricted-use pesticide (RUP) for the purpose of public health mosquito abatement, and is available for this use only by certified pesticide applicators or persons under their direct supervision (U.S. EPA 2006b).

Phenothrin has been registered by the U.S. EPA since 1976, and is used to control adult mosquitoes, and as an insecticide in transport vehicles such as aircraft, ships, railroad cars, and truck trailers. It is also used as an insecticide and miticide in commercial, industrial, and institutional nonfood areas, in homes and gardens, in greenhouses, and in pet quarters and on pets, and is used in urban areas, outdoor residential areas, around buildings and structures, at recreational areas, golf courses, zoos, and for agricultural crops (DPR 2009).

Prallethrin is a synthetic pyrethroid with fast knock-down activity against household insect pests. It is used in household insecticide products against mosquitoes, houseflies, and cockroaches. Prallethrin also has veterinary uses in the treatment of domestic pets. Prallethrin has an exciting effect on mosquitoes, and is added to Duet (the only prallethrin-containing adulticide product used in California) primarily for this property rather than its inherent toxicity. Prallethrin has been applied in urban areas, outdoor residential areas, recreational areas, golf courses, around building and structures, and at areas of standing water (DPR 2009).

Etofenprox is a pyrethroid-like insecticide registered by the U.S. EPA since 2001. It is used as an indoor non-food crack and crevice insecticide, a spot treatment for pets, and as an outdoor fogger to control a variety of insect pests. Etofenprox is used in backyards, patios, barns, picnic areas, and other areas where flying and crawling insects are a problem. It is also used as a mosquito adulticide (U.S. EPA 2007c).

Malathion is an organophosphate insecticide that has been registered for use in the United States since 1956. It is used in agriculture, indoor and outdoor household areas, residential gardens,

food-processing areas, animal husbandry premises, and in public health pest control programs (DPR 2009).

Naled is an organophosphate insecticide that has been registered since 1959 for use in the United States. In addition to use for controlling adult mosquitoes, naled also has indoor and outdoor general use, and is used on food and feed crops, farms, dairies, pastureland, and in greenhouses and over standing water (DPR 2009).

3.1 MOSQUITO LARVICIDES

Mosquito control agencies in California moved away from the use of organophosphate insecticides in the 1970's. Today, MVCAC member agencies have chosen to use materials that are highly selective and have minimal toxicity for nontarget organisms. For most of the active ingredients in mosquito larvicides, a substantial amount of data is available on fate, transport, and aquatic toxicity. Available data on fate and transport for each active ingredient are summarized in Table 3-1.

3.1.1 Bacillus Thuringiensis

Persistence of Bti is low in the environment, usually lasting 1 to 4 days due to sensitivity to ultraviolet (UV) light (Table 3-1). The amount of toxins contained within *Bti* products is reported indirectly as the result of at least two different bioassays, and is difficult to equate to one another. Prepared volumes of toxins are applied to living mosquito larvae and the resulting mortality produces through formulae numerical measures known as International Toxic Units (ITUs) and *Ae. aegypti* International Toxic Units (AA-ITUs). These measures are only roughly related to observed efficacy in the field, and are therefore inappropriate to consolidate and report on like other toxicants (active ingredients). There is currently no chemical test that will differentiate Bti from mosquito control products from other spore forming bacilli existing in the environment.

Bti applied at label rates has virtually no adverse effects on applicators, livestock, or wildlife, including beneficial insects, annelid worms, flatworms, crustaceans, mollusks, fish, amphibians, reptiles, birds, or mammals (deBarjac et al. 1980; Garcia et al. 1981; Gharib and Hilsenhoff 1988; Holck and Meek 1987; Knepper and Walker 1989; Leclair et al. 1988; Marten et al. 1993; Merritt et al. 1989; Molloy et al. 1992; Miura et al. 1980; Mulla et al. 1983; Mulla et al. 1982; Purcell 1981; Reish et al. 1985; Siegel et al. 1987; Tietze et al. 1993,1992,1991; Tozer and Garcia 1990). However, non-target activity on larvae of some insect species closely related to mosquitoes and found with mosquito larvae in aquatic habitats has been observed. There have been reported impacts in larvae belonging to the midge families Chironomidae, Ceratopogonidae, and Dixidae (Anderson et al. 1996; Molloy 1992; Mulla et al. 1990; Rodcharoen et al. 1991; Tozer and Garcia 1990). These non-target insect species, taxonomically closely related to mosquitoes and black flies, apparently contain the necessary gut pH and enzymes to activate delta-endotoxins. However, the concentration of *Bti* required to cause these effects is 10 to 1,000 times higher than maximum allowed label rates for mosquito control.

Table 3-1. Persistence of the Active Ingredients of Mosquito Larvicides

Class	Active ingredient	Half-life	Degradation Method (and Matrix)	Reference
Microbial[1]	*Bacillus Sphaericus*	0.5-2 weeks	not reported (formulated product)	EPA 1999
	Bacillus Thuringiensis	1 - 4 days	UV light (foliage)	EPA 1998
		several months	not reported (soil)	EPA 1998
Surface agents	Monomolecular film[2]	5 - 7 days	not reported (water)	EPA 2007a
		5 - 22 days	not reported (water)	Cognis Corporation 2004
	Petroleum Distillates[3]	2 - 3 days	not reported (water)	EPA 2007b
Insect growth regulator	Diflubenzuron	2 days	aerobic metabolism (soil)	EPA 1997
		3.7 - 11.3 days	photolysis (soil)	EPA 1997
		34 days	anaerobic metabolism (water)	EPA 1997
		30 - 80 days	hydrolysis, pH 5-9 (water)	EPA 1997
		80 days	photolysis (water)	EPA 1997
		5.8 - 60 days	not reported (field data)	EPA 1997
	Methoprene[4]	rapid	photolysis (water and soil)	EPA 2001
		<1 day	photolysis (water)	ASTDR 2005
		<13 days	photolysis (water)	Csondes 2004
		10 - 14 days	aerobic and anaerobic metabolism (soil)	EPA 1991
		>150 days	not reported (briquettes in water)	Csondes 2004
Organophosphate	Temephos	rapid	not reported (natural waters)	EPA 2000
		>7 days	not reported (field data)	ASTDR 2005
Insect neuro-disruptor	Spinosad	0.84 - 0.96 day	photolysis (water)	Kollman 2002
		8.68 - 9.44 days	photolysis (soil)	Kollman 2002
		>30 days	hydrolysis, pH 7-9 (water)	Kollman 2002
		14.5 - 17.3 days	aerobic metabolism (soil)	Kollman 2002
		161 - 250 days	anaerobic metabolism (soil)	Kollman 2002

Notes:

[1] Formal environmental fate data is not generally required for microbial pesticides because it is not usually needed and it is difficult to evaluate due to the potential for microbial growth under suitable environmental conditions (EPA 1998).

[2] Alpha-Isooctadecyl-Omega-Hydroxypoly(Oxyethylene)

[3] Reported as either Petroleum Distillates or Refined Petroleum Distillates

[4] S-Methoprene is the active ingredient of Methoprene.

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Bacterial spores of *Bti* are uniquely toxic to nematoceran Diptera (mosquitoes, midges, blackflies, psychodids, and ceratopogonids) (Lacey and Mulla 1990). That result was reported after reviewing *Bti* studies conducted using a variety of *Bti* formulations, and under a variety of test conditions. Lacey and Mulla (1990) concluded that *Bti* was a highly selective larvicide that produced minimal adverse impact on the environment. Garcia et al. (1981) tested a total of 23 species of aquatic organisms other than mosquito larvae using various formulations of *Bti* in his laboratory. No mortality was observed for these species with the exception of *Chironomus maturus* and a *Simulium* sp. (black fly), which showed a degree of susceptibility similar to that of mosquito larvae. Miura et al. (1980) found *Bti* at rates used for mosquito control to be very safe to organisms associated with mosquito breeding habitats. A total of 28 species or species groups were treated with the bacterium under simulated or field conditions, with no adverse effects observed, except for chironomid larvae, which were slightly affected. However, the effect was so light that the population in the field continuously increased after the treatment. Miura et al. (1981) found *Bti* and *Bacillus sphaericus*, when applied at rates used for mosquito control, was very safe to organisms associated with mosquito breeding habitats, including the natural enemies of mosquito larvae. When various aquatic organisms were exposed to the bacteria under laboratory or field conditions, no adverse effect was noted on the organisms, with the exceptions of chironomid and psychodid larvae. Chironomid larvae were slightly affected by *Bti* treatment at a rate used for mosquito control, but pyschodid larvae were only affected at the higher concentration (50 parts per million [ppm]).

Exposure of brook trout (*Salvelinus fontinalis)* fry to 4,500 and 6,000 milligrams per liter (mg/L) Teknar (a liquid formulation of Bti) (more than 50 times the allowed label rate for mosquito control) for 45 minutes resulted in 20 and 86.4 percent mortality, respectively (Fortin et al., 1986). Some species of chironomids are also susceptible to *Bti*, but at doses 10 to 1,000 times higher than those used to control mosquito larvae (Becker and Margalit, 1993; Mulla et al., 1990b). *Bti* has been used extensively for control of mosquitoes in Germany without affecting populations of chironomids (Becker and Margalit 1993)

A number of *B. thuringiensis* fermentation-based products tested at high-dose levels have shown intrinsic toxicity to nontarget organisms. Investigations conducted to determine the source of the nontarget activity have implicated heat-labile soluble substances contaminating the technical material. Toxic effects have been seen in aquatic invertebrate *Daphnia magna*, the honeybee, some beneficial insects and fish (rainbow trout, bluegill) studies, with Daphnia being the most sensitive indicator of toxicity. The impurities are found in the supernatant fluids separate from the delta-endotoxins. The toxicity does not appear to be due to the heat-stable beta-exotoxin, because autoclaving of the test material renders the supernatant fluids innocuous. The heat-labile, soluble toxic impurities have thus far been seen in *B. thuringiensis* subspecies *kurstaki*, *aizawai*, and *israelensis*, but may possibly be present in other *B. thuringiensis* varieties. Damgaard (1995) reported varying levels of at least one soluble exotoxin in all commercial *B. thuringiensis* products tested (FEMS Immunology and Medical Microbiology 12:245-250). *B. thuringiensis* subspecies *aizawai*-based products show the greatest negative effects on nontarget organisms. With *B. thuringiensis* subspecies *kurstaki*, the manifestation of the toxin(s) appears to be at least partly related to production methodology, especially the composition of the growth media used in industrial fermentation. In response to concerns, the manufacturer of VectoBac has completed continuous 10-day exposure tests on *Daphnia magna* with the active ingredients found in VectoBac products (fermentation solids and solubles produced by *Bti* strain AM65-52).

Results indicated that the LC_{50} is higher than 50 ppm for *Daphnia magna* when exposed continuously for 10 days. Based on maximum label rates of VectoBac products, expected environmental concentrations (EEC) of active ingredients do not exceed 1 ppm immediately following application, based on a conservative assumption of a water depth of 10 cm. Therefore, application of VectoBac at label rates will not result in AI concentrations approaching 10 percent of the LC_{50} for *Daphnia magna* (DeChant2010).

3.1.2 Bacillus Sphaericus (Bs)

Isolation and identification of the primary toxin in *B. sphaericus* responsible for larval activity has demonstrated that it is a protein with a molecular weight of 43 to 55 kD. A standard bioassay similar to that used for *Bti* has been developed to determine preparation potencies. The bioassay uses *Culex quinquefasciatus* 3rd to 4th instar larvae. In contrast to *Bti*, field evaluations of VectoLex-CG (a commercial formulation of *B. sphaericus*) have shown environmental persistence for several weeks (Table 3-1; Mulla et al. 1988).

B. sphaericus has a very low toxicity for fish, and all aquatic invertebrates Levels that effective control mosquito larvae are many levels of magnitude below those which affect other organisms. Acute aquatic freshwater organism toxicity tests were conducted on bluegill sunfish, rainbow trout and daphnids. The 96-hour LC_{50} and No Observable Effect Concentration (NOEC) value for bluegill sunfish and rainbow trout was greater than 15.5 mg/LL; the 48-hour EC 50 and NOEC value for daphnids was greater than 15.5 mg/L. Acute aquatic saltwater organism toxicity tests were conducted on sheepshead minnows, shrimp and oysters. The 96-hour LC_{50} value for both sheepshead minnows and shrimp was 71 mg/L, while the NOEC value was 22 mg/L for sheepshead minnows and 50 mg/L for shrimp. The 96-hour EC_{50} value for oysters was 42 mg/L with an NOEC of 15 mg/L. The LC_{50} and NOEC value for immature mayflies was 15.5 mg/L. Additional studies on various microorganisms and invertebrates, specifically cladocerans, copepods, ostracods, mayflies, chironomid midges, water beetles, backswimmers, water boatmen, giant water bugs, and crawfish, have shown no adverse effects or negative impacts (Holck and Meek 1987; Miura et al. 1981; Mulla et al. 1984; Rodcharoen et al. 1991; Walton and Mulla 1991; Key and Scott 1992; Tietze et al. 1993). Furthermore, Ali (1991) states that although *B. sphaericus* is known to be highly toxic to mosquito larvae, *B. sphaericus* does not offer any potential for midge control.

Applications of B. sphaericus also leave populations of mosquito predators intact and do not cause secondary effects when treated larvae are consumed by other insects. Key and Scott (1992) conducted laboratory studies with *Bacillus sphaericus* on the grass shrimp *Palaemonetes pugio* and the mummichog *Fundulus heteroclitus*. Their study indicated that both *Bti* and *B. sphaericus* larvicides have large margins of safety. In a study by Aly and Mulla (1987), aquatic mosquito predators were fed with *Cx. quinquefasciatus* 4th instar larvae intoxicated with either *Bti* or *Bacillus sphaericus* preparations. Although the mosquito larvae contained large amounts of the bacterial preparations in their gut, no effect upon longevity or ability to molt was observed in the backswimmer *Notonecta undulata*, in naiads of the dragonfly *Tarnetrum corruptum*, or in naiads of the damselfly *Enallagma civile*. Equally, the reproduction of *N. undulata* and the predation rate and ability to emerge normally in *T corruptum* and *E. civile* were not affected by ingestion of large amounts of bacterial toxins.

3.1.3 Spinosad

Spinosad is rapidly and extensively photolyzed in water with a half life of less than one day (Table 3-1 and Goudie 2010). Photolysis results in degradates that are orders of magnitude less toxic than spinosad. Spinosad is moderately to strongly sorbed by soil particles (Goudie 2010).

Acute LC 50 values for bluegill and sheepshead minnow are greater than 5,000 ppb and 7,000 ppb, respectively, and the chronic NOAEC values for trout and sheepshead minnow are both greater than 1,000 ppb (Goudie 2010). Hertlein et al (2010) stated that no negative impacts were observed for individual mosquito fish held in water containing up to 50,000 ppb of spinosad. This material also has low acute toxicity for fresh and saltwater invertebrates, with an acute EC 50 of greater than 10,000 ppb for daphnia (Goudie 2010). The acute EC50 for oysters was greater than 300 ppb (Goudie 2010). Laboratory studies demonstrate some toxicity for some aquatic invertebrates under chronic exposure, but residues dissipate rapidly and are rapidly degraded by photolysis with a half life in water of less than half a day (Goudie 2010). Stark and Vargas (2003) reported a decline in *Daphnia pulex* when exposed to Spinosad in the laboratory. However, the organisms were held in a continuous renewal system, with fresh spinosad added every 24 hours. Mortality also occurred in daphnia held in plexiglass enclosures at a field site during applications of spinosad (Duchet et al 2008) However, mortality occurred immediately after the applications and the authors also noted that the spinosad dissipated rapidly from the water column and was detected at 4 to 13 percent of the initial concentrations (8 to 33 µg/L) in water 4 days after its application (Duchet et al 2008). Hertlein et al. (2010), reporting an unpublished study by Laddoni (2006) noted slight impacts on non-mosquito insects (Dyticsidae, Hesteridae, Libelluledae, Notonectidae) were observed in an artificial pond treated with 50 ppb or 50 g/ha of spinosad. But this is far below field use rates and the authors concluded that spinosad was minimally disruptive to nontargets when applied near field use rates (15-25 ppb).

3.1.4 Monomolecular Film

Agnique is the trade name for a recently reissued surface film larvicide, comprised of ethoxylated alcohol. Molecular film larvicides spread across water surfaces and disrupt larval respiration, killing mosquitoes and some other classes of air-breathing aquatic insects. Reported half-lives of monomolecular films in water range from 5 to 22 days (Table 3-1), and Agnique has an average persistence in the environment of 5 to 21 days at label application rates (Oester 2010). A number of efficacy and nontarget studies had been conducted on this material when it was registered under the name Aerosurf. Minor proprietary changes in preparation did not apparently change any of the material's potential environmental impacts; therefore, the earlier literature is referenced.

Most published studies conducted with this larvicide tested application rates of 3 to 100 times the maximum label rate. At these rates, no observable effect on mortality or development was noted in tests on green tree frogs, seven species of fresh and salt water fish, two species of shrimp, five species of water beetle, or one species each of fairy shrimp, crayfish, snail, polychaete worm, mayfly naiad, copepod, ostracod, or midge. In addition, no effect was seen on five species of plants. Air (surface) breathing insects were temporarily adversely impacted. Waterboatmen, backswimmers, and one species of water beetle exhibited increased mortality at application rates above label limits. In addition, a clam shrimp, a crab, an amphipod, and one species of isopod

exhibited minor to significant increases in mortality at levels several times the highest application rate allowed by the label (Oester 2010).

3.1.5 Petroleum Distillates

Petroleum distillates ore effective in many situations in which monomolecular films do not give effective control. These materials also break down much more rapidly than monomolecular films (2-3 days as opposed to 21 days) which further decrecreases their impact to nontarget organisms (Table 3-1).

The safety of petroleum distillates for nontargets has been demonstrated by both laboratory and field studies. Three studies by Tietze et al. (1991, 1992, 1994) tested three species of fish (Inland Silversides, Mosquitofish, and Sheepshead Minnows), and a range of microorganisms and concluded that petroleum distillate formulation GB-1111is not toxic to the tested organisms at label application rates. Mulla and Darwazeh (1981) tested with GB-1111 in small experimental ponds and found that benthic invertebrates (including mayflies, dragonflies, and damselflies) were unaffected, while populations of surface-breathing insects were temporarily reduced, following application of this larvicide. Miles et al. (2002) completed an independent study of non-target effects of GB-1111, with financial assistance from the U.S. Fish and Wildlife Service (USFWS), on the tidal marshes of the Don Edwards National Wildlife Refuge in San Francisco Bay near Newark, California, and observed the following effects: 1) surface-breathing insect populations were reduced at the time of treatment; 2) this effect did not persist beyond a few days (no residual pesticide effects); 3) those potentially affected animals with high mobility left the site, while some of those that could not leave died (especially water boatmen (Corixidae)); and 4) overall populations of invertebrate species were not affected, apparently because of recolonization from neighboring untreated sites.

3.1.6 Methoprene

s-Methoprene is a very short-lived material in nature, with a half-life less than 13 days in water (Table 3-1), two days in plants, and 10 days in soil (Wright 1976; La Clair et al. 1998). It degrades quickly in soil or groundwater and exposed water (Wright 1976). Eighty percent of the material is removed by degradation within 13 days of application to water (U.S. EPA 1991). Methoprene is applied at very low concentrations for mosquito control. The manufacturer has developed a number of formulations to maintain an effective level of the active material in the mosquito habitat (0.5 to 3.0 parts per billion [ppb[1]]; (Scientific Peer Review Panel 1996) for a practical duration, thus minimizing the cost and potential impacts associated with high-frequency repeat applications (see Table 2-4). Rate of release and data generated under laboratory and field conditions with methoprene mosquito product formulations, including slow release briquet formulations, indicate a maximal rate of release of ≤4 ppb (U.S. EPA 2001). Ross et al. (1994) conducted microcosm studies which applied 5 sustained release methoprene formulations at maximum label application rates to tanks containing water 6 inches deep. Methoprene

concentrations were measured 1, 2, 4, 7, 14, 21, 28 and 35 days after treatment, and the highest methoprene concentration measured was 6 ppb.

Methoprene is a material with very high specificity in its mode of action. Exhaustive reviews of the published literature on this material attest to its lack of adverse environmental impact (Mian and Mulla 1982; Scientific Peer Review Panel 1996; Glare and O'Callaghan 1999; Office of the Minnesota Legislative Auditor 1999; U.S. EPA 2001). The acute, short-term toxicity of ZR-515 (methoprene) was also tested on 35 aquatic organisms, including Protozoa, Platyhelminths, Rotatoria, Annelida, Arthropoda, Mollusca, Chordata and Thallophyta, and LC_{50} values of 0.9 to 5.0 ppm were calculated (250 to 1,000 times label rates) (Miura and Takahashi 1973). Dosages used for larval mosquito control produced no adverse effect on the organisms tested, except for some sensitivity in the aquatic Diptera (flies) in the families Chironomidae, Ephydridae, and Psychodidae.

Bircher and Ruber (1988) assessed the toxicity of methoprene to all lifecycle stages of the salt marsh copepod (*Apocyclops spartinus*) at concentrations ranging from 100 to 10,000 ppb. In general, the copepods were resistant to concentrations of methoprene used to control mosquitoes, but early larval stages did show some mortalities (the calculated 48-hour LC_{50}, adjusted for control mortality, was 800 ppb). Christiansen et al. (1977) showed a reduction in survival of larvae of the mud-crab *Rhithropanopeus harrisii* (Gould) in the laboratory under a range of salinity and temperature conditions, when exposed to 10, 100, and 1,000 ppb methoprene, levels 5 to 500 times field application rates. McKenney and Mathews (1988) reported that larval survival, growth, and energy metabolism of an estuarine shrimp *Palaemonetes pugio* were altered by exposure to 100 ppb of methoprene (50 times greater than application rates). However, Wirth et al. (2001) reported no observed differences in the percent successfully hatching or larval mortality 3 days post hatch in *P. pugio* exposed for 96 hours to 1000 ppb. In addition, in 2005, Suffolk County conducted 4-day static renewal toxicity tests on grass shrimp (*Palaemonetes pugio*) using water collected 30 minutes after aerial application of methoprene for mosquito control and observed no toxicity. Similar investigations have been carried out with *Leander tenuiconis*, an estuary shrimp that occurs in Australian intertidal marshes. Methoprene was nontoxic at field application levels in 96-hour toxicity tests (Brown et al. 1996). The LC_{50} of methoprene for *L tenuiconis* (14,320 ppb) in these tests was 1,790 times field concentrations when applied at label rates. The authors concluded that methoprene could be safely applied in situations where the shrimp were present and that no mortality of shrimp was likely at the levels applied for mosquito control. Further laboratory work by Brown et al. (2000), found that the dose lethal to mosquitoes (*Culex annulirostris*) was 3,000 times below the LC_{95} for shrimp (*Caradina indistincta)*. Zulkosky et al. (2005) investigated potential effect of methoprene runoff to larval lobsters (*Homarus americanus*) in continuous flow-through systems for 48 hours: methoprene was not toxic at the highest concentration tested (10 micrograms per liter [µg/L] or 10 ppb). Laboratory studies with fish demonstrated that methoprene had no effect on the survival of adult and juvenile rainbowfish (*Melanotaenia duboulayi*) (Brown 2002). No effect was observed on swimming performance of rainbowfish when exposed to up to ten times effective field concentrations of applications made for mosquito control (Hurst et al. 2007).

Methoprene does not have adverse effects on amphibians. Tests conducted on various life stages of different amphibian species (*Bufo woodhousei*, *Rana catesbeiana* and *Rana pipiens*) found no adverse effects from acute or chronic exposures at the highest dose tested. Acute studies on

R. catesbeiana and *R. pipiens* larvae indicate LC_{50} values >10,000 ppb and *B. woodhousei* adult LC_{50} values >1,000 ppb (highest dose tested). Chronic studies on *B. woodhousei* indicate a 22-day LC_{50} >1,000 ppb and LC_{50} > 1,000 ppb for *R. catesbeiana* and *R. pipiens*. (U.S. EPA 2001).

One early field study assessing applications of technical (pure powdered) methoprene on a Louisiana coastal marsh yielded ambiguous results (Breaud et al. 1977). Highly significant declines were observed in the occurrence of 14 invertebrates immediately following the application, including selected life stages and species of amphipods, shrimp, mayflies, dance flies, midges, freshwater snails, damselflies and dragonflies, and water beetles. However, the abundance of five other invertebrates significantly increased including water boatmen, moth flies, two species of crawfish, and predaceous diving beetles. No statistically significant difference was seen between the test and control populations of another 28 aquatic organisms. Interpretation of this study is difficult in part because of the mixed nature of the results, which may simply indicate the complexity of ecosystem dynamics in marshlands. Also, the application rate (28 gm AI/ha technical powder) was at least twice the highest label rate of active ingredient allowed today, and was effectively much higher when the encapsulation and other coatings on modern formulations are considered. The relevance of Breaud et al.'s entire experiment as a legitimate field study may be called into question, as the properties of technical grade methoprene powder render it unfit for any type of direct field application under current label restrictions.

Since the publication of Breaud et al. (1977), there have been numerous field studies using currently available mosquito control products containing methoprene, in which no detectable effect was observed in aquatic invertebrates. For example, no detectable mortality occurred in Talitridae amphipods exposed to aerial applications of Altosid to a Florida mangrove swamp in 1999 (Lawler et al. 1999b). A similar study assessed applications of a sustained release formulation of methoprene and a combined liquid formulation of Bti and methoprene (duplex) to tidal wetlands of San Francisco Bay. No difference was seen in growth or development of corixid beetles, and no difference in the number of nontarget insects inhabiting treated versus untreated plots (Lawler et al. 2000). The authors also monitored brine flies at treated and untreated sites using sentinel cages, and sampled populations with sweep nets. No decline was observed in flies relative to controls collected by sweep nets. Caging of sentinels was unsuccessful at assessing impacts, since none of the caged flies survived at untreated sites or treated ones.

Aerial applications of liquid methoprene on saltmarsh habitat have also been assessed in Australia (Russell et al. 2009). Changes in assemblages of invertebrates through time were observed in both treated and untreated (control) plots. No significant effects were seen on arthropods in ephemeral pools. There was no significant difference in abundance of nonmosquito dipterans (flies), heteropterans (true bugs), and hymenopterans (primarily ants) in treated versus untreated sites. Some differences were observed in copepod populations during the treatment period, but these were short-term or inconsistent between localities or between sampling method. The authors concluded that applications of Bti and methoprene to salt marshes do not affect the structure or composition of assemblages of nontarget arthropods (Russell et al. 2009).

Published studies on nontarget impacts of methoprene for mosquito control were reviewed most recently by Davis (2007) and by Davis and Peterson (2008). The authors also carried out an ecological risk assessment of mosquito larvicides in a series of ponds at the Benton Lakes National Wildlife Refuge in Montana. *Bti* and methoprene were applied directly to water as liquids, and aquatic arthropods were sampled following the applications. No overall treatment effects were observed on aquatic nontarget invertebrates collected in D-shaped net samples. A linear model was then fitted to each of the response variables to determine multivariate treatment effects. Data indicated a possible acute impact on amphipods immediately following application, but no significant effect at 7 to 28 days. No trend was seen across dependant groups of nontarget organisms, and there were no persistent biological effects.

Careful review of these and other studies, and the recent reviewers listed above leads to the conclusion that: 1) applications of methoprene (especiallytechnical powder) at rates significantly higher than allowed by the label can adversely impact a number of aquatic animals; 2) animal species are not extirpated (locally eliminated) by repeated methoprene use except at application rates far higher than those used for mosquito control; 3) emergence of adults of some fly species (specifically, some types of midges) can be temporarily reduced at application rates similar to those used for mosquito control; 4) larval flies affected by methoprene are not killed at label application rates, but are prevented from becoming adults; 5) for species that are affected by methoprene, recolonization and reestablishment of populations from neighboring sites is fast once intense control was relaxed; 6) the patchy distribution of mosquito larvae leads to maintenance of untreated refugia for non-targets, speeding recolonization; and 7) no bioaccumulation of methoprene has been seen in animals that have eaten mosquito or midge larvae treated with methoprene.

3.1.7 Temephos

Temephos is an extremely hydrophobic material with low solubility. It adsorbs rapidly onto organic material in the water and degrades to low or undetectable concentrations (U.S. EPA 2000). The Registration Eligibility Decision (RED) cites a study submitted by the registrant in which temephos was monitored in sediments following field applications for mosquito control over a 3-year period. The active ingredient became undetectable in sediment after 24 hours (U.S. EPA 2000) (Table 3-1). Temephos breaks down rapidly in water through photodegradation and bacterial degradation (U.S. EPA 2000). The liquid and BG formulation products are designed to deliver the active ingredient to the water surface in order to maximize exposure of mosquito larvae. Lores et al. (1985) found that concentrations in water of 15 to 60 ppb immediately following the application declined to 2 to 5 ppb within 24 hours. Sanders et al. (1981) reported similar results. Pierce et al. (1989) examined aerial application of liquid formulation of temephos to a mangrove swamp in Florida, and found the material had become undetectable 4 hours after the application in intertidal water. It persisted in simulated intertidal pools for 72 hours.

Temephos is a cholinesterase inhibitor with low toxicity for vertebrates at the levels used for mosquito control (U.S. EPA 2000). However, it is toxic to insects and some other invertebrates (Brown et al. 1996), and the margin of safety between concentrations effective for mosquito

control and levels at which nontarget impacts occur is much narrower than that of s-methoprene or the bacterial larvicides (Brown 1999, Lawler et al. 1999, Hurst et al. 2007).

Temephos is slightly to moderately toxic to fish (U.S. EPA 2000); however, field applications result in concentrations of temephos far lower than that at which fish are affected. Field studies have repeatedly demonstrated a lack of impact on fish inhabiting treated sites. Mulla et al. (1964) reported that temephos was nontoxic to mosquito fish that were confined in screened cages for one week in artificial ponds treated with 0.1 pound per acre AI. Similarly, no significant mortality was observed in juvenile snook (*Centroponzis undecimalis*) or sheepshead minnow (*Cyprinodon variegatus*) caged in a mangrove swamp treated with aerial applications of liquid temephos (Pierce et al. 1989). Tietze et al. (1999) demonstrated in Tietze et al., 1991 laboratory tests that liquid formulations of temephos were nontoxic to young mosquitofish (3 to 5 days old) at field application rates. Mosquitofish exhibited no mortality when exposed to up to 100 times field application rates.

Temephos is highly toxic to aquatic invertebrates, but many groups are only impacted at concentrations far above those used for mosquito control applications (U.S. EPA 2000). Von Windeguth and Patterson (1966) conducted laboratory tests on temephos and fenthion (another organophosphate) to determine margin of safety for treatment of midges in a lake. The dose of fenthion used for midges was above that which caused mortality in shrimp and amphipods. Abate (temephos) was less toxic to most aquatic nontarget organisms than fenthion and not toxic to shrimp (*Palomonetes paladosus*) and amphipods (*Hyalella azteca*) at concentrations used for mosquito control applications (LD_{50} was 1 ppm and 0.65 ppm, respectively). Neither product was toxic to fish at levels necessary to kill midge larvae (0.25 lb AI per acre). In field tests, they reported that no noticeable mortality was observed for Odonates (dragonflies), copepods, ostracods, or shrimp (Von Windeguth and Patterson 1966).

Temephos does have an immediate impact on some groups of planktonic crustaceans, with copepods and brachiopods (cladocera) being more sensitive than amphipods or ostracods. Fortin et al. (1987) studied the impact of temephos on non-target organisms in rectangular manmade pods. Application of temephos resulted in an immediate reduction in populations of copepods and cladocerans, but populations began to recover within 3 days and had reached pre-treatment levels within 2 to 3 weeks. Ostracopods in the ponds were not affected. Helgen et al. (1988) also reported sharp reductions in populations of calanoid copepods (*Diaptomus leptopus*) and cladocreans (*Daphnia pulex*, *Simocephalus* sp., and Chydoridae) following applications of temephos. Copepods exhibited varying degrees of recovery. However, some cladocerans remained absent from the treated area for up to 35 days. In an open field setting, Lawler et al. (1999) reported that aerial applications of temephos to a mangrove swamp in Florida resulted in no observable effect on survival of amphipods (Talitridae), the primary nontarget organism present.

Temephos is a broad-spectrum insecticide, and has been used operationally to control midges and black flies for many years. However, the concentration that effectively controls mosquito larvae is well below that needed for control of other insects. In addition, midges and black flies are found in different habitats than larval mosquitoes. The larval stage of most midges develop in sediment at the bottom of water bodies, while black flies develop attached to hard surfaces in swift moving rivers and streams. Materials commercially available for midge control are heavy

and designed to release their active ingredients on the floor of the water body, those for control of black flies are placed in flowing streams and allowed to move down with the current.

Several studies have evaluated effects on nontarget insects. A field study of repeated applications of temephos to a saltmarsh in New Jersey concluded that species richness, diversity, and community structure of aquatic insects was unaffected (Campbell and Denno 1976). Stoneflies and mayflies are particularly susceptible to temephos and the label carries a prohibition against applying Abate in habitats containing these organisms.

Many of the studies of nontarget effects have looked at organisms inhabiting saltmarsh environments or flowing streams (Pinkney et al. 1999; Ward et al. 1976; Lawler et al. 1999 Brown et al. 1999). However, in California, temephos has not been used in salt marshes or in flowing streams for many years.

3.2 MOSQUITO ADULTICIDES

For most of the active ingredients in mosquito adulticides, a substantial amount of data is available on fate, transport, and aquatic toxicity. Available data on fate and transport for each active ingredient are summarized in Table 3-2. This table also includes the toxicity-based Receiving Water Monitoring Trigger levels adopted by the SWRCB. These trigger levels are based on the acute water quality objectives when available. When no water quality objective is available, the trigger values are based on the lowest freshwater LC_{50} divided by a factor of 10.

This section focuses on data collected specifically in studies done on ULV application of mosquito adulticides. As discussed in Section 2.3, most active ingredients in adulticides are also used for many other purposes, and a substantial amount of data has been collected for other uses. However, the characteristics of ULV applications are quite different from other applications, such as those made for agricultural crops. These differences can have dramatic differences in the fate and transport of the active ingredients. Some of these differences include:

Table 3-2. Persistence of the Active Ingredients of Mosquito Adulticides

Class	Active ingredient	Half-life		Degradation Method (and Matrix)	Reference
Pyrethrins (naturally occurring chemicals in pyrethrum)	Pyrethrins[1]	< 1	day	Photolysis (water and soil)	U.S. EPA 2006a (RED), Gunasekara 2005
		14-17	hrs	Hydrolysis, pH 9 (water)	U.S. EPA 2006a (RED)
		86.1	days	Anaerobic metabolism (soil)	U.S. EPA 2006a (RED)
		10.5	days	Aerobic metabolism (soil)	U.S. EPA 2006a (RED)
		1.8 – 97	days[2]	Volatilization (soil)	Gunasekara 2005
		"slow"		Hydrolysis, neutral or acidic	U.S. EPA 2006a (RED)
Pyrethroids (synthetic)	d-phenothrin (Sumithrin®)	6.5	days	Photolysis (water)	U.S. EPA 2008 (RED)
		18.6 – 25.8	days	Aerobic metabolism (soil)	U.S. EPA 2008 (RED)
		36.1	days	Aerobic metabolism (water)	U.S. EPA 2008 (RED)
		173.3	days	Anaerobic metabolism (water)	U.S. EPA 2008 (RED)
		stable		Hydrolysis, all pH levels	U.S. EPA 2008 (RED)
	Resmethrin	22	minutes	Photolysis (seawater)	U.S. EPA 2006b (RED)
		47	minutes	Photolysis (distilled water)	U.S. EPA 2006b (RED)
		198	days	Aerobic metabolism (soil)	U.S. EPA 2006b (RED)
		37	days	Aerobic metabolism (water)	U.S. EPA 2006b (RED)
		stable		Anaerobic metabolism (soil)	U.S. EPA 2006b (RED)
		> 89	days	Hydrolysis, pH 5 – 9	U.S. EPA 2006b (RED)
	Permethrin	stable		Hydrolysis, pH 5 – 7	U.S. EPA 2009a (RED), Imgrund 2003
		242	days	Hydrolysis, pH 9	Imgrund 2003
		125 – 350	days	Aquatic degradation, pH 9	U.S. EPA 2009a (RED)
		113 – 175	days	Anaerobic degradation (water)	U.S. EPA 2009a (RED)
		51 – 100	days	Photolysis, pH 5 (water)	Imgrund 2003
		< 3 – 197	days	Anaerobic degradation (soil)	Imgrund 2003

Table 3-2. Persistence of the Active Ingredients of Mosquito Adulticides

Class	Active ingredient	Half-life		Degradation Method (and Matrix)	Reference
		3.5 – 113	days	Aerobic degradation (soil)	Imgrund 2003
		104 – 324	days	Photolysis (soil)	Imgrund 2003
		< 2.5	days	Sediment/seawater degradation	Imgrund 2003
		1.8 – 20.4	hours	Streams, pH 7.0 – 7.5, 13 – 15°C	Imgrund 2003
		19.6 – 27.1	hours	Photolysis, ponds (water)	Imgrund 2003
	Prallethrin	25	days	Photolysis (soil)	Sumitomo Chemical 2009
		13.6	hours	Photolysis (water)	Sumitomo Chemical 2009
	Etofenprox	4.4	days	Photolysis (soil)	Central Life Sciences 2009
		1.7	days	Photolysis (water)	Central Life Sciences 2009
Synergist for pyrethrins& pyrethroids	Piperonyl Butoxide (PBO)	8.4	hours	Photolysis (water)	U.S. EPA 2006c (RED)
		"very slow"		Hydrolysis & aerobic/anerobic metabolism	U.S. EPA 2006c (RED)
Organophosphates	Naled	< 2	days	Hydrolysis & biodegradation (water & soil)	U.S. EPA 2006d (RED)
		"high"		Volatilization (soil)	U.S. EPA 2006d (RED)
	Dichlorvos (DDVP) (degradation product of Naled)	0.88 – 11.6	days	Hydrolysis, pH 5 – 9	U.S. EPA 2006e (RED)
		8.9 – 10.2	days	Photolysis (water)	U.S. EPA 2006e (RED)
		15.5 – 16.5	hours	Photolysis (soil)	U.S. EPA 2006e (RED)
		10.18	hours	Aerobic metabolism (soil)	U.S. EPA 2006e (RED)
		6.3	days	Anaerobic metabolism (soil)	U.S. EPA 2006e (RED)
	Malathion	0.1 – 11	days	Aerobic metabolism (soil)	U.S. EPA 2009b (RED), Newhart 2006
		0.67 – 42	days	Photodegradation (water)	U.S. EPA 2009b (RED)
		1 – 14	days	Aerobic metabolism (water)	U.S. EPA 2009b (RED)
		persistent		Anaerobic degradation (water)	U.S. EPA 2009b (RED)

Table 3-2. Persistence of the Active Ingredients of Mosquito Adulticides

Class	Active ingredient	Half-life		Degradation Method (and Matrix)	Reference
		1.4 – 147	days	Aerobic degradation (water)	Newhart 2006

Note:
[1] Pyrethrins are a mix of Pyrethrin I, Pyrethrin II, Cinerin I, Cinerin II, Jasmolin I, and Jasmolin II
[2] Estimated value

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- ULV applications are designed to maximize the duration of the pesticide in the air, rather than deposition on surfaces;
- ULV applications are designed to use drift to increase coverage; and
- Adulticides are often applied adjacent to or over water bodies.

Because of these differences, data from studies done on agricultural applications or other types of applications may have limited relevance for mosquito control applications. Therefore, MVCAC and the SWRCB agreed it was important to compile and review the results of studies done specifically on ULV applications of mosquito adulticides.

3.2.1 Pyrethrins (in Formulations with PBO)

Pyrethrins are composed of a mixture of six compounds: pyrethrin I and II, cinerin I and II, and jasmolin I and II. As shown in Table 3-2 the photolysis half-life in water and soil is less than one day, and the hydrolysis half-life in water is 14 to 17 hours. They adsorb strongly to soil surfaces and are generally considered immobile in soils; therefore, the potential to leach into groundwater is considered low. Pyrethrins quickly adsorb to suspended solids in the water column, and partition into the sediment. Non-degraded pyrethrins are likely to bind to sediment, because they persist under anaerobic conditions (U.S. EPA 2006a).

Pyrethrins are contact poisons that can quickly penetrate the neural system. Although pyrethrins have an effective "knockdown" action (induction of temporary paralysis), they do not necessarily have high killing properties by themselves. These compounds are moderately persistent under certain environmental conditions, but are quickly metabolized under other conditions, such as in the presence of sunlight. In order to delay the metabolic action (inhibition of microsomal enzymes) so that a lethal dose is assured, the synergist PBO is added to the mosquito adulticides (U.S. EPA 2006a).

3.2.1.1 Receiving Water Monitoring Triggers

The SWRCB has adopted a Receiving Water Monitoring Trigger for pyrethrins of 0.32 µg/L, based on freshwater aquatic life toxicity data from U.S. EPA's Office of Pesticides' Ecotoxicity Database. The SWRCB identified the lowest LC_{50} of 3.2 µg/L based on toxicity to rainbow trout during a 96-hour test, and their monitoring trigger value is one-tenth of that value (see Table 3-3).

The SWRCB has a Receiving Water Monitoring Trigger for PBO of 0.34 µg/L when applied in a pyrethrins formulation, which is also based on toxicity data from U.S. EPA's Office of Pesticides' Ecotoxicity Database. The SWRCB monitoring trigger value is one-tenth of the lowest LC_{50} of 3.4 µg/L, based on toxicity to bluegill sunfish during a 96-hour test (see Table 3-3).

Table 3-3. Summary of Existing Study Results for ULV Applications

Active Ingredient	Product	Method of Application	Application Rate	Monitoring Trigger in ppb (water)	Field Results in ppb (water)	Field Results in ppb (sediment)	Time Sampled	Type of Sample	Notes	Reference
Pyrethrin	Evergreen Crop Protection EC 60-6	Aerial	2.8 g/ha AI	0.32	<0.5 @ 1, 12, and 24 hr 0.213, jasmolin II @ 36 hrs		1, 12, 24, 36 hours	H_2O 2-6 cm below surface Cotton pads	1 river, 7 creeks and a pond Jasmolin not detected at 24 hrs but appeared @ 36 hr, from another source	Schleier et al. 2008
	Evergreen Crop Protection EC 60-6	Aerial	2.8 g/ha AI	0.32	Average 0.270; <0.2 – **3.77** (Imm.) <0.2 @ 16-23 hrs		Immediately (1 to 6 hours) 16 to 23 hours	H_2O Mid-depth 10 sites	No significant increase after multiple applications	Larry Walker & Assoc. 2006
	Evergreen Crop Protection EC 60-6	Aerial	2.8 g/ha AI	0.32	<0.05	Average 184.51; <1 – 403	10 to 34 hours	H_2O 10-20 cm below surface and Sediment	No water caused significant mort in 7 days (for Ceriodaphnia dubia) Sediment in samples taken before spray was toxic to Hyalella	Weston et al. 2006
	Pyrocide™ 5%	Truck	0.118 L/min; 16 kph truck speed 1-31 µm droplets	0.32	<20		1 hour	Water column	No significant mortality in caged mosquito larvae, mosquitofish or invertebrates sampled Analytical method not specified (UC Davis) Permethrin and malathion were also applied to wetlands during this study	Jensen et al. 1999
	Pyrenone 25-5 Public Health Insecticide	Truck	0.458 g AI/ha	0.32		Average 4.9; <2 - 33.1 after Spray #5 Average 3.2; <2 - 34.5 after spray # 11	within 12 hours	Sediment only	23 & 33 µg/kg in 2 of 6 tanks after spray #5; 34.5 µg/kg in 1 of 6 tanks after spray #11; Detection limits 2 µg/kg – CDFG lab No accumulation of pyrethrins in water or sediment	Lawler et al. 2008
PBO (with Pyrethrins)	Evergreen Crop Protection EC 60-6	Aerial	28 g/ha PBO	0.34	0.012-0.172 @ Princeton site 0.073 – **1.274** @ Colusa site		1, 12, 24, 36 hours	H_2O and Sediment	Background concentration = 0.008 µg/L at Princeton and 0.218 µg/L at Colusa. For water, 36 hrs after Tx PBO returned to pre Tx levels or near that level (0.012 @ 36 hrs for 1 site). Results were 0.172 & 1.274 @ 1 hr after	Schleier et al. 2008
	Evergreen Crop Protection EC 60-6	Aerial	28 g/ha PBO	0.34	Average **2.036**; <1.0 – **20** ppb (Imm.) Average **0.853**; <1.0 – **4.2** @ 16-23 hrs		Imm. (1 to 6 hours) 16 to 23 hours	H_2O Mid-depth 10 sites		Larry Walker & Assoc. 2006
	Evergreen Crop Protection EC 60-6	Aerial	28 g/ha PBO	0.34	Average **1.96**; **0.44 - 3.92**	Average 22.05; <1 – 61.4	10 to 34 hours	H_2O 10-20 cm below surface and Sediment	Prior to application, PBO was <0.01 to 0.2 µg/L	Weston et al. 2006
	Pyrenone 25-5 Public Health Insecticide	Truck	0.458 g AI/ha	0.34		Average 4.76; <2 – 14.9 after spray #5 Average 0.37; <2 – 2.55 after spray #11	within 12 hours	Sediment only	No accumulation of PBO in water or sediment	Lawler et al. 2008
	Pyrenone 25-5 Public Health Insecticide	Truck	Biweekly application 9/9-10/13	0.34	Average 0.01; <0.01 – 0.08 <0.01 @ 1 week	Average 0.392; <2 – 3.27 <2 @ 1 week	12 hours 1 week after last application	Water and Sediment	PBO detected in H_2O after spray #2, #3, & #8 @ 0.04,0.06, 0.08 ppb on 3 of 18 samples taken; PBO detected in sediment after spray #6 & #7 @ 3, 3.27 ppb in 2 of 18 samples Peak sediment concetrations were fourfold below effective synergistic concentration Returned to baseline by 1 week 8 biweekly applications, no accumulation	Amweg et al. 2006
Permethrin	Permanone	Truck	0.4 L/ ha; Wt AI not given	0.03	<0.07 – **9.4** @ surface; <0.07 @ 20 cm (2-4 hr)		2-4 hrs, 12 hrs	Filters and H_2O column	3 applications; Droplet size not characterized; Permeth by truck, Naled by plane	Pierce et al. 2005

Table 3-3. Summary of Existing Study Results for ULV Applications

Active Ingredient	Product	Method of Application	Application Rate	Monitoring Trigger in ppb (water)	Field Results in ppb (water)	Field Results in ppb (sediment)	Time Sampled	Type of Sample	Notes	Reference
			Max label rate is 8 g AI/ha		<0.07 @ 12 hr				5.1 to 9.4 ppb in surface microlayer of canal but not detected at 20 cm. Occurred during last sampling event.	
	Biomist	Truck	0.148 L/min; 16 kph truck speed; 1-31 micron droplet size	0.03	<20		1 hr	Water column	No significant mortality in caged mosquito larvae, mosquitofish or invertebrates sampled. Analytical method not specified (UC Davis)	Jensen et al. 1999
	AquaReslin	Truck	7.8 g AI/ha	0.03				Sampled inverts	No significant effect on aquatic or terrestrial inverts	Davis & Peterson 2008
Resmethrin	Scourge	Aerial		0.028	Average **0.037**; <0.005 – **0.293**		30 min; time series of 20 min to 96 hrs	Water 6 in. below surface	1:3 ratio of the pyrethroid resmethrin to the synergist piperonyl butoxide (PBO); Analytical Method: Zimmerman et al. 2001 Values return to pre Tx levels by 9 hrs post Tx (time series)	Abbene et al. 2005
	Scourge	Aerial		0.028					Doses used in the spray were not directly toxic to estuarine grass shrimp (*Palaemonetes pugio*) and did not affect their ability to capture prey under controlled conditions; mortality seen in the field could have been caused by low dissolved oxygen alone.	Suffolk County 2006
	Scourge	Aerial or Truck		0.028	<0.0005 – **0.98**		<1 hr	Water column	Detected in 5 of 10 locations	Zulkowsky 2005
	Scourge	Truck		0.028	<0.005		<2 hrs	Water column	6 sites	Abbene et al. 2005
PBO (with Resmethrin)	Scourge	Aerial		0.24	Average **4.361**; <0.005 – **59.8**		30 min; time series of 20 min to 96 hrs	Water 6 in. below surface	Values return to pre Tx levels by 96 hrs post Tx (time series)	Abbene et al. 2005
	Scourge	Aerial or Truck		0.24	<0.0005 – **15**		<1 hr	Water column	Detected in 9 of 10 locations; still present at three locations in samples collected 3 days after a Scourge spray	Zulkowsky 2005
	Scourge	Truck		0.24	<0.005 – 0.017		<2 hrs	Water column	6 sites	Abbene et al. 2005
d-Phenothrin (Sumithrin)	Anvil 10+10 ULV	Aerial		0.14	ND		Not given	water	6 sites	Mass. Dep of Ag 2006
	Not given	Aerial or Truck		0.14	<0.5 – **1.1**		Not given	water	32 locations and 68 samples; 2 detections (0.55and 1.1 ppb) New York City Department of Health	Suffolk County 2006
	Anvil	Truck		0.14	0.0011 @ Imm. <0.0005 @ 1 to 10 days		Imm., 1, 2, 3, 10 day	Water column	1.1 ng/L immediately post treatment No det @ 1 hr PT @ 2 other sites	Zulkowsky 2005
	Anvil 10+10 ULV	Truck	4 g AI/ha	0.14				Sampled inverts	Reductions in aquatic nontarget populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application.	Davis & Peterson 2008
PBO (with Sumithrin)	Anvil 10+10 ULV	Aerial		180	ND 0.12		Not given	water	6 sites	Mass Dep of Ag 2006
	Not given	Aerial or Truck		180	<0.5 – 1.03		Not given	water	32 locations and 68 samples; 1 detection - New York City Department of Health	Suffolk County 2006

Table 3-3. Summary of Existing Study Results for ULV Applications

Active Ingredient	Product	Method of Application	Application Rate	Monitoring Trigger in ppb (water)	Field Results in ppb (water)	Field Results in ppb (sediment)	Time Sampled	Type of Sample	Notes	Reference
PBO (with Sumithrin) (cont)	Anvil	Truck		180	0.02 @ Imm. 0.00033 – 0.057 @ 1 day <0.0005 to 0.007 @10 day		Imm., 1, 2, 3, 10 day	Water column		Zulkowsky 2005
Naled	Dibrom liquid concentrate	Aerial	0.128 lb/acre	16	<0.05 – **20.15** <0.05 @ 12 hr		0 – 12 hrs; 27 min peak conc	Water column samples 2.5 cm below surface; Pads, 200ml dishes	On pads: 0.622 – .90 µg/cm; Average 0.761 µg/cm; Persist 9 hours in water Copepod mortality; No fish mort Dibrom liquid concentrate – 85 percent naled, 14 lb naled/gal Fixed wing aircraft	Tucker et al. 1987
	Dibrom-14	Aerial	21.3 g/ha tech product	16	<0.05 @ surface <0.05 – 0.19 @ subsurface		2 – 4 hrs; 12 hrs	Water surface and 20 cm below surface Filter pads	Naled below threshold; Dichlorovos remains up to 12 hours but below threshold Dichlorovos at surface: 1.3 ppb @ 1/18 sites; and at subsurface: 0.08 – 0.56 ppb @ 4/18 sites Dichlorovos at subsurface: 0.05 – 0.33 ppb @ 3/9 sites at 12 hrs	Pierce et al. 2005
	Dibrom	Aerial	0.12 lb/acre (142 g/ha)	16	<0.05 – **20.15** 3.01 @ 0.7 hrs		0 – 12.45 hrs	Water 1 cm below surface; Filter papers on raft and dock	30 minutes after application, the concentration of naled in the water was 20.15 µg/L, decreasing to 0.2 µg/L at 6.45 hours and non detectable at 12.45 hours (detection limit of 0.05 µg/L). The peak concentration of dichlorvos was 2.22 µg/L approximately 30 minutes after application, and was still detectable at 12.45 hours (0.28 µg/L). Sampling occurred at -0.67, 0, 0.45, 0.70, 0.95, 1.45, 1.95, 2.45, 3.45, 4.45, 6.45, 8.45, and 12.40 hrs after application	Wang et al. 1987
	Dibrom liquid concentrate	Truck	0.025 lb/acre	16	<0.05 – 0.71 <0.05 @ 12 hr		0 – 12 hrs; 15 min peak conc	Water column	Significant mortality in copepods held in sentinel cages in the treated area and exposed to naled by aerial application. No significant mortality observed for juvenile fish Persists 4 hrs in water Dibrom liquid concentrate – 85 percent naled, 14 lb naled/gal	Tucker et al. 1987
Malathion	Cythion liquid concentrate	Aerial	0.241 lb/acre	0.1	<0.05 – **5** <0.05 @ 48 hrs		0 – 48 hrs; 84 min peak conc	H_2O column; Pads, 200 ml dishes	No mortality fish or copepods Cythion liquid concentrate – 91 percent malathion, 9.33 lb malathion/gal Fixed wing aircraft	Tucker et al. 1987
	Cythion	Aerial	0.19 lb/acre (213 g/ha)	0.1	<0.05 – **5**		0 – 48.4 hrs	Water 1 cm below surface; Filter papers on raft and dock	After malathion application, the peak concentration of 5 µg/L was detected at 1.4 hours, and malathion was still detected (0.22 µg/L) at 22.4 hours but was below the reporting limit of 0.05 µg/L at 48.4 hours. Sampling occurred at -1.87, 0, 0.15, 0.40, 0.65, 0.90, 1.40, 1.90, 2.40, 4.35, 8.35, 12.40, 18.17, 24.40, and 48.40 hrs after application	Wang et al. 1987

Table 3-3. Summary of Existing Study Results for ULV Applications

Active Ingredient	Product	Method of Application	Application Rate	Monitoring Trigger in ppb (water)	Field Results in ppb (water)	Field Results in ppb (sediment)	Time Sampled	Type of Sample	Notes	Reference
Malathion (cont)	Cythion liquid concentrate	Truck	0.050 lb/acre	0.1	<0.05 – **1.3** <0.05 @ 18 hrs		0 – 48 hrs; 15 min peak conc	Water column	Cythion liquid concentrate – 91 percent malathion, 9.33 lb malathion/gal; Persists 4 -18 hrs	Tucker et al. 1987
	Cythion	Truck	0.236 L/min; 16 kph truck speed	0.1	ND – **6**		1 hr	Water column	Analytical method not specified (UC Davis)	Jensen et al. 1999

Note:
Wang et al. (1987) may be describing the same aerial application event as the Tucker et al. (1987).

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3.2.1.2 Studies on Pyrethrins and PBO Adulticide Applications

Following aerial applications of Evergreen Crop Protection EC 60-6 (6 percent pyrethrins, 60 percent PBO) in Sacramento for West Nile virus, Larry Walker Assoc. (2006) reported results of water testing on samples from 10 waterways within the treatment area. Treated areas were sprayed nightly for 3 days. One additional application occurred 9 days prior to the 3-day event at selected locations. Samples were taken immediately after application (within 1 to 6 hours), and the next day (16 to 23 hours after the application). Pyrethrins concentrations were detected between 0.234 to 3.77 µg/L from 9 of 26 samples collected immediately after the application. The average concentration for samples collected 1 to 6 hours after application was 0.270 µg/L. Pyrethrins were not detected (<0.2 µg/L) 16 to 23 hours after each spray event. Piperonyl butoxide was detected in water from 14 of the 25 samples collected after the application; this reporting limit (1.0 µg/L) was greater than the SWRCB monitoring trigger of 0.34 µg/L. Concentration of PBO ranged from <1.0 to 20 µg/L (average 2.036 µg/L) immediately after application. PBO concentrations ranged from <1.0 to 4.2 µg/L with an average of 0.853 µg/L in samples taken between 16 and 23 hours after application. Of the 31 samples taken between 16 and 23 hours after application, PBO was detected in 11 samples. Water samples were tested eight days following aerial applications, from four sites. No PBO was detected in any of these samples, therefore, the duration of persistence of PBO appears to be greater than 16 hours, but less than 1 week.

Testing was also carried out by Weston et al. (2006) following the same applications. Prior to aerial spraying, pyrethrins were not detected in water or sediment samples and PBO was not detected in sediment samples. However, PBO was detected at 0.2 µg/L in 2 of 4 water samples. Pyrethrins were not detected in water samples taken 10 to 34 hours after the spray applications. Pyrethrins were detected in sediment samples after aerial spraying at concentrations ranging from 93.1 to 403 micrograms per kilogram [µg/kg] in 4 of 6 samples. PBO was detected in water (0.44 to 3.92 µg/L, all 7 samples) and sediment (16 to 61.4 µg/kg, for 4 of 6 samples) at 10 to 34 hours after application. The PBO levels detected in water were above the SWRCB monitoring trigger of 0.34 µg/L. Neither water nor sediment was tested at later intervals, so the duration of persistence could not be determined in this study. Laboratory tests were conducted to determine the effects of short-term chronic exposure of *Ceriodaphnia dubia* to water collected after the spray events, following U.S. EPA protocol. No significant differences in mortality were observed. In addition, sediment toxicity tests were performed with the amphipod *Hyalella azteca,* and toxicity was observed in samples collected both before and after application.

The authors concluded that pyrethrins and PBO should present little risk to aquatic organisms due to the low toxicity and lack of long-term persistence, but that PBO had the potential to enhance toxicity of other pesticides, especially pyrethroids, already present in the environment. Weston et al. performed additional laboratory tests to determine the effect of PBO on toxicity of pyrethroids present on sediment, and found that even by removing 80 percent of the overlying water and replacing it with fresh PBO solution daily, within 24 hours, over 30 percent of PBO is lost, most likely to photodegradation. The results indicated that most sediments present at the creeks used for this study already contained concentrations of pyrethroids acutely lethal to *H. azteca* from urban uses not related to mosquito control activities.

Water and soil deposition of pyrethrins following aerial applications was evaluated at two sites in California by Schleier et al. (2008). Water was sampled after aerial applications of pyrethrins and PBO in irrigation ditches at one site (Princeton) and in static ponds at another (Colusa). Pyrethrins were not detected following spray events at either site (the reporting limit was 0.5 µg/L or less depending on parameter, which is greater than the SWRCB monitoring trigger of 0.32 µg/L). PBO was detected at low levels and decreased exponentially with time. Average concentrations were below the SWRCB monitoring trigger of 0.34 µg/L at the Princeton site and average concentrations dropped below this trigger at the Colusa site within 36 hours. Average PBO concentrations were 0.0125 to 0.0199 micrograms per square centimeter (µg/cm^2) on ground deposition pads, and 0.1723 to 1.274 µg/L in water samples, immediately following the applications. Within 36 hours of the applications, PBO had decreased to background levels in water. Concentrations of PBO decreased 77 percent between 1 and 12 hours after the spray event. The authors concluded that the amounts of pyrethrins and PBO deposited on the ground and in water after aerial ULV insecticide applications are probably lower than those estimated by previously published studies to predict exposure and risk.

Deposition of pyrethrins following truck-mounted application was evaluated in large seasonal wetlands in California (Jensen et al. 1999). Pyrethrins were not detected (<20 µg/L) in surface waters 1 hour after ULV applications, but the reporting limit was greater then the SWRCB monitoring trigger for pyrethrins of 0.32 µg/L. The authors found no significant differences in macroinvertebrate abundance and biomass or species diversity in areas treated with any of the materials when compared with untreated ponds. No mortality occurred in mosquitofish held in sentinel cages in treated ponds. Similarly, no difference in mortality was observed for mosquito larvae held in sentinel cages in treated ponds when compared with untreated ones. The authors concluded that ULV applications for adult mosquito control were not likely to significantly affect aquatic insects or fish in these habitats.

Lawler et al. (2008) evaluated pyrethrins and PBO in sediment following multiple applications of pyrethrins from truck-mounted equipment in the Colusa and Sacramento National Wildlife Refuges in California (see Table 3-4). Stock tanks were filled with a layer of soil overlain with 1,150 liters of water. Zooplankton (*Daphnia magna*) were held in sentinel cages in the water column and mayfly larvae (*Callibaetis californicus*) were placed in cages at the bottom of each tank, where they were in contact with sediment. ULV applications of pyrethrins were made from truck-mounted equipment twice weekly for six weeks. Pyrethrins concentration in sediments and sentinel survival were evaluated after applications 5 and 11. No pyrethrins were detectable in 4 of 6 tanks after five spray events. Pyrethrins were found at low concentrations (23.1 and 33.1 µg/kg) in 2 of 6 tanks. There was no evidence of accumulation in sediments. After 11 spray events, sediment in 4 of 6 tanks (including one that had held residues after spray 5) contained no detectable amount of pyrethrins (<2 µg/kg), one had pyrethrins concentrations at 4 µg/kg, and another at 34.5 µg/kg.

PBO concentrations ranging from 8.37 to 14.9 µg/kg were seen in 5 of 6 tanks after five applications, but in only 2 of 6 tanks after 11 applications (1.93 and 2.55 µg/kg). There was no significant difference in mortality for mayfly larvae held in sentinel cages on the sediment. Likewise, there was no significant difference in mortality seen in *D. magna* held in the water column. They concluded that applications of pyrethrins and PBO at rates used for mosquito

control did not have detectable effects on the indicator species. The persistence of PBO in sediment was not evaluated in this study. PBO-synergized pyrethrins had no detectable effect on the survival of *D. magna* held in tanks in the spray area, even after 11 biweekly spray events.

Table 3-4. Published Studies Assessing the Effects of Multiple Applications of ULV Mosquito Adulticides

Active Ingredient	Product	Sample Type	Time Sampled	Results	Notes	Reference
Pyrethrins and PBO	Pyrenone 25-5	Sediment	Immed. After the 5th and 11th spray	Level of pyrethrins and PBO did not increase significantly from the 5th to 11th spray event	Sediment in 6 stock tanks tested after 5 and 11 spray events[a]	Lawler et al. 2008
Pyrethrins and PBO	Evergreen	Water mid-depth; 10 sites under an aerial application	16-23 hours 8 days	No significant increase in concentration of AI or PBO Decrease to ND (<0.2 ppb AI and <1.0 ppb PBO) 8 days after spraying ceased	3 consecutive spray events occurring once per night; 1 additional event occurring 9 days prior at select locations.	Larry Walker Assoc. 2006 SYVCD report
Pyrethrins and PBO	Pyrenone 25-5	Water + sediment	12 hours 1 week 1 week	Under RL 1 wk after 8th spray event	8 spray events Sampled 1 week after last one[b]	Amweg et al. 2006

Notes:

[1] Lawler et al. (2008) found no accumulation of pyrethrins or PBO in sediment after multiple spray events by truck mounted equipment.

- Pyrethrins were only detectable in sediment in 2 tanks after the 5th spray event, and 2 after the 11th
- Concentrations of pyrethrins in sediment were not significantly higher after the 11th spray event than after the 5th one, and in some cases were actually lower after the 11th event.
- PBO was detected in fewer tanks after 11 (2 of 6) biweekly spray events than after the fifth event (5 of 6).
- Concentrations of PBO were lower after the 11th event than after only 5 events
- Four of 6 tanks had no detectable PBO
- The persistence of PBO in sediment was not evaluated in this study
- PBO-synergized pyrethrins had no detectable effect on the survival of *Daphnia* held in tanks in the spray area, even after 11 biweekly spray events

[2]Amweg et al. (2006) reported that levels of pyrethrins and PBO in water or sediment was below reporting limits when sampled one week after the last of eight weekly spray events.

References

Amweg, E. L., D. P. Weston, C. S. Johnson, J. You and M. J. Lydy. 2006. Effect of piperonyl butoxide on permethrin toxicity in the amphipod *Hyalella azteca*. Environmental Toxicology and Chemistry 25 (7):1817-1825.

Lawler, S. P., D. A. Dritz, C. S. Johnson, and M. Wolder. 2008. Does synergized pyrethrin applied over wetlands for mosquito control affect *Daphnia magna* zooplankton or *Callibaetis californicus* mayflies? *Pest Manag Sci* 64: 843-847.

Amweg et al. (2006) evaluated deposition of PBO in water and sediment following truck-mounted applications of synergized pyrethrins to a freshwater wetland in Colusa County in 2004. PBO was detected in 2 of 18 sediment samples above the reporting limit of 2.0 µg/kg, at 3.27 and 3.0 µg/kg, respectively. PBO was detected in 3 of 10 samples of water at concentrations above the reporting limit of 0.01 µg/L, ranging from 0.04 to 0.08 µg/L. The highest concentrations of PBO were observed in samples obtained within 12 hours of spraying; concentrations in water and sediment were below the reporting limit in samples taken one week after the last ULV application (Amweg et al. 2006). Concentrations in water samples were below the SWRCB monitoring trigger of 0.34 µg/L.

Several papers were published documenting that ULV-applied mosquito adulticides do not accumulate in water or sediment during repeated applications. Chemical testing was conducted following multiple spray events in 2006 by Amweg et al. There was no increase in the level of pyrethrins or PBO following multiple daily spray events, and the concentration had returned to background level when samples taken one week after the last application were tested. Similarly, Lawler et al. (2008), reported that the concentration of pyrethrins and PBO in tanks within a treated area were not significantly higher after 11 applications than in samples taken after the fifth application. In many cases, the concentrations were actually lower following the 11th spray event than after the fifth spray event. Accumulation of PBO was evaluated by Amweg et al. (2006). PBO did not accumulate in water or sediment, even after eight biweekly applications by truck-mounted equipment over the course of two months.

3.2.2 Pyrethroids (in Formulations with PBO)

Pyrethroids are synthetic compounds that are chemically similar to the pyrethrins, but have been modified to increase their stability and activity against insects, while minimizing their effect on nontarget organisms. Pyrethrins and pyrethroids act by causing a persistent activation of the sodium channels on insect neurons. These materials are relatively non-toxic to mammals and birds, but may be toxic to fish and invertebrates. These products break down rapidly and do not persist in the environment. Photolysis and microbial activity are responsible for the majority of this decomposition; hydrolysis also plays a role under some conditions (pH 9). Pyrethroids are hydrophobic, and adsorb quickly onto particles of soil and organic material suspended in the water column, which reduces their bioavailability (Coats et al. 1989).

As shown in Table 3-4, pyrethroid formulations generally include the synergist PBO. Most studies on PBO used in adulticides have been conducted on formulations with pyrethrins (discussed above in Section 3.2.1), resmethrin (discussed below in Section 3.2.2.1), and phenothrin (discussed below in Section 3.2.2.3). The SWRCB has a Receiving Water Monitoring Trigger for PBO of 0.24 µg/L when applied in a resmethrin formulation, based on toxicity data from the U.S. EPA's Office of Pesticides' Ecotoxicity Database. The SWRCB identified the lowest LC_{50} of 2.4 µg/L based on toxicity to rainbow trout during a 96-hour test, and their monitoring trigger value is one-tenth of that value (see Table 3-3). For PBO applied in formulations other than pyrethrins or resmethrin, the SWRCB has a Receiving Water Monitoring Trigger for PBO of 180 µg/L. The SWRCB identified the lowest LC_{50} of 1,800 µg/L based on toxicity to rainbow trout during a 96-hour test (U.S. EPA's Office of Pesticides' Ecotoxicity Database), and their monitoring trigger value is one-tenth of that value (see Table 3-3).

3.2.2.1 Permethrin

Permethrin is a Type I pyrethroid (i.e., it lacks a cyano group at the α carbon position of the alcohol moiety) with the primary target organ being the nervous system of insects, which then causes muscle spasms, paralysis, and death (U.S. EPA 2009a). Reported half-lives in surface water range from 1.8 hours to <2.5 days (see Table 3-2).

The SWRCB has adopted a Receiving Water Monitoring Trigger for permethrin of 0.03 µg/L, based on the California Department of Fish and Game's (CDFG's) ambient water quality criterion for freshwater aquatic life.

Pierce et al. (2005) evaluated deposition after two permethrin ULV applications made with truck-mounted equipment on Key Largo, Florida. They collected samples in the Atlantic Ocean and Florida Bay on either side of the treated area, including measurement of pesticide residues on glass fiber pads set on floats above the water surface, and water collected from the surface microlayer and 20 centimeters below the surface. Water was sampled from a canal running through the treated area following a third application. With the exception of a 0.07 µg/L sample from the bay, permethrin was not detected in the offshore samples; however, was detected in samples of the water surface microlayer taken from the canal. Detection of permethrin occurred in samples of the surface microlayer taken 2 to 4 hours after the applications (5.1 to 9.4 µg/L). Samples taken below the water surface did not contain detected residues. Within 12 hours of the application, permethrin was undetected in either surface microlayer or subsurface water. The application was carried out shortly before the arrival of a hurricane, and droplet size was not reported. This is the only published study in which significant amounts of pesticide were detected following an application by truck-mounted equipment. This study did not measure PBO concentrations.

Deposition of permethrin following truck-mounted application was evaluated in large seasonal wetlands in California (Jensen et al. 1999). Permethrin was not detected (<20 µg/L) in surface waters 1 hour after ULV applications, but the reporting limit was greater then the SWRCB monitoring trigger for pyrethrins of 0.32 µg/L. The authors found no significant differences in macroinvertebrate abundance and biomass or species diversity in areas treated with any of the materials when compared with untreated ponds. No mortality occurred in mosquitofish held in sentinel cages in treated ponds. Similarly, no difference in mortality was observed for mosquito larvae held in sentinel cages in treated ponds when compared with untreated ones. The authors concluded that ULV applications for adult mosquito control were not likely to significantly affect aquatic insects or fish in these habitats.

Davis and Peterson (2008) measured family diversity, richness, and evenness 1, 7, 14, and 28 days after truck application of permethrin. Most response variables showed no significant treatment effect, although there were some reductions in number of individuals. The authors concluded that the reductions in aquatic nontarget populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application. Significant differences for the pond study were found on the dates closest to the spray event.

3.2.2.2 Resmethrin and PBO

Resmethrin degrades rapidly when exposed to light (photolysis); however, when not subject to photolysis, resmethrin tends to be more environmentally persistent. Resmethrin has low mobility and has a high affinity to bind to soils/sediments and organic carbon. Resmethrin works by interacting with sodium channels in the peripheral and central nervous system of target organisms (U.S. EPA 2006b). Reported half-lives in water range from 22 minutes (photolysis in seawater) to 37 days (aerobic metabolism) (see Table 3-2).

The SWRCB has adopted a Receiving Water Monitoring Trigger for resmethrin of 0.028 µg/L, based on toxicity data from the U.S. EPA's Office of Pesticides' Ecotoxicity Database. The SWRCB identified the lowest LC_{50} of 0.28 µg/L based on toxicity to rainbow trout during a 96-hour test, and their monitoring trigger value is one-tenth of that value (see Table 3-3).

The SWRCB has adopted a Receiving Water Monitoring Trigger for PBO of 0.24 µg/L when applied in a resmethrin formulation, based on toxicity data from the U.S. EPA's Office of Pesticides' Ecotoxicity Database. The SWRCB identified the lowest LC_{50} of 2.4 µg/L based on toxicity to bluegill sunfish during a 96-hour test, and their monitoring trigger value is one-tenth of that value (see Table 3-3).

Evaluation of ULV applications of the pyrethroid resmethrin have been carried out in Suffolk County New York (Abbene et al. 2005). These studies are part of the Draft Generic Environmental Impact Statement (DGEIS) for the Suffolk County Vector Control and Marsh Management Long Term plan, and include field studies to assess the effects of truck-mounted and aerial applications on aquatic organisms.

Deposition of resmethrin following truck-mounted applications in fresh and salt water marshes was assessed at 6 sites by Abbene et al. (2005). Resmethrin was not detected in water samples from any site (<0.005 µg/L). The synergist, PBO was detectable at low levels (0.008 µg/L and 0.017 µg/L) in 2 of 6 water samples taken immediately after the application.

Deposition of resmethrin following aerial applications by helicopter was assessed in the same report (Abbene et al. 2005). Applied materials were detected in some water samples taken within 30 minutes of the application. PBO was detected more frequently than resmethrin, and detection of PBO was more common after helicopter applications (83 percent) than following those carried out by truck (33.3 percent). The average concentration of resmethrin following helicopter applications was 0.037 µg/L (slightly above the SWRCB- monitoring trigger of 0.028 µg/L). The average concentration of PBO was 4.361 µg/L, also above the SWRCB-monitoring trigger of 0.24 µg/L. The highest concentrations were found in some samples collected from surface water within 1 hour of helicopter applications (59.8 µg/L PBO and 0.293 µg/L resmethrin). The authors carried out a series of sample collections after two spray events to evaluate the persistence of the materials in water. Resmethrin displayed an exponential decrease and was not detected (<0.005 µg/L) within 9 hours of the application. PBO was not detected (<0.005 µg/L) in samples taken 96 hours after the application (Abbene et al. 2005). One site included two repeat weekly applications of resmethrin follow an application of methroprene the prior week. Concentrations of resmethrin and PBO measured after the second application were lower than those measured after the first application.

The same study included effects of aerial applications of resmethrin and PBO on two aquatic organisms: the sheepshead minnow (*Cyprinodon variegatus*) and the estuarine grass shrimp (*Palaemonetes pugio*) (Suffolk County 2006). The field study faced problems with low dissolved oxygen and high temperature, which compromised their ability to detect toxicity that may have been due to pesticide exposure. Therefore, dosing experiments and prey capture tests were conducted in the laboratory to measure toxicity of the applied products. These tests demonstrated that the doses used in the spray were not directly toxic to grass shrimp and did not affect their ability to capture prey under controlled conditions. Further laboratory experiments demonstrated that all of the mortality seen in the field could have been caused by low dissolved oxygen alone, using a U.S. EPA time-to-death approach. Furthermore, their data showed that the chemicals used had very low persistence in the water column, as discussed above. Resmethrin was never detected in sediment and was not detected in samples from surface water taken more than 2 hours after the spray. PBO was last detected in samples taken 48 hours after the spray.

Another study, part of the same DGEIS, evaluated benthic community structure, and found that benthic population differences could not be attributed to the application of pesticides, but were more likely due to environmental differences (Suffolk County 2006).

Zulkosky et al. (2005) sampled freshwater ponds, salt marshes, tidal inlets and embayments, and marine coastal water off Staten Island, New York within an hour after mosquito control applications of Scourge (resmethrin). In 2002, resmethrin was detected in five of ten locations at concentrations ranging from 0.0017 to 0.98 µg/L (detection limit of 0.0005 µg/L), and was detected at two of ten locations above the SWRCB- monitoring trigger of 0.028 µg/L. PBO was detected in all but one location at concentrations ranging from 0.0006 to 15 µg/L, and was detected at three of ten locations above the SWRCB- monitoring trigger of 0.24 µg/L. PBO was still present at three locations in samples collected three days after a Scourge spray. No information was provided on application methods at each site.

3.2.2.3 Phenothrin (Sumithrin) and PBO

New York City Department of Health sampled 32 locations for phenothrin and PBO before and after spraying events during the mosquito adulticide applications that occurred during July through September 2000. Out of the 68 post-application samples collected by the City, only two had concentrations of either phenothrin or PBO greater than the 0.5 µg/L reporting limit: 1.10 µg/L for phenothrin on August 18, 2000, at Mt. Loretto Pond on Staten Island; and 1.03 µg/L for PBO and 0.55 µg/L for phenothrin for a sample collected on August 5, 2000, at Alley Park Pond in Queens (Suffolk County 2006).

The Zulkosky et al. (2005) study described above in Section 3.2.2.2 also included phenothrin applied as Anvil. In 2002, phenothrin was not detected in either spray event (detection limit of 0.0005 µg/L). PBO was detected in all samples at concentrations ranging from 0.0003 to 0.0007 µg/L. In 2003, phenothrin was detected at 0.0011 µg/L immediately after spray application, but was not detected in samples collected one to ten days after spraying Anvil. PBO was detected at 0.020 µg/L immediately after spraying Anvil and was found at concentrations ranging from <0.0005 to 0.007 µg/L 10 days later.

The Massachusetts Department of Agricultural Resources (2008) conducted a study where phenothrin was applied aerially as Anvil 10+10 ULV to six sites. There were no detections of phenothrin during this study; however, PBO was detected at concentrations (0.12 µg/L) below the monitoring trigger.

The Davis and Peterson (2008) study described above in Section 3.2.2.1 also included phenothrin applied as Anvil 10+10 ULV. The authors concluded that the reductions in aquatic nontarget populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application.

3.2.3 Organophosphates

Naled and malathion are organophosphates used for mosquito adulticides. These materials work by inhibiting the enzyme acetylcholinesterase. Organophosphates have low persistence in the environment, and degradation occurs by reaction with photochemically produced hydroxyl radicals and by hydrolysis and biodegradation (U.S. EPA 1999).

3.2.3.1 Malathion

Malathion is a broad-spectrum organophosphorous pesticide that is soluble in water and therefore does not tend to associate with sediment. Malaoxon is the primary metabolite of malathion, and under certain conditions, is formed as an environmental breakdown product of malathion (U.S. EPA 2009b [RED]). As shown in Table 3-2, reported half-lives for water range from 0.67 day (photodegradation) to 147 days (anaerobic degradation).

The SWRCB has adopted a Receiving Water limit for malathion of 0.1 µg/L, based on U.S. EPA's ambient water quality criterion for freshwater aquatic life (Table 3-3).

Tucker et al. (1987) evaluated deposition and nontarget effects for truck-mounted and aerial applications of malathion in an estuary in east-central Florida. Deposition in filter pads was measured after application, and concentrations in water were measured in 12 samples up to 48 hours after application. Malathion concentrations in water peaked at 5 µg/L 84 minutes after aerial application. Malathion concentrations peaked at 1.3 µg/L 15 minutes after truck application and remained detected for up to 18 hours. Sentinel cages containing calanoid copepods (*Acartia tonsa*) and three species of juvenile fish were deployed in the treated area. No significant mortality was observed in copepods or fish exposed to truck-mounted or aerial applications of malathion.

In what may have been the same study, Wang et al. (1987) investigated the fate of malathion after aerial ULV applications of mosquito adulticides at a salt marsh in Florida. After application, the peak malathion concentration of 5 µg/L was detected at 1.4 hours, and was still detected (0.22 µg/L) at 22.4 hours at concentrations above the SWRCB- monitoring trigger (0.1 µg/L) but was below the reporting limit of 0.05 µg/L at 48.4 hours.

Deposition of malathion following truck-mounted application was evaluated in large seasonal wetlands in California (Jensen et al. 1999). Malathion was detected at levels above the SWRCB monitoring trigger of 0.1 µg/L 1 hour after application (6 µg/L). The authors found no

significant differences in macroinvertebrate abundance and biomass or species diversity in areas treated with any of the materials when compared with untreated ponds. No mortality occurred in mosquitofish held in sentinel cages in treated ponds. Similarly, no difference in mortality was observed for mosquito larvae held in sentinel cages in treated ponds when compared with untreated ones.

3.2.3.2 Naled

The SWRCB has adopted a Receiving Water Monitoring Trigger for naled of 16 µg/L, based on toxicity data from the U.S. EPA's Office of Pesticides' Ecotoxicity Database (Table 3-3).

Tucker et al. (1987) (described above in 3.2.3.1) also evaluated deposition and nontarget effects for truck-mounted and aerial applications of naled. The maximum concentration of naled in water samples following truck applications (0.71 µg/L) occurred 15 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 4 hours. No significant mortality was observed in copepods or fish exposed to truck-mounted applications of either product. The same study evaluated deposition of these materials following applications made from aircraft (Tucker et al. 1987). The maximum concentration of naled in water samples following aerial applications (20.15 µg/L) occurred 27 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 9 hours. Deposition rates for naled from aerial applications were much higher (47 to 68 percent) than those resulting from ground applications (21 to 22 percent). The authors reported significant mortality in copepods held in sentinel cages in the treated area and exposed to naled by aerial application. No significant mortality was observed for juvenile fish held in the treated area. This is the only report of significant mortality in aquatic organisms following a ULV application. The size of droplets released is not given and the amount of material recovered from glass filter pads placed on the ground was unusually high. Perhaps the conditions of the applications resulted in a greater proportion of the product reaching the ground.

In what may have been the same study, Wang et al. (1987) (described above in Section 3.2.3.1) also investigated the fate of naled after aerial ULV applications of mosquito adulticides at a salt marsh in Florida. Approximately 30 minutes after application, the concentration of naled in the water was 20.15 µg/L, decreasing to 0.2 µg/L at 6.45 hours, and was not detected at 12.45 hours (detection limit of 0.05 µg/L). The peak concentration of dichlorvos (breakdown product of naled) was 2.22 µg/L approximately 30 minutes after application, and was still detectable at 12.45 hours (0.28 µg/L). With the exception of the peak concentration, naled concentrations were below the SWRCB- monitoring trigger (16 µg/L).

Deposition of naled during aerial applications was also evaluated in Pierce et al. (2005) (study described in 3.2.2.1 above). Naled was detected in low concentrations (0.19 µg/L) in the water surface microlayer at 1 of 18 sites. It was not detected in subsurface water (detection limit 0.05 µg/L). Residues were not detectable in the water surface microlayer 12 hours after the application. Dichlorovos, a breakdown product of naled, and itself a registered pesticide, was detected at 2 to 4 hours after the application. Trace amounts were still detectable at 10 to 12 hours post-treatment.

4.1 NPDES PERMIT REQUIREMENTS AND KEY QUESTIONS

The current permit includes a Monitoring and Reporting Program (MRP) by the SWRCB staff. The SWRCB draft MRP identified the following key questions to focus the initial monitoring program:

1. Does the pesticide residue from spray applications cause an exceedance of receiving water limitations or monitoring triggers?

2. Does the pesticide residue, including active ingredients, inert ingredients, and degradates, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

To assist in answering these questions, the SWRCB and MVCAC envision a process that will use existing data, determine the critical gaps in knowledge, and develop a monitoring program to address key areas of uncertainty. Because existing data are insufficient to set Receiving Water Limitations for most of the active ingredients in adulticides, the SWRCB has established Receiving Water Monitoring Triggers that would be used in combination with toxicity testing to determine potential impacts to beneficial uses of affected surface water bodies.

The SWRCB has indicated that initial studies should focus on the adulticides most commonly used in California, using application sites that represent the "highest use" scenario in terms of frequency of application, size of application areas, and application methods. This monitoring plan incorporates that approach; however, it must be recognized that the "highest use" study results are intended to represent the maximum impact, and are not expected to be typical of adulticide applications for many areas where they may be applied once a year or less, and on a smaller scale.

4.2 DO EXISTING DATA ANSWER KEY QUESTIONS?

4.2.1 Mosquito Larvicides

The key questions in the draft adulticide permit do not specifically apply to larvicides. As described in Section 3.1, because mosquito larvicides are applied directly to water, many more aquatic toxicity studies (both laboratory and field studies) have been conducted for larvicides than for adulticides. Receiving water monitoring triggers have only been adopted for temephos,

The results of the studies described in Section 3.1 indicate that the majority of the larvicides used by MVCAC member agencies are unlikely to cause significant adverse impacts to aquatic ecosystems, due to their high specificity for mosquitoes and short persistence in surface waters.

Evidence indicates that chironomid larvae (which are closely related to mosquitoes) are the only nontarget aquatic species that may be affected at concentrations of *Bti* used for mosquito control. Observed effects on chironomids were slight and populations in the field continuously increased after the treatment. *Bacillus sphaericus* has not been found to have adverse effects on chironomids or any other aquatic species at levels used for mosquito control. While high doses

and/or chronic exposure of spinosad may adversely effect some aquatic invertebrates, the short term exposure at levels used for mosquito control are unlikely to have significant effects.

Although evidence indicates that application of monomolecular films and petroleum distillates may result in reductions to populations of surface-breathing insects at the time of treatment, it is unlikely that overall populations of invertebrate species are affected as populations recover quickly due to recolonization from neighboring sites.

Methoprene is a material with very high specificity in its mode of action, and exhaustive reviews of the published literature on this material attest to its lack of adverse environmental impact. The concentrations of methoprene applied for mosquito larvae control are unlikely to affect nontarget aquatic species, except for some fly species closely related to mosquitos. For species that are affected by methoprene, recolonization and reestablishment of populations from neighboring sites is fast once intense control is relaxed.

Among the materials available for control of mosquito larvae, temephos has the narrowest margin of impact and the greatest potential for effects to nontarget organisms. However, it is an effective method of control in isolated sources that may be difficult to treat by other means, such as sources with high concentrations of organic material, and ones in which other less toxic alternatives have failed to produce adequate levels of control. Temephos was in widespread use in California for control of larval mosquitoes from 1965 into the mid 1980s. The microbial pesticides, methoprene, and surface oils are used much more frequently now and have largely replaced temephos as the method of choice for larval sources in water of the U.S. Temephos is more widely used in other parts of the U.S. such as Delaware, New Jersey, New York, Maryland, and Florida.

As shown in Table 2-6, most temephos use for mosquito control in California occurs in the Central Valley. None of the southern California agencies use temephos; and only one county in northern coastal California has used temephos for larval mosquito control in manmade sources, on a limited basis. MVCAC agencies hope not to need to apply temephos in the future if other methods can achieve adequate control; however, temephos applications may be necessary in some situations. Field studies indicate that temephos does have an immediate impact on some groups of planktonic crustaceans with copepods and brachiopods (cladocera) being more sensitive than amphipods or ostracods, and that population recovery can be variable. Data indicate that temephos does not persist longer than about one day in surface water and sediment.

4.2.2 Mosquito Adulticides

4.2.2.1 Pyrethrins (Formulations with the Synergists PBO and MGK-264)

As discussed in Sections 2.2.2 and 2.2.3, pyrethrins are the most frequently used mosquito adulticides in California. As discussed in Section 3.2.1, there is already a considerable amount of data on the fate, transport and toxicity of pyrethrins and PBO from studies conducted on ULV applications of mosquito adulticides in California. Five field studies evaluated effects of ULV application of pyrethrins adulticides in California, and four of these studies also measured PBO concentrations.

URS was unable to find any published studies that included measurement of the synergist MGK-264 in ULV applications of pyrethrins pesticides used for mosquito control. As shown in Table 2-9, MGK-264 is used as a synergist in only one formulation that MVCAC agencies plan to use as a mosquito adulticide in the future (Prentox Pyronyl Oil Concentrate # OR-3610A). As shown in Table 2-8, use of this formulation has been negligible (comprising 0 to 0.1 percent of pyrethrins adulticide use statewide).

Exceedance of Receiving Water Monitoring Triggers

As shown in Table 3-3 and discussed in Section 3.2.1.1, three studies measured the levels of pyrethrins in surface water following aerial applications and two studies measured the levels following truck applications. Pyrethrins concentrations greater than the trigger were detected in only one of these studies (Larry Walker and Associates 2006), within 6 hours after application. Other studies measured pyrethrins within 12 hours of application and they did not detect pyrethrins. Therefore, existing data indicate that the pyrethrins trigger may be exceeded under some conditions.

As shown in Table 3-3 and discussed in Section 3.2.1.2, three studies measured PBO in surface water following aerial applications of pyrethrins formulations with PBO, and one study following truck application. PBO concentrations greater than the trigger were detected in all three of the aerial application studies, but not in the truck application study. All three of the aerial application studies used the formulation Evergreen Crop Protection EC60-6, which contains 60 percent PBO, the highest concentration used in any of the pyrethrins formulations as shown in Table 2-9. The truck application studies both used Pyrenone 25-5 Public Health Insecticide, which contains only 25 percent PBO. Therefore, existing data indicate that the PBO trigger is likely to be exceeded in some instances after aerial applications, and more data are needed for truck applications.

Toxicity

As shown in Table 3-3 and discussed in Section 3.2.1, three studies investigated aquatic toxicity following ULV applications of pyrethrins. One study using laboratory toxicity tests on samples after aerial application found no significant mortality to *Ceriodaphnia dubia* following aerial application, and inconclusive results for *Hyalella azteca* (sediment collected prior to application was toxic to *H. azteca*) (Weston 2006). The author concluded that PBO had the potential to enhance toxicity of other pesticides already present. Another study found no significant mortality in caged mosquito larvae or mosquitofish after truck application, and no significant difference in macroinvertebrate abundance, biomass, or species diversity (Jensen et al. 1999). Another study (Lawler et al. 2008) used caged organisms (*Daphnia magna* and *Callibaetis californicus*) to evaluate toxicity after multiple applications, and found no significant difference in mortality.

While existing data indicate that aquatic life may not be significantly impacted by ULV application of pyrethrins/PBO application for mosquito control, more data are needed to confirm this, especially in locations where other sources of pyrethrins and/or pyrethroids may already be present.

Spatial and Temporal Extent

As shown in Table 3-3 and discussed in Section 3.2.1, pyrethrins were detected in water in two of four studies, and in sediment in both of those two studies. While in one study pyrethrins were not detected within the first 24 hours, but were detected at 36 hours, it is likely that the source of this detection was not the adulticide application (Schleier et al. 2008). Larry Walker and Associates (2006) detected pyrethrins in samples collected from 1 to 6 hours after application, but not in samples collected from 16 to 23 hours after application. Water testing was also carried out by Weston et al. (2006) following the same applications. Pyrethrins were not detectable in any samples taken from 10 to 34 hours after the spray applications. Pyrethrins were detected in sediment samples collected in two studies, but persistence was not evaluated. As shown in Table 3-2, the photolysis and hydrolysis half-lives in water are less than one day. While available data indicate that pyrethrins are not likely to persist after the first day or two in the water column, additional investigation is necessary to determine when peak concentrations and subsequent decay rates are likely to occur.

As shown in Table 3-3 and discussed in Section 3.2.1, PBO was detected in water in all four studies in which it was measured following applications of adulticides containing pyrethrins and PBO. Larry Walker and Associates (2006) found higher concentrations in samples collected within 1 to 6 hours after aerial application than in samples collected 16 to 23 hours after application, and no PBO was detected in samples collected eight days after application. Following the same application events, Weston et al. (2006) detected PBO above the monitoring trigger in all seven water samples and in four of six sediment samples collected 10 to 34 hours after application. Neither water nor sediment was tested at later intervals, so the duration of persistence could not be determined in this study. In another study, Schleier et al. (2008) found that concentrations of PBO in water decreased 77 percent between 1 and 12 hours after a spray event, and returned to background levels within 36 hours. These studies evaluated aerial applications of the formulation Evergreen Crop Protection EC60-6, which contains 60 percent PBO, the highest concentration used in any of the pyrethrins formulations as shown in Table 2-9. Amweg et al. (2006) found the highest concentrations of PBO in samples obtained within 12 hours of spraying; concentrations in water and sediment were below the reporting limit in samples taken one week after the last ULV application. This study used Pyrenone 25-5 Public Health Insecticide, which contains 25 percent PBO. While available data indicate that PBO in pyrethrins formulations are likely to peak within a few hours after application, and PBO may persist several days, additional investigation is necessary to better define when peak concentrations are likely to occur, and to characterize subsequent decay rates.

Minimal data are available on the spatial extent of pyrethrins or PBO in water bodies following ULV applications of mosquito adulticides.

Repeated Applications

As described in Section 2.3.3, pyrethrins formulations may be used over 25 times in the same season at various locations in the Central Valley.

The pyrethrins formulations for which fate and transport studies have been conducted for repeated applications include Pyrenone 25-5 Public Health Insecticide (Lawler et al. 2008 and

Amweg et al. 2006) and Evergreen Crop Protection EC 60-6 (Larry Walker and Associates 2006 and Weston et al. 2006). Evergreen Crop Protection EC 60-6 contains 60 percent PBO, which is the highest PBO content of any of the currently used adulticide formulations that include pyrethrins.

As discussed in Section 3.1.3, three field studies measured water and/or sediment concentrations after repeated ULV adulticide applications. None of these studies found significantly higher concentrations of pyrethrins or PBO after multiple applications (up to 11 applications) as compared to the initial application. One of these studies (Lawler et al. 2008) also used caged organisms (*Daphnia magna* and *Callibaetis californicus*) to evaluate toxicity after multiple applications, and found no significant difference in mortality. No studies evaluated the higher number of applications known to occur at some locations in the Central Valley (over 20), and no studies are available on *Hyalella azteca*, which is known to be more sensitive to pyrethroids than most other aquatic organisms.

4.2.2.2 Pyrethroids (Formulations with the Synergist PBO)

ULV field studies have been done for the pyrethroid adulticides used most in California, (permethrin, phenothrin, and resmethrin), but no field data are available for the lesser used pyrethroids (phenothrin, prallethrin, or etofenprox).

4.2.2.2.1 Permethrin

As shown in Table 3-3 and discussed in Section 3.2.1.2, three field studies investigated the effects of permethrin adulticides, but none of these studies measured PBO. One of these studies (Jensen et al. 1999) used the formulation with the higher PBO content (Biomist 4+12 ULV). All other permethrin formulations contain equal proportions of permethrin and PBO. Biomist 4+12 ULV contains three times as much PBO; between 2005 and 2008 it comprised 10 to 16 percent of permethrin adulticide use in California. Although this study did not measure PBO concentrations, it did investigate toxicity.

Exceedance of Receiving Water Monitoring Triggers

The permethrin trigger was exceeded in one of the two studies that measured permethrin concentrations in water. Both of these studies were conducted after truck applications; no aerial application studies for permethrin are available. The study that did not detect permethrin (Jensen et al. 1999) used an analytical method with detection limits significantly higher than the trigger (20 ppb vs. 0.03 ppb).

Toxicity

Two studies evaluated potential effects to aquatic organisms after truck application of permethrin adulticide. One study (Jensen et al. 1999) found no significant differences in macroinvertebrate abundance and biomass or species diversity, and no significant differences in mortality occurred in mosquitofish or mosquito larvae held in sentinel cages. The other study (Davis and Peterson 2008) measured family diversity, richness, and evenness 1, 7, 14, and 28 days after truck

application of permethrin. Most response variables showed no significant treatment effect, although there were some reductions in the number of individuals. The authors concluded that the reductions in aquatic nontarget populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application. Significant differences were found on the dates closest to the spray event.

Spatial and Temporal Extent

In the one study in which permethrins were detected (Pierce et al. 2005), they were detected on the surface microlayer in samples collected 2 to 4 hours after application, but were not detected at a depth of 20 cm or in any samples collected 12 hours after application.

Repeated Applications

As described in Section 2.3.3, permethrin formulations may be used over 25 times in the same season, at various locations in the Central Valley. No published field studies have evaluated the effects of repeated applications of permethrin adulticides.

4.2.2.2.2 Resmethrin and PBO

As shown in Table 3-3 and discussed in Section 3.2.2.2, three field studies investigated the effects of resmethrin adulticides two of which measured PBO.

Exceedance of Receiving Water Monitoring Triggers

The resmethrin trigger was exceeded in the two studies that measured resmethrin concentrations in water; both of these studies included aerial application. Resmethrin was not detected after truck application in one of these studies.

PBO was detected above the trigger in both studies. One of these studies (Abbene et al. 2005) detected PBO after aerial application but not after truck application.

Toxicity

One study (Abbene et al. 2005) evaluated potential effects to aquatic organisms after aerial application of resmethrin adulticide with PBO (Scourge). Results of field studies were confounded by low dissolved oxygen and high temperatures, which were found to have been the likely causes of toxicity. Another study conducted on the same applications evaluated benthic community structure. This study found that benthic population differences could not be attributed to the application of pesticides, but were more likely due to environmental differences (Suffolk County 2006).

Spatial and Temporal Extent

Abbene et al. (2005) found the highest concentrations in samples collected from surface water within 1 hour of helicopter applications. The authors carried out a series of sample collections after two spray events to evaluate the persistence of the materials in water. Resmethrin displayed an exponential decrease and was not detected within 9 hours of the application. PBO was not detected in samples taken 96 hours after the application (Abbene et al. 2005). In a related study (Suffolk County 2006), resmethrin was not detected in samples from surface water taken more than 2 hours after the spray, and PBO was last detected in samples taken 48 hours after the spray.

Zulkosky et al. (2005) detected resmethrin in five of ten locations within an hour after mosquito control applications of Scourge. PBO was detected in all but one location, and was still present at three locations in samples collected three days after a Scourge spray.

There are limited data on spatial extent. In both of the previous studies, PBO was detected more frequently (in up to 83 percent of samples) than resmethrin (in up to 50 percent of samples).

Repeated Applications

The Abbene et al. (2005) study included one site with two weekly applications of resmethrin. Concentrations of resmethrin and PBO measured after the second application were lower than those measured after the first application.

4.2.2.2.3 Phenothrin (Sumithrin) and PBO

As shown in Table 3-3 and discussed in Section 3.2.2.3, four field studies investigated the effects of phenothrin adulticides, and three of these studies measured PBO.

Exceedance of Receiving Water Monitoring Triggers

As discussed in Section 3.2.2.3, the phenothrin monitoring trigger was exceeded in two of 68 water samples collected by the New York City Department of Health following mosquito adulticide applications (Suffolk County 2006). However, the phenothrin trigger was not exceeded in either of the other two studies that measured phenothrin concentrations in water; these studies included both aerial and truck application. PBO concentrations also did not exceed the trigger in any of the three studies.

Toxicity

Davis and Peterson (2008) measured family diversity, richness, and evenness 1, 7, 14, and 28 days after truck application of phenothrin. Most response variables showed no significant treatment effect, although there were some reductions in number of individuals. The authors concluded that the reductions in aquatic nontarget populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application.

Spatial and Temporal Extent

Zulkosky et al. (2005) detected phenothrin in some samples immediately after spray application, but not in samples collected one to ten days after spraying Anvil. PBO was detected immediately after spraying and was still found in some samples ten days later.

There are limited data on spatial extent. Generally, PBO was detected much more frequently (up to 100 percent of samples collected immediately after sampling) than phenothrin.

Repeated Applications

None of the studies reviewed included repeated application to the same site.

4.2.2.3 Organophosphates

4.2.2.3.1 Malathion

As shown in Table 3-3 and discussed in Section 3.2.3.1, three field studies investigated the effects of malathion adulticides.

Exceedance of Receiving Water Monitoring Triggers

All three studies detected malathion concentrations that exceeded the SWRCB trigger, including both truck and aerial applications.

Toxicity

Tucker et al. (1987) found no significant mortality in copepods or fish in sentinel cages exposed to truck-mounted or aerial applications of malathion. Jensen et al. (1999) found no significant differences in macroinvertebrate abundance and biomass or species diversity, and no mortality occurred in mosquitofish or mosquito larvae held in sentinel cages after truck application.

Spatial and Temporal Extent

Tucker et al. (1987) evaluated deposition and nontarget effects for truck-mounted and aerial applications of malathion in an estuary in east-central Florida. Malathion concentrations in water peaked at 5 µg/L 84 minutes after aerial application. Malathion concentrations peaked at 1.3 µg/L 15 minutes after truck application and remained detected for up to 18 hours.

In what may have been the same study, Wang et al. (1987) investigated the fate of malathion after aerial ULV applications of mosquito adulticides at a salt marsh in Florida. After application, the peak malathion concentration of 5 µg/L was detected at 1.4 hours, and was still detected (0.22 µg/L) at 22.4 hours at concentrations above the SWRCB- monitoring trigger (0.1 µg/L), but at 48.4 hours, was below the reporting limit of 0.05 µg/L.

There are limited data on spatial extent.

Repeated Applications

None of the studies found included repeated application to the same site.

4.2.2.3.2 Naled

As shown in Table 3-3 and discussed in Section 3.2.3.2, three field studies investigated the effects of naled adulticides.

Exceedance of Receiving Water Monitoring Triggers

Two of the three studies detected naled concentrations that exceeded the SWRCB trigger. One of these studies (Tucker et al. 1987) included both truck and aerial applications; the trigger was not exceeded after truck application but was exceeded after aerial application.

There are limited data on spatial extent.

Toxicity

Tucker et al. (1987) found significant mortality in copepods, but not in fish in sentinel cages exposed to truck-mounted or aerial applications of malathion.

Spatial and Temporal Extent

Tucker et al. (1987) found the maximum concentration of naled in water samples following truck applications (0.71 µg/L) 15 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 4 hours. The same study evaluated deposition of these materials following applications made from aircraft (Tucker et al. 1987). The maximum concentration of naled in water samples following aerial applications (20.15 µg/L) occurred 27 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 9 hours.

In what may have been the same study, Wang et al. (1987) detected naled 30 minutes after application, when the concentration was 20.15 µg/L, decreasing to 0.2 µg/L at 6.45 hours, and not detected at 12.45 hours. The peak concentration of dichlorvos was 2.22 µg/L approximately 30 minutes after application, and it was still detectable at 12.45 hours (0.28 µg/L).

Pierce et al. (2005) detected naled in the water surface microlayer at one of eighteen sites. It was not detected in subsurface water. Residues were not detected in the water surface microlayer 12 hours after the application. Dichlorovos, a breakdown product of naled, was detected at 2 to 4 hours after the application. Trace amount were still detectable at 10 to 12 hours post-treatment.

Repeated Applications

None of the studies reviewed included repeated application to the same site.

4.3 MONITORING OBJECTIVES

Based on the existing information summarized in Section 4.2, the following monitoring objectives are proposed to help answer the key questions identified by the SWRCB and MVCAC:

- Focus first on "highest use" scenarios (sites with high frequency of application, large area covered, maximum application rates, formulations with high percentage of PBO (relevant for pyrethrins and pyrethroids), and applications over/near water)
- Focus on aerial application, as available data indicate that deposition tends to be higher for aerial application than for truck application
- Include various types of sites representative of statewide applications (urban, agricultural, wetlands)
- Characterize chemistry

Section 5 describes the focused research study program to achieve these objectives.

This section describes the focused research study approach by MVCAC to answer the key questions and meet the study objectives identified in Section 4.

5.1 MONITORING APPROACH FOR LARVICIDES

Monitoring and reporting requirements for mosquito larvicide applications are described in Attachment C (Monitoring and Reporting Program) of the existing NPDES permit for vector control. These requirements are summarized in table C-1 under B. Monitoring Requirements for Larvicides and the MVCAC Monitoring Coalition will follow these guidelines to ensure compliance with the permit. The Coalition will monitor for the visual, physical, and chemical components of Table C-1.

As described in Sections 3.1 and 4.2.1, adequate data exist for most of the larvicides used by MVCAC to characterize aquatic toxicity. The evidence indicates that most larvicides, when used at label application rates, are not likely to have significant adverse effects on nontarget aquatic organisms. In addition, because larvicides are applied directly to water bodies for control of mosquito larvae, the permit would apply for residual concentrations that remain after the treatment period; evidence indicates that while limited potential effects may occur with some larvicides during the treatment period, the persistence of most larvicides is very short and significant residues are not likely to remain after the treatment period.

5.2 MONITORING APPROACH FOR ADULTICIDES

Monitoring and reporting requirements for mosquito adulticide applications are described in Attachment C (Monitoring and Reporting Program) of the existing NPDES permit for vector control. These requirements are summarized in table C-2 under B. Monitoring Requirements for Adulticides and the MVCAC Monitoring Coalition will follow these guidelines to ensure compliance with the permit. The Coalition will monitor for the visual, physical, and chemical components of Table C-2.

5.3 SELECTION OF MONITORING PARAMETERS

The monitoring program will focus on evaluating the products with the highest percentages of the active ingredients as highlighted in Attachment C-Monitoring and Reporting Program of the permit.

Pyrethrins Formulations

Pyrethrins are the most commonly used mosquito adulticides in California, comprising approximately 77.1 percent of acreage treated in 2008 (estimated assuming maximum application rates). The percentage by weight is smaller, because the application rate for pyrethroids is lower than other pesticides such as organophosphates.

A pyrethrins formulation with a relatively high ratio of PBO to active ingredient (such as Evergreen Crop Protection EC 60-6, Pyrenone Crop Spray, or Prentox Pyronyl Crop Spray) will

be selected for the monitoring program, and PBO concentrations in surface water will also be monitored.

Organophosphates

Because application rates are high relative to other adulticides, naled accounts for a large proportion of adulticide use by mass (74.9 percent in 2008), but a much smaller proportion by acreage (estimated 8.8 percent) (see Figures 2-4 and 2-5).

Malathion use has declined over the past several years; it accounted for less than 4 percent of adulticide application by mass in California in 2008, and an estimated 0.2 percent of the acreage covered by adulticide applications.

Pyrethroids

The pyrethroids most used for adult mosquito control in California are phenothrin (sumithrin) and permethrin (see Figures 2-4 and 2-5). Monitoring of pyrethroid formulations will include analysis of PBO if present. Etofenprox is a relatively formulation available to vector control districts and anticipated use should increase in future seasons and this increase will facilitate appropriate monitoring. The permethrin formulation monitored will be that with the highest proportion of PBO (currently Biomist 4+12 ULV); all formulations of phenothrin currently used contain the same ratio of PBO to active ingredient.

5.4 SELECTION OF REPRESENTATIVE LOCATIONS

5.4.1 Types of Applications

As described in Section 2.3.1, ULV applications for adult mosquito control may be made by air, truck, or handheld equipment. MVCAC proposes that the monitorning program focus on aerial applications. Handheld applications are limited and small scale, and generally do not occur over water. As discussed in Section 3, available data indicate that deposition rates are likely to be higher for aerial applications than for truck applications.

5.4.2 Types of Sites

As described in Section 2.3.2, ULV applications for adult mosquito control may be made in a variety of locations, including but not limited to ditches, storm drains, wetlands, tidal marshes, woodlands, rice fields, neighborhoods, tree holes, overgrown areas, and golf courses. Locations may be urban, suburban, agricultural, recreational, or wildlife refuge areas and application sites may vary in size from a fraction of an acre to several thousand acres. The MRP will focus on large application sites in urban, wetland, and agricultural areas.

5.4.3 Examples of Representative Sites

Table 5-1 and Figures 5-1, 5-2, and 5-3 show examples of potential monitoring sites that may be used to represent pyrethrins and PBO applications, based on recent adulticide use patterns. Because the nature of mosquito control and the application materials and frequency may change from year to year, these sites should be considered only as potential examples, not as proposed monitoring sites. Due to these variables, specific monitoring sites can not be pre-selected at this time. Based on historical control needs, the Coalition anticipates most site selection and monitoring to occur June-Sep. Representative monitoring sites will be selected each year based on expected pesticide use, frequency of application, available water quality data in the region, information on other potential sources of toxicity, and availability of appropriate reference sites. An example of recent available monitoring data for one of the potential sites (Brack Tract) is provided in Table 5-2.

Table 5-1. Potential Monitoring Sites for Pyrethrins/PBO

Site	District	Adulticide Formulations Typically Used	Aerial Application Frequency	Type of Site	Approximate Size of Application Area
Gustine Spray Block 39	Merced County	Pyrenone 6-60, Evergreen 6-60, or Pyronyl 6-60	3 to 6 times/year	Wetlands and agriculture	1,800 acres
Brack Tract	San Joaquin County	Evergreen 60-6, Trumpet EC	Up to 6 times/year	Wetlands, irrigated pasture, and agriculture	2,000 to 5,000 acres
City of Colusa	Colusa	Pyrenone 6-60, Evergreen 6-60, or Pyronyl 6-60, Trumpet EC	Up to 3 times a year	Residential and agricultural	2,240 acres

Table 5-2 2009 Monitoring Data from Irrigation Lands Program for Brack Tract

Analyte and Unit	Count	Min	Max	Average	Percentage Detected
Aldicarb µg/L	3	0.2	0.2	0.2	0%
Aldrin µg/L	3	0.005	0.005	0.005	0%
Ammonia as N mg/L	3	0.26	0.33	0.3	100%
Arsenic,Total µg/L	3	12	15	13.7	100%
Atrazine µg/L	3	0.25	0.25	0.25	0%
Azinphos methyl µg/L	3	0.05	0.05	0.05	0%
Boron,Total µg/L	3	120	130	126.7	100%
Cadmium,Dissolved µg/L	3	0.011	0.05	0.037	33%
Cadmium,Total µg/L	3	0.02	0.04	0.03	100%
Carbaryl µg/L	3	0.035	0.035	0.035	0%
Carbofuran µg/L	3	0.035	0.035	0.035	0%
Chlordane µg/L	3	0.005	0.005	0.005	0%
Chlorpyrifos µg/L	3	0.0075	0.0075	0.0075	0%
Copper,Dissolved µg/L	3	0.44	0.9	0.6	100%
Copper,Total µg/L	3	1.5	2.6	1.9	100%
Cyanazine µg/L	3	0.25	0.25	0.25	0%
DDD(p,p') µg/L	3	0.005	0.005	0.005	0%
DDE(p,p') µg/L	3	0.005	0.005	0.005	0%
DDT(p,p') µg/L	3	0.005	0.005	0.005	0%
Demeton-s µg/L	3	0.05	0.05	0.05	0%
Diazinon µg/L	3	0.01	0.01	0.01	0%
Dichlorvos µg/L	3	0.05	0.05	0.05	0%
Dicofol µg/L	3	0.05	0.05	0.05	0%
Dieldrin µg/L	3	0.005	0.005	0.005	0%
Dimethoate µg/L	3	0.05	0.05	0.05	0%
Dissolved Solids,Total mg/L	3	660	1100	847	100%
Disulfoton µg/L	3	0.025	0.025	0.025	0%
Diuron µg/L	3	0.2	0.61	0.35	67%
E. coli MPN/100 mL	3	28	49	41	100%
Endosulfan I µg/L	3	0.005	0.005	0.005	0%
Endosulfan II µg/L	3	0.005	0.005	0.005	0%
Endrin µg/L	3	0.005	0.005	0.005	0%
Glyphosate µg/L	3	2.5	2.5	2.5	0%
Hardness as CaCO3 mg/L	3	370	640	473	100%
HCH, alpha µg/L	3	0.005	0.005	0.005	0%
HCH, beta µg/L	3	0.005	0.005	0.005	0%
HCH, delta µg/L	3	0.005	0.005	0.005	0%
HCH, gamma µg/L	3	0.005	0.005	0.005	0%
Heptachlor µg/L	3	0.005	0.005	0.005	0%
Heptachlor epoxide µg/L	3	0.005	0.005	0.005	0%
Lead,Dissolved µg/L	3	0.125	0.125	0.125	0%
Lead,Total µg/L	3	0.42	0.79	0.55	100%
Linuron µg/L	3	0.2	0.2	0.2	0%
Malathion µg/L	3	0.05	0.05	0.05	0%

Analyte and Unit	Count	Min	Max	Average	Percentage Detected
Methamidophos µg/L	3	0.1	0.1	0.1	0%
Methidathion µg/L	3	0.05	0.05	0.05	0%
Methiocarb µg/L	3	0.2	0.2	0.2	0%
Methomyl µg/L	3	0.035	0.035	0.035	0%
Methoxychlor µg/L	3	0.005	0.005	0.005	0%
Molybdenum,Total µg/L	3	4.1	4.5	4.23	100%
Nickel,Dissolved µg/L	3	1.6	2.1	1.87	100%
Nickel,Total µg/L	3	2.4	3.5	2.93	100%
Nitrate + Nitrite as N mg/L	3	0.29	0.72	0.57	100%
Nitrogen, Total Kjeldahl mg/L	3	0.05	1.1	0.72	67%
OrthoPhosphate as P,Dissolved mg/L	3	0.021	0.043	0.03	100%
Oxamyl µg/L	3	0.2	0.2	0.2	0%
Paraquat dichloride µg/L	3	0.25	0.25	0.25	0%
Parathion, Methyl µg/L	3	0.05	0.05	0.05	0%
Phorate µg/L	3	0.05	0.05	0.05	0%
Phosmet µg/L	3	0.1	0.1	0.1	0%
Phosphate as P mg/L	3	0.24	0.26	0.25	100%
Selenium,Total µg/L	3	0.08	0.12	0.10	100%
Simazine µg/L	3	0.12	0.47	0.28	67%
Suspended Solids,Total mg/L	4	12	37	27.5	100%
Total Organic Carbon mg/L	3	8.5	9.4	9.03	100%
Toxaphene µg/L	3	0.25	0.25	0.25	0%
Trifluralin µg/L	3	0.025	0.025	0.025	0%
Turbidity NTU	4	17	30	20.3	100%
Zinc,Dissolved µg/L	3	0.5	1	0.67	33%
Zinc,Total µg/L	3	2.6	4	3.17	100%
Oxygen, Dissolved mg/L	3	5.12	7	5.8	100%
pH none	3	7.28	7.49	7.4	100%
SpecificConductivity µS/cm	3	1211	1910	1493	100%
Temperature °C	3	10.12	12.04	10.8	100%

Source: CVWQCB 2010

Note: For the purpose of data evaluation, non-detect data was assumed to equal half the reporting limit.

5.5 CHEMISTRY ANALYSIS METHODS

The MVCAC Monitoring Coalition will comply with the laboratory requirements of the permit as highlighted in attachments C-Monitoring and Reporting Program, I-General Monitoring Provisions, B and C.

5.6 REPORTING REQUIREMENTS

The MVCAC Monitoring Coalition will comply with the reporting requirements of the permit as highlighted in attachments C-Monitoring and Reporting Program, V-Reporting Requirements, Provisions, A, B and C.

Figure 5-1 Gustine Spray Block 39

Figure 5-2. Brack Tract

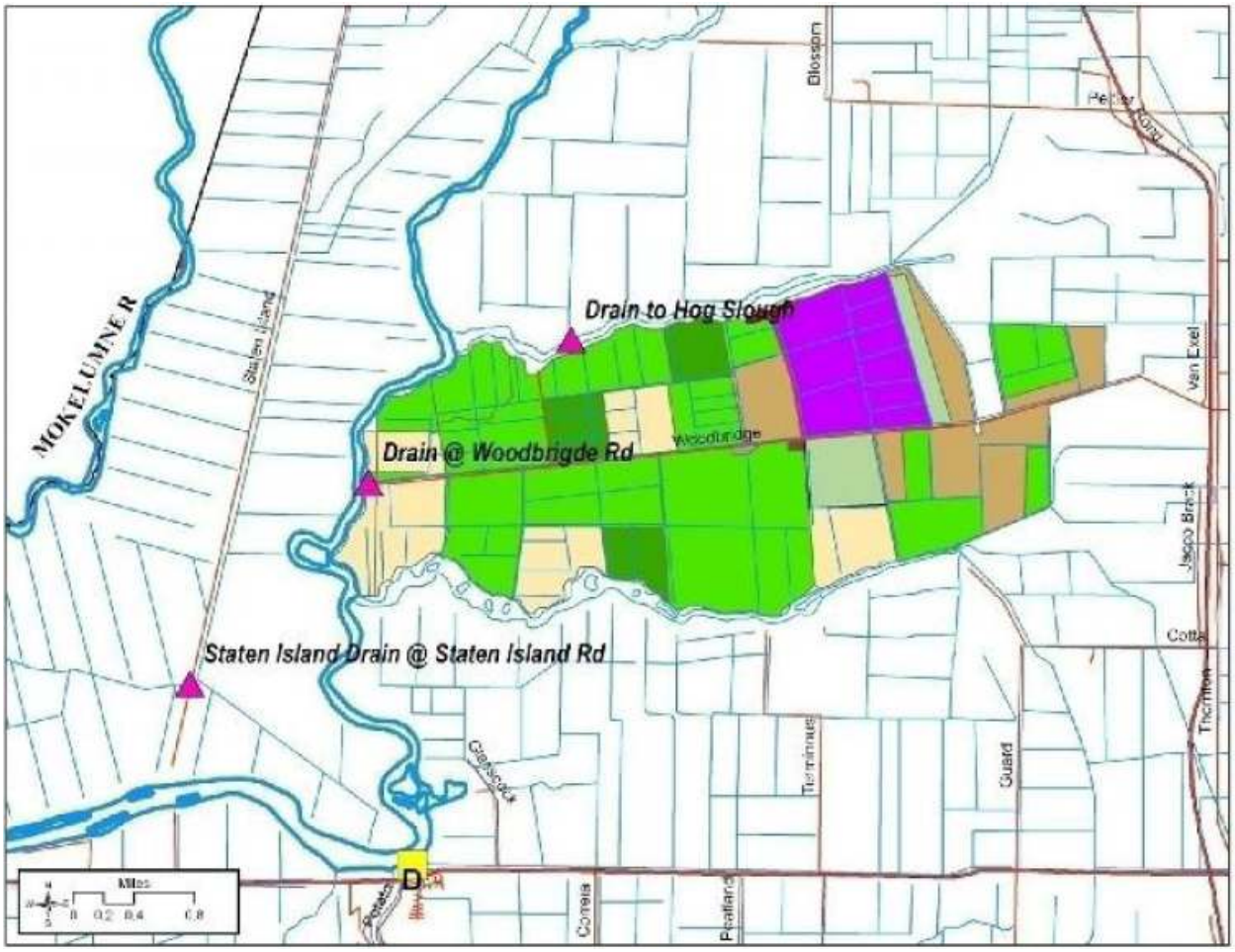

Figure 5-3 City of Colusa

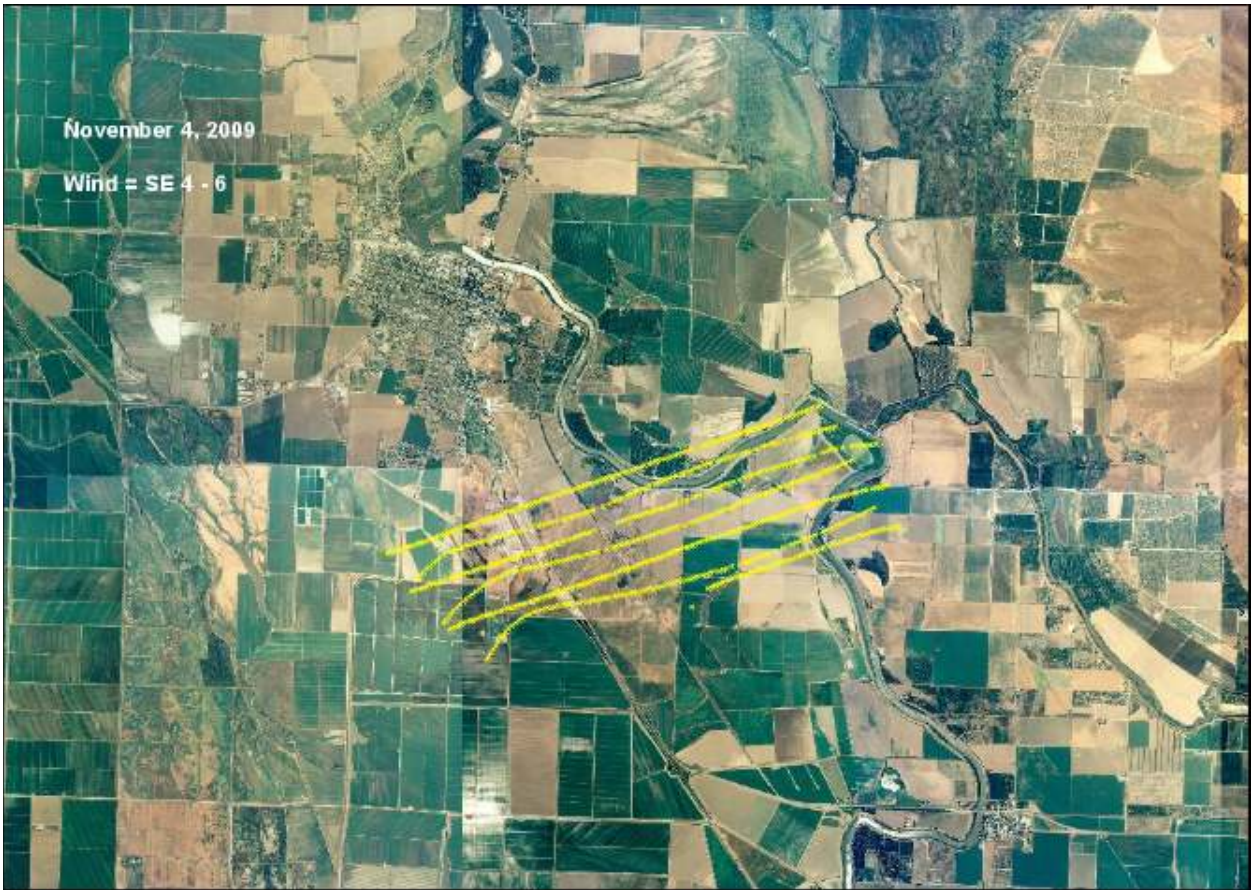

Table 5-3 Examples of Current Analytical Methods

Parameter	Laboratory	Analytical Method or Detectors	Reporting Limits (µg/L)	Detection Limits (µg/L)
Pyrethrins	Caltest Analytical Laboratory	EPA 8270 (GCMS-SIM)	0.1 to 0.5	0.004 to 0.11
Pyrethoids	USGS	GCMS		0.002 to 0.006
	USGS	GCMS-MS		0.0005 to 0.001
	CDFG	GCMS and GC-ECD		0.001 to 0.005[a]
	Caltest Analytical Laboratory	EPA 8270 (GCMS-SIM)	0.005[b]	0.004[b]
	CRG Marine Laboratories, Inc.	GCMS-NCI	0.025[a]	0.005[a]
Naled	Caltest Analytical Laboratory	U.S. EPA 614(m) or 8141A	1	0.03
	CRG Marine Laboratories, Inc.	U.S. EPA 625(m)	0.01	0.005
Temephos	Universtiy of California IR-4 Laboratory	GCMS, GCMS-MS	0.005	0.0005

Notes:

[a] Analysis of Permethrin, but detection limits are not developed for Phenothrin.

[b] Detection/reporting limits for both Permethrin and Phenothrin.

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Appendix B

INTEGRATED VECTOR MANAGEMENT & RESPONSE PLAN

ORANGE COUNTY VECTOR CONTROL District

Integrated Vector Management & Response Plan

May 11, 2010

Integrated Vector Management & Response Plan
Preface

The purpose of the Integrated Vector Management and Response Plan is to provide guidelines to Orange County Vector Control District (District) staff and information to stakeholders regarding the various responses made to prevent and control disease vectors as well as introduced diseases and vectors in Orange County. A vector is any insect or arthropod, rodent or other animal of public health significance capable of harboring or transmitting the causative agents of human disease, or capable of causing human discomfort or injury. This document details the roles and responsibilities of Management, Administration, Public Information, Laboratory, and Operations staff in responding to vector-borne disease threats. The responses are organized by vector species that cause illnesses in humans, domestic animals, and wildlife. This Response Plan also includes contingencies for targeting control of newly introduced disease vectors that are nonnative in Orange County. The formation of this document is guided by the following principles: The application of professional knowledge and judgment for the protection of public health, the use of integrated vector management (IVM) concepts, partnerships with stakeholders, and continuous assessment and improvement.

Protection of Public Health
The mission of the Orange County Vector Control District is to provide the citizens of Orange County with the highest level of protection from vectors and vector-borne diseases. This mission is achieved by being proactive in response to current and future vector threats; responding effectively and courteously to the needs of the public; informing and educating the public about the shared responsibility of vector control; utilizing the most effective and safest methods available for the control of vectors; and providing vector control services in the most cost-effective manner.

Integrated Vector Management
The District's vector control activities are based solely on Integrated Vector Management principles. These principles serve as the foundation for developing vector control activities. Vector population and pathogen monitoring are integral to the control program and are used to generate criteria to implement mosquito management. The District recognizes that utilizing IVM principles will reduce the use of pesticides.

Professional Knowledge and Judgment
The District applies professional knowledge and judgment when necessary. Although this document represents the District's best efforts to delineate the District's response for reasonably foreseeable situations, it is recognized that management of vector populations and vector diseases is part of a natural process; and, therefore, very complex and not completely understood. In addition, site specific and incident specific conditions are highly variable and unpredictable. Therefore, District management and staff are allowed and expected to exercise professional knowledge and judgment in implementation of these policies and procedures. Deviation from these guidelines is, therefore, allowable when deemed necessary by District management or

authorized staff, based on available information and conditions, to meet the District's primary goal of protecting the public from vector-borne diseases.

Stakeholder Partnerships

The District works actively and cooperatively with stakeholder groups to help ensure that vector production is avoided or minimized; and, when necessary, controlled to protect both human and environmental health. The District aims to engage the public in the shared responsibility of vector control. The District identifies Federal Government agencies, State of California, Orange County, incorporated city and local government officials and agencies, agricultural producers, environmental groups, community groups and leaders, and citizens within the District's jurisdiction as stakeholders.

Continuous Improvement

The District regularly researches and tests new and innovative vector monitoring and management techniques. Staff is encouraged to investigate methods to improve vector and vector-borne disease management tools and incorporate them into activities as necessary. For this purpose, this document will be reviewed as necessary by District staff and approved by the Board of Trustees.

The effective cooperation and communication among collaborative agencies is critical to the success of these responses to prevent or stop the spread of vector-borne disease. Included in this response as an appendix is the "California Mosquito-Borne Virus Surveillance and Response Plan" prepared jointly by the California Department of Public Health, Mosquito and Vector Control Association of California, and the University of California.

Integrated Vector Management Response & Guidelines
Orange County Vector Control District

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List of Abbreviations

BMP – Best Management Practice for stormwater and urban runoff.
CAC – County Agricultural Commissioner Office.
CDC – Center for Disease Control and Prevention.
CDPH – California Department of Public Health.
CO_2 – Carbon dioxide.
GIS – Geographical Information System.
HCPS – Hantavirus Cardiopulminary Symptom.
IVM – Integrated Vector Management.
OCHCA – Orange County Health Care Agency.
OCVCD – Orange County Vector Control District.
PCO – Pest Control Operator.
PHP – Public Health Pesticide.
RIFA – Red Imported Fire Ant.
SLE – St. Louis Encephalitis.
ULV – Ultra Low Volume.
USDS – Underground Storm Drain System.
WEE – Western Equine Encephalitis.
WNV – West Nile virus, On-Going Mosquito Control Activities.

Integrated Vector Management Response Plan

On-Going Mosquito Control Activities

Standard mosquito control activities follow the Immature Mosquito Management Guidelines and the Adult Mosquito Management Guidelines and generally consist of the components listed below. This level is equivalent to the "California Mosquito-Borne Virus Surveillance and Response Plan" Level 1 – Normal Season.

- Increase public education and awareness through the regular distribution of media releases, attendance at public events, public lectures, and other similar outreach mechanisms.

- Monitor mosquito, mosquito-borne disease, and public health pesticide efficacy surveillance activities using the following:
    a. Mosquito and insect identification.
    b. CDC/CO_2-baited traps.
    c. Gravid traps.
    d. Encephalitis virus testing in mosquitoes, dead birds, and wild birds.
    e. Sentinel chicken testing.
    f. Develop GIS maps.
    g. Monitor Public Health Pesticide Efficacy.

- Conduct routine immature mosquito identification and management (See Immature Mosquito Management Guidelines).
    a. Evaluate sites for immature mosquito threshold densities by species.
    b. Maintain continuous surveillance for potential mosquito development sites.
    c. Conduct aerial surveillance for residential green pools.
    d. Evaluate environmental and regulatory conditions and requirements.
    e. Determine the possibility of source reduction by drainage or modification of site.
    f. Introduce biological control measures (such as mosquito fish) if appropriate.
    g. Apply public health pesticides when necessary.
    h. Maintain larval treatment cycle time between 7-30 days.

- Routine adult mosquito management (See Adult Mosquito Management Guidelines).
    a. Control in urban areas will be on an as needed basis, as determined by the Director of Operations and resident requests.
    b. Initiate adult mosquito management when threshold criteria are met or exceeded.
    c. Utilize historical mosquito distribution and abundance data to make control decision.

Detection of a Dead Bird/Mosquito Pool/ Sentinel Chicken/Animal with a Mosquito-borne Virus

The following responses are initiated when the District's Scientific and Technical Services Laboratory detects a mosquito-borne virus (WNV, WEE, SLE) or when CDPH notifies the District of a mosquito-borne virus from dead bird(s), mosquito pool(s), sentinel chicken(s), or animal(s) within District boundaries. This level is equivalent to the "California Mosquito-Borne Virus Surveillance and Response Plans" Level 2 Normal Season and Emergency Planning Rating.

Management Responsibility Notify the District Board of Trustees. Evaluate District staffing and program needs.	**Communications Department Responsibility** Distribute a News Release.
Scientific and Technical Services Responsibility Notify County Public Health Officials. Notify County and City Animal Services. Provide additional localized disease surveillance to determine scope of virus activity. Continue to collect mosquito pools for isolation of virus as scheduled. Continue to bleed sentinel chickens as scheduled. Provide GIS maps.	**Control Operations Management Responsibility** Prepare for controlling adult mosquitoes when initiation criteria are met.
Control Operations Zone Responsibility Inspect and treat mosquito larval development sites. Investigate mosquito service requests from the public. Assess adult mosquito populations. Inspect known green pool locations in area.	**Control Operations Special Services Responsibility** Inspect flood channels in area. Inspect problem underground water storage devices and BMPs in the area. Inspect possible breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect historical breeding sites. Inspect other tracked sources in the area.

Locally Acquired Human Case of a Mosquito-borne Virus

The following responses are initiated when the OCHCA, or CDPH notifies the District that a human has acquired a mosquito-borne infection(s) within Orange County. This level is equivalent to the "California Mosquito-Borne Virus Surveillance and Response Plans" Level 3 Emergency Planning and Epidemic Rating.

Management Responsibility Notify the District Board of Trustees. Evaluate District staffing and program release needs.	**Communications Department Responsibility** Coordinate the distribution of a news with OCHCA.
Scientific and Technical Services Responsibility Coordinate with County Public Health USDS Officials. Determine scope of virus activity to support control efforts. Continue to collect mosquito pools for isolation of virus as scheduled. Continue to bleed sentinel chickens as scheduled. Provide GIS maps.	**Control Operations Management Responsibility** Consider reducing the spray route and cycle time to 8-10 days. Consider controlling adult mosquitoes when initiation criteria are met.
Control Operations Zone Responsibility Inspect and treat mosquito larval development sites. Investigate mosquito service requests from the public. Assess adult mosquito populations. Inspect known green pool locations in area.	**Control Operations Special Services Responsibility** Inspect flood channels in area. Inspect problem underground water storage devices and BMPs in the area. Inspect possible breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect historical breeding sites. Inspect other known sources in the area.

Epidemic Conditions of a Mosquito-borne Virus

The following responses are initiated when OCHCA or CDPH officials notify the District that multiple infections have occurred within a specific area, or there is evidence that an epidemic condition exists. The epidemic area is defined as the geographic region in which human cases are clustered (incorporated city, community, neighborhood, or Zip Code). This level is equivalent to the "California Mosquito-Borne Virus Surveillance and Response Plans" Level 2 Normal Season and Emergency Planning Rating.

Management Responsibility Consider holding a special Board of Trustee meeting. Shift District staffing and resources to meet program needs.	**Communications Department Responsibility** Distribute a News Release. If truck mounted ULV is necessary, include additional information in News Release.
Scientific and Technical Services Responsibility Coordinate with County Public Health Officials. Determine scope of virus activity to support control efforts. Continue to collect mosquito pools for isolation of virus as scheduled. Continue to bleed sentinel chickens as scheduled. If truck mounted ULV is appropriate, evaluate the control program. Provide GIS maps.	**Control Operations Management Responsibility** Consider reducing the treatment cycle time below 8-10 days. Consider controlling adult mosquitoes when initiation criteria are met. Delineate and map the treatment area. As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Inspect and treat mosquito larval development sites. Investigate mosquito service requests from the public. Assess adult mosquito populations. Inspect known green pool locations in area. Provide educational materials to affected area. Distribute information to collaborating agencies and stakeholders in the area.	**Control Operations Special Services Responsibility** Inspect flood control channels in area. Inspect problematic underground water storage devices and BMPs in the area. Inspect possible breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect historical breeding sites. Inspect other known sources in the area.

Response to Imported Malaria Case

The following responses are initiated when OCHCA notifies the District of an imported malaria case(s) within the District boundaries. District response to a reported malaria case(s) is determined by the vector activity period, difference between the date of diagnosis and the current date, mosquito population, and the date of the reported case.

Scientific and Technical Services Responsibility Determine scope of activity. Identify adult mosquitoes collected. Determine if *Anopheles* spp.are infected with malaria parasites.	**Control Operations Management Responsibility** Determine if adult mosquito control is necessary if initiation criteria are met in area. Delineate treatment area, as necessary.
Control Operations Zone Responsibility Inspect *Anopheles* mosquito development sites in area. Assess adult mosquito population.	**Control Operations Special Services Responsibility** Inspect *Anopheles* breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect problem underground water storage devices and BMPs in the area. Inspect other known sources in the area.

Response to a Locally Acquired Malaria Case and/or Infected Mosquitoes

The following responses are initiated when Orange County Health Care Agency notifies the District of a locally acquired malaria case(s) and or when *Anopheles* spp. are found infected with malaria parasites within the District boundaries. District response is determined by the vector activity period, difference between the date of diagnosis and the current date, mosquito population, and the date of the reported case.

Management Responsibility Notify District Board of Trustees President. Evaluate District staffing and program needs.	**Communications Department Responsibility** Prepare educational materials. Coordinate the distribution of a news release with OCHCA. Consider a region-wide press conference.
Scientific and Technical Services Responsibility Determine scope of activity. Identify adult mosquitoes collected. Analyze climate and meteorological data to determine if conditions are favorable for Anopheline development. Determine if *Anopheles* are infected with malaria parasites. Provide GIS maps.	**Control Operations Management Responsibility** Contact County Agricultural Commissioner. Delineate and map the treated area. Coordinate response with other local vector control agencies.
Control Operations Zone Responsibility Inspect *Anopheles* mosquito development sites in area. Assess adult mosquito population. Conduct surveillance for *Anopheles* at local airports. Distribute educational materials.	**Control Operations Special Services Responsibility** Inspect *Anopheles* breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect problem underground water storage devices and BMPs in the area. Inspect historical breeding sites. Inspect other known sources in the area.

Critical Response to the Detection of an Introduced, Non-Native Disease or Disease Vector Within Orange County

The following response is initiated when the District detects an introduced, nonnative disease, or disease vector within Orange County. The District recognizes that a quick, efficacious response is necessary to prevent the vector or disease from becoming established in Orange County and Southern California.

Management Responsibility Notify District Board of Trustees. Contact and coordinate response with other stakeholders.	**Communications Department Responsibility** Conduct a press conference and distribute a news release. Prepare educational materials. If truck mounted ULV spraying is necessary, include additional information in news release.
Scientific and Technical Services Responsibility Notify County Public Health Officials. Train District staff about the disease or disease vector. Identify insect vectors and develop a surveillance strategy. Determine scope of infestation. Sample vectors for the presence of disease organism. If truck mounted ULV is necessary, evaluate the control program. Provide GIS maps.	**Control Operations Management Responsibility** Contact County Agricultural Commissioner. Determine a control strategy. Delineate and map the treatment area. Coordinate control of disease vector when initiation criteria are met. As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Assess adult population. Conduct a thorough inspection for and treat mosquito development sites. Control adult mosquitoes. Distribute educational materials.	**Control Operations Special Services Responsibility** Inspect flood control channels in area. Inspect problem underground water storage devices and BMPs in the area. Inspect possible breeding sites (Canyon Drains\Marshes\Reservoirs) in area. Inspect other known sources in the area.

Black Fly Control Operations

Standard black fly activities follow Black Fly Management Guidelines and generally consist of the components listed below.

- Routine public education and awareness through the distribution of media releases, attendance at public events, public lectures, and other similar outreach mechanisms.

- Routine black fly and public health pesticide efficacy surveillance activities. Occurrence of black flies may also be noted by resident complaints.
    a. Black fly Identification.
    b. CDC/CO_2-baited traps.
    c. Prepare GIS maps.
    d. Conduct posttreatment surveillance.

- Routine immature black fly management.
    a. Evaluate the site for immature black fly habitat.
    b. Evaluate environmental and regulatory conditions and requirements.
    c. If appropriate, apply PHP.
    d. Apply PHP again, if needed, at time interval noted on PHP label.

Fly Control Operations

Fly control is initiated when the District is notified of an infestation occurring within District boundaries. The response follows Fly Control Guidelines. The District only uses pesticides to control fly infestations where source reduction is not possible, in situations that are deemed significant, and considered a threat to public health and safety.

- Fly control is instigated only after a thorough evaluation of the site is conducted and should include:
    a. Identification of pest fly species and estimation of population density.
    b. Identification of larval breeding source.
    c. Reduction of larval breeding source through habitat and source reduction, when possible.

- If reduction of larval breeding source is conducted, but a significant population of flies remains, the use of a public health pesticide may be necessary to control the population.

Scientific and Technical Services Responsibility Identify fly species and estimate population density. Determine scope of infestation. Conduct posttreatment evaluation of fly population. If necessary, provide GIS maps detailing surveillance and control activities.	**Control Operations Management Responsibility** Determine a control strategy. Delineate treatment area. As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Distribute educational materials.	**Control Operations Special Services Responsibility** Distribute educational materials. Assist in source removal, if necessary. Apply pesticides to control flies, if necessary.

Response to a Flea-borne Typhus Case

The following responses are initiated when the District is notified of a human case of flea-borne typhus occurring within Orange County. The District recognizes that a quick response is necessary to instigate a reduction of the flea population in the area.

- A comprehensive flea-borne typhus risk evaluation of the area is warranted and should include:
    a. Notification of surrounding residents that a flea-borne typhus case has occurred in the area and what can be done to reduce the flea population in the area (use of flea control measures on pets).
    b. Live-trapping of opossums to determine the flea species and flea load per animal and the collection of whole blood for assessment of transmission activity.
    c. Assessing the flea abundance on backyard wildlife and pets.
    d. Assessing the potential for humans to be exposed to vector fleas.
    e. Reviewing the past history of flea-borne typhus activity and/or flea-borne typhus cases in the region.

Management Responsibility Notify District Board of Trustees. Contact and coordinate response with other stakeholders.	**Communications Department Responsibility** Conduct a press conference and distribute a news release.
Scientific and Technical Services Responsibility Notify County Public Health Officials. Conduct comprehensive flea-borne typhus risk assessment. Determine scope of infestation. Sample vectors for the presence of disease organism. Provide GIS maps detailing surveillance and control activities.	**Control Operations Management Responsibility** As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Distribute educational materials and assist with surveillance activities. Assist with comprehensive flea-borne typhus risk assessment.	

Response to a Tick-borne Disease Case (Lyme Disease, Rocky Mountain Spotted Fever, Tularemia)

The following responses are initiated when the District is notified of a human case of tick-borne disease occurring within Orange County.

- A comprehensive tick-borne disease risk evaluation of the area is warranted and should include:
    a. Live-trapping (flagging) ticks to estimate tick density and the presence and/or prevalence of pathogens within the tick population.
    b. Assessing the potential for humans to be exposed to ticks.
    c. Reviewing the past history of tick populations and tick-borne disease in the area.
    d. Distribution of tick-borne disease educational materials to landholders and/or the affected population.

Ongoing RIFA Activities

Standard RIFA control activities follow Red Imported Fire Ant Guidelines and generally consist of the components listed below.

- Routine public education and awareness through the distribution of educational DVDs and flyers and attendance at public events. Education of maintenance staff at infested sites, such as schools, parks, golf courses, and nurseries. Distribution of educational material to residents in affected neighborhoods.

- Routine RIFA surveillance activities and public health pesticide efficacy.
    a. Insect identification.
    b. Inspection for mounds, foraging ants, and other signs of RIFA infestation around residential treatment sites and adjacent to large treatment sites.
    c. Placement of RIFA surveillance lures.
    d. Evaluation of new sites in Orange County for RIFA populations.
    e. Monitor pesticide efficacy.

- Routine RIFA Residential Site Management (Residential RIFA Treatment Cycle).
    a. Initial report is followed up by District staff who conduct RIFA surveillance and identification, and apply a pesticide ant bait.
    b. 2nd Residential treatment is conducted by a local Pest Control Operator (PCO) after 3 months of initial treatment.
    c. 3rd Residential treatment is conducted by the same PCO after 3 months of the 2nd treatment.
    d. Posttreatment survey is conducted at selected sites by the District. If RIFA are identified, the site begins the treatment cycle again.
    e. If a residence reports RIFA activity while on a RIFA treatment cycle, the District will respond and treat the site.

- Routine RIFA Large-Site Management (Large-Site RIFA Treatment Cycle)
    a. Specific guidelines are in place for large sites such as sites >1 acre, parks, schools, golf courses, and rights-of-way.
    b. Initial report is followed up on by District staff who conduct RIFA surveillance, identification, and apply a pesticide ant bait.
    c. 2nd, 3rd, and posttreatment surveys are conducted by District staff.
    d. If a large site reports RIFA activity while on a RIFA treatment cycle, the District will respond and treat the site.

RIFA Activities in Response to a Stinging Incident

The following response is instigated when the District is notified of a RIFA stinging incident within county boundaries. The District recognizes that a quick and efficacious response is necessary.

- RIFA treatment in response to a stinging incident.
    a. The District will respond to a stinging incident as quickly as possible.
    b. Advise persons to stay away from the area and post area conspicuously to keep others away.
    c. Staff will identify ant species and bring a sample to the District for confirmation.
    d. Staff will treat the mound.
    e. If ants are confirmed as RIFA, a residential or large site RIFA treatment cycle will be initiated.

Ongoing Rat Control Activities

Standard rat control activities (*Rattus* spp.) follow the Rat Management Guidelines and generally consist of the components listed below.

- Routine public education and awareness through the education of residents by responding to service requests, attendance at public events, public lectures, and other similar outreach mechanisms.

- Rat inspections and control.
    a. Inspections for rat activity around residences, businesses, parks, schools, city, county, state, and federal lands in Orange County.
    b. Recommendations to abate rat harborage, food sources, and modify rat entry points in homes and structures.
    c. Placement of rodenticide in tamper-resistant bait stations around exterior of residences.

Ongoing Rodent Surveillance Activities

Standard rodent surveillance activities generally consist of the components listed below.

- Routine rodent and rodent-borne disease surveillance and rodenticide efficacy.
    a. Rodent trapping and identification (rats, mice, and ground squirrels).
    b. Rodent parasite identification.
    c. Testing of rodents for rodent-borne diseases, such as bubonic plague, Hantaviruses, and additional diseases as needed.
    d. Testing of squirrels for WNV.
    e. Monitoring rodenticide efficacy.

Response to a Human or Animal Plague Case

The following response is initiated when the District is notified of a human or rodent plague case within county boundaries. The District recognizes that a quick and efficacious response is necessary to control rodents and their parasites that can further transmit the pathogen. This response is equivalent to recommendations set forth in the "California Department of Public Health 2008 Compendium for Plague Control."

- A comprehensive plague risk evaluation of the area is warranted and should include:
    a. Live-trapping rodents to estimate the population densities of known plague-amplifying species and the collection of serum specimens for assessment of plague transmission activity.
    b. Assessing the extent and phase of the outbreak.
    c. Evaluating the abundance and infectivity of known vector fleas (flea index and flea pools for plague testing).
    d. Assess the potential for humans to be exposed to vector fleas.
    e. Review the past history of plague activity and/or human plague cases in the region.
    f. Collaborate with CDPH and the County Agricultural Commissioner's Office.

- A decision to suppress vector fleas on rodents or rodents is based on:
    a. The presence and prevalence of susceptible rodents and vector fleas in areas of human activity.
    b. A high potential for humans to be exposed to vector fleas.
    c. Confirmation of plague activity among susceptible rodents and/or fleas in areas of human activity.
    d. A history of plague activity and/or human cases in the area.

Management Responsibility	**Communications Department Responsibility**
Notify District Board of Trustees. Contact and coordinate response with other stakeholders.	Conduct a press conference and distribute a news release. Prepare educational materials. If burrow dusting flea control is necessary, include additional information in news release.

Cont'd. on next page

Response to a Human or Animal Plague Case - cont'd.

Scientific and Technical Services Responsibility Notify County Public Health Officials. Conduct comprehensive plague risk assessment. Train staff about the disease and disease vector. Identify fleas and develop a surveillance strategy. Determine scope of infestation. Sample vectors for the presence of disease organism. If burrow dusting flea control is necessary, conduct a posttreatment evaluation. Provide GIS maps detailing surveillance and control activities.	**Control Operations Management Responsibility** Contact County Agricultural Commissioner. Determine a control strategy with Scientific and Technical Services. Delineate and map the treatment area. Coordinate burrow dusting flea control as necessary. As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Distribute educational materials. Assist with comprehensive plague risk assessment.	**Control Operations Special Services Responsibility** Distribute educational materials. Assist with burrow dusting flea control as necessary.

Response to a Human Hantavirus Cardiopulminary Symptom (HCPS) Case

The following response is initiated when the District is notified of a human HCPS case within county boundaries. The District recognizes that a quick response is necessary to educate the public and determine the prevalence of the virus in vector species. This response is equivalent to recommendations set forth in the "California Department of Public Health "Guidelines for conducting surveillance for hantavirus in rodents in California, 2004."

- A comprehensive HCPS risk evaluation of the area is warranted and should include:
  a. Live-trapping rodents to estimate the population densities of known HCPS amplifying species and the collection of specimens for assessment of HCPS prevalence.
  b. Assessing the extent and phase of the infestation.
  c. Assessing the potential for humans to be exposed to rodent vectors.
  d. Reviewing the past history of HCPS activity in the region.

- A decision to suppress rodents is based on:
  a. The presence and prevalence of susceptible rodents in areas of human activity.
  b. A high potential for humans to be exposed to rodents.
  c. Confirmation of HCPS activity among susceptible rodents in areas of human activity.
  d. A history of HCPS activity in the area.

Management Responsibility Notify District Board of Trustees. Contact and coordinate response with other stakeholders.	**Communications Department Responsibility** Conduct a press conference and distribute a news release. Prepare educational materials including transmission and prevention information. If rodent suppression is necessary, include additional information in news release.
Scientific and Technical Services Responsibility Notify County Public Health Officials. Conduct comprehensive HCPS assessment. Train staff about the disease and hosts. Determine scope of infestation. Sample hosts for the presence of disease organism. If rodent suppression is necessary, conduct a posttreatment evaluation. Provide GIS maps detailing surveillance and control activities.	**Control Operations Management Responsibility** Contact County Agricultural Commissioner. Determine a control strategy with Scientific and Technical Services. As necessary, contact and coordinate with other local agencies.
Control Operations Zone Responsibility Distribute educational materials. Assist with comprehensive HCPS risk assessment.	**Control Operations Special Services Responsibility** Distribute educational materials.

Integrated Vector Management
Immature Mosquito Guidelines

Definitions

Catch basin – Curbside opening that collects water runoff from streets and serves as an entry point to the storm drain system.

Endangered Species – This is a list of animals found within California or off the coast of the State that have been classified as Endangered or Threatened by the California Fish & Game Commission (State list) or by the U.S. Secretary of the Interior or the U.S. Secretary of Commerce (Federal list).

Environmentally sensitive habitats – Wetlands, riparian areas, organic producers, State, Federal, local wildlife area, or other areas posted as such.

Flood control channel - Open waterway that is designed to carry large amounts of rain water.

Freeway drain – A ditch or drain used to collect water from freeways.

Green pool – A pool that is not serviced, allowing for mosquito larvae development.

Gutter –The edge of a street (below the curb) designed to drain water runoff from streets, driveways, parking lots, etc., into catch basins. Area formed by the curb and the street to prevent flooding by channeling runoff to the storm drains.

Mosquito breeding site – A location where mosquitoes can complete their lifecycle.

Public Health Pesticide (PHP) – A pesticide registered by the Environmental Protection Agency and the California Department of Pesticide Regulation for use against insects of public health importance in California.

Underground Storm Drain System (USDS) – A network of conveyance systems that includes catch basins, grates, gutters, underground pipes, creeks, or open channels designed to transport rain from developed areas and discharged to a receiving body of water.

Larvicide - General term used to describe immature mosquito control.

Additional Technical Considerations

USDS, Flood Channels, and Freeway Drains

These sites have unique properties that make it impossible to conduct surveillance for immature mosquitoes prior to every treatment. During the breeding season, nighttime temperature, historical surveillance data, response to arboviral activity, and complaints by residents initiate larval treatment.

Larval Sampling

Due to the skittish nature of some larval species, such as *Cx. erythrothorax*, visual counts of larvae on the water surface, instead of collections, are considered acceptable to consider larvicide applications.

PHP Use and Resistance Management

The PHP's label must be consulted prior to every treatment. PHPs will be rotated at the Operations Director's discretion. If resistance is suspected in the field, laboratory and operations staff should be notified for follow-up.

Cont'd. on next page

Immature Mosquito Guidelines - cont'd.

Factors or conditions that may modify the Immature Mosquito Management Guidelines

Human malaria or encephalitis occurrence.
Encephalitis or malaria mosquito pool isolation.
Sentinel chicken seroconversion.
Cluster of dead animals indicating arboviral activity.
Unforeseen biological or environmental conditions.
Introduction of an invasive disease vector.
Legislation, regulation or precedential legislation.
Availability of District funding, resources, or equipment.
Availability of suitable larvicides.
Susceptibility of immature mosquito populations to larvicides.
Environmental condition not listed in the program.
Continued occurrence of immatures in a development site.
Natural Disasters.

Integrated Vector Management
Immature Mosquito Guidelines

Site Assessment

Criteria	*Evaluation*	*Decision*
Is site a historical mosquito producer?	Yes→	Collect mosquito larvae samples. Consider **source reduction**.
No ↓		
Is site a mitigation wetland?	Yes→	Consult with Supervisor and District Biologist prior to treatment. Consider **larvae sampling criteria.**
No ↓		
Is breeding site an USDS, flood channel, or freeway drain?	Yes→	See technical considerations for **USDS, flood channels, and freeway drains**.
No ↓		
Environmentally sensitive habitat?	Yes→	Consult supervisor about habitat. Avoid damage to sensitive areas. Consider **larvae sampling criteria.**
No ↓		
Are their active bird nests?	Yes→	Do not disturb habitat. Consult with District Biologist.
No ↓		
Are endangered species present?	Yes→	Consult Supervisor about habitat. Avoid taking endangered species.
No ↓		
Vernal pool?	Yes→	Consult Supervisor about habitat. Avoid taking endangered species.
No ↓		
Will mosquitoes develop in the habitat?	No→	Consult Supervisor about habitat. Consider reducing site surveillance. Consider **source reduction**.
Yes ↓		
Sample mosquito breeding site and then consider **source reduction**.		

Integrated Vector Management
Immature Mosquito Guidelines

Source Reduction

Criteria	*Evaluation*	*Decision*
Can I eliminate the mosquito breeding site? Can I remove the water? Can I drain the mosquito breeding site?	Yes→	Institute necessary **source reduction.**
No ↓		
Can habitat be modified to reduce mosquito breeding?	Yes→	Consult with Special Services Institute necessary **source reduction.**
No ↓		
Consider **biorational control measures.**		

Integrated Vector Management
Immature Mosquito Guidelines

Biorational Control Measures

Criteria	*Evaluations*	*Decision*
Will habitat support immature mosquitoes?	No →	Do not apply biorationals. Set a return inspection date.
Yes ↓		
Time water will remain in breeding site?	< 96 hours →	Consider **larvae sampling critiera**.
Semi-permanent or permanent (> 96 hours)		
Yes ↓		
Environmentally sensitive habitat?	Yes→	Consult with supervisor before release of mosquitofish or **larvicide application**.
No ↓		
Water quality?	Highly organic →	Consider **larvae sampling criteria**. Consider stocking mosquito fish. Consider **larvicide application**.
Fresh ↓		
Swimming pool or backyard pond?	Yes→	Can stock mosquitofish. Add to pool list and set a return inspection date.
No ↓		
Can apply mosquito fish if applicable. Set a return inspection date. Consider **larvae sampling criteria.**		

Integrated Vector Management
Immature Mosquito Guidelines

Larvae Sampling Criteria

Criteria	*Evaluation*	*Decision*
Mosquito stages present?	none→	Do not treat. Set a return inspection date.
eggs to pupa ↓		
Number of immature mosquitoes?	*Anopheles* spp. = 0 immature/40 dips→ *Culex* spp. = 0 immature/20 dips→ *Aedes* spp. or *Culiseta* spp. = 0 immature/10 dips→	Do not treat. Set a return inspection date.
Anopheles spp. ≥ 1 immature/40 dips *Culex* spp. ≥ 1 immature/20 dips *Aedes* spp. or *Culiseta* spp. ≥ 1 immature/10 dips ↓		
Mosquitofish present with immature mosquitoes?	*Anopheles* spp. ≤ 1 immature/40 dips→ *Culex* spp. ≤ 1 immature/20 dips→ *Aedes* spp. or *Culiseta* spp. ≤ 1 immature/10 dips→	Do not treat. Set a return inspection date.
Anopheles spp. ≥ 2 immatures/40 dips *Culex* spp. ≥ 2 immatures/20 dips *Aedes* spp. or *Culiseta* spp. ≥ 2 immatures/10 dips ↓		
Consider **larvicide application.**		

Integrated Vector Management
Immature Mosquito Guidelines

Larvicide Application

Criteria	*Evaluation*	*Decision*
Is development site an USDS, flood channel, or freeway drain?	Yes→	See technical considerations for **USDS, flood channels, and freeway drains**.
No ↓		
Mosquito development site size?	more than 1 acre→	Consult with **Special Services** for treatment.
less than 1 acre ↓		
Water quality	moderate to highly organic *Culex* spp.→	Apply appropriate larvicide and consider **treatment methods.**
Fresh ↓		
Majority of immature stages present?	late 4th to pupae stages→	Apply appropriate larvicide and consider **treatment methods.**
eggs to early 4th larval stages ↓		
Vernal pool?	Yes→	Consult supervisor and consider **treatment methods.**
No ↓		
Fairy shrimp present?	Yes→	Consult supervisor and consider **treatment methods.**
No ↓		
Apply appropriate larvicide and consider **treatment methods.**		

Integrated Vector Management
Immature Mosquito Guidelines

Treatment Method

Criteria	*Evaluation*	*Decision*
Distribution of immatures?	Isolated locations→	Treat selective areas.
Throughout source ↓		Treat entire mosquito development site.

Integrated Vector Management
Immature Mosquito Guidelines

USDS, Catch Basin and Freeway Drain Treatment Criteria

Criteria	*Evaluation*	*Decision*
Historical mosquito breeding site?	Consult historical records, if yes →	Treat with appropriate larvicide every 10-14 days during mosquito season
No ↓		
Standing water present and/or water flowing into site?	Yes→	Treat with appropriate larvicide and schedule inspection in 10-14 days.
No ↓		
Adult mosquitoes seen leaving system.	Yes→	Adulticide storm drain and schedule additional treatment for 10-14 days.
No ↓		
Inspect channel every 10-14 days during mosquito breeding season and consider ecologic criteria.		

Flood Channel Treatment Criteria

Criteria	*Evaluation*	*Decision*
Historical mosquito breeding site?	Consult historical records, if yes →	Collect and identify larvae from site at beginning of mosquito season. Treat with appropriate larvicide every 10-14 days during mosquito season.
No ↓		
Standing water present?	Yes→	Consider ecologic criteria. Treat with appropriate larvicide and schedule inspection in 10-14 days.
No ↓		
Inspect channel every 10-14 days during mosquito breeding season and consider ecologic criteria.		

Integrated Vector Management
Adult Mosquito Guidelines

Definitions

Adult Mosquito Control

The management of adult mosquitoes may consist of application of a PHP by ultra low volume (ULV) application equipment or direct application (barrier treatments) to residences, outbuildings, other structures and mosquito resting sites.

Continuance Criteria

Criteria that trigger additional applications in an area that has previously attained an initiation criterion. These criteria are considered until a termination criterion is achieved for a treatment area.

Initiation Criteria

Criteria that when achieved trigger the initial adult mosquito application measures. At present, the District recognizes eight separate conditions to be adult mosquito control application triggers.

Termination Criteria

Criteria that conclude adult mosquito application measures in a treatment area until initiation criteria are again achieved.

Additional Technical Information

1. **Adult Mosquito Surveillance Devices**
   Each year, a surveillance device and/or method may be selected to measure the adult mosquito population. This device and/or method can be altered at the discretion of the Operations Manager and/or Laboratory Director.
2. **USDS, Catch basins, and Freeway Drains.**
   Adult mosquito control is initiated year round in these habitats when adult mosquitoes are seen flying from manhole covers upon inspection, and based on historical surveillance data.
3. **Evidence of a non-native, mosquito disease vector within District boundaries.**
   In the event a non-native, mosquito disease vector is introduced into Orange County the District will consider a single female specimen the trigger point for adult mosquito management.
4. **Delineate treatment area**
   The Operations Manager has the flexibility to delineate the treatment area for adult mosquito control when mosquito trigger points have been reached. Knowledge gained from surveillance and research can change the phased response recommendations. In the District treatment area, the primary goal of the adult mosquito management program is to maintain *Cx. tarsalis, Cx. quinquefasciatis, Cx. Stigmatostoma, and Cx. erythrothorax* populations below disease transmission levels. These species are the primary target for control because they vector mosquito-borne arboviruses like West Nile virus (WNV), western equine encephalitis (WEE), Saint Louis encephalitis (SLE), or California encephalitis (CE) in Southern California, and may play a role in other diseases, such as dog heartworm. *Anopheles freeborni* is targeted for management because it is a vector of malaria. These additional species are targeted because their biting habits also create a public nuisance. The boundaries of the area to be treated are determined by the mosquito species that achieved the

criterion, species biology and flight range, and the infested area. Defining a boundary does not imply that all or part of that area can or will be treated and that the mosquito species targeted will be eradicated within those boundaries.

Public Health Pesticide Use and Resistance Management

1. Consult Public Health Pesticide *(*PHP) label before treatment.
2. Apply PHPs within the same class or mode of activity on a rotational basis as determined by the Director of Operations.
3. If resistance is suspected in the field, laboratory and operations staff should be notified for follow-up.

Factors That May Influence the Implementation or Modify the Program

1. Availability of a suitable adulticiding material.
2. Susceptibility of mosquito populations to adulticiding materials.
3. Environmental conditions not listed in the program.
4. Availability of District funding or resources.
5. Legislation, regulation or precedential case authority.
6. Unforeseen biological conditions.
7. Presence or absence of mosquito-borne disease.
8. Introduction of an invasive disease vector of public health importance.

Integrated Vector Management
Adult Mosquito Guidelines

Meterological Conditions for Ground Applications

Temperature inversion?	Absent→	Delay Instituting **Adult Mosquito Management.**
Present ↓		
Wind Speed?	Exceeds PHP label recommendations→	Delay Instituting **Adult Mosquito Management.**
Less than maximum PHP label recommendations ↓		
Institute Adult Mosquito Management with Appropriate Public Health Pesticide.		

Integrated Vector Management
Adult Mosquito Guidelines

Delineate Treatment Area

Is the inititation or continuance criteria met?	Yes→	Define the boundaries of the **Treatment Area** and consider **Agricultural and Land Use Practices.**

Agricultural and Land Use Practices

Are endangered or threatened species present?	Yes→	Consider the presence of Endangered or Threatened Species, then consider **Meterological Conditions** within the **Delineated Treatment Area.**
No ↓		
Environmentally sensitive habitat?	Yes→	Consider treatments compatible with an environmentally sensitive habitat, then consider **Meteorological Conditions** within the **Delineated Treatment Area.**
No ↓		
Organically grown crops?	Yes→	Consider treatments that meet Organic Standards, then consider **Meteorolgical Conditions** within the **Delineated Treatment Area.**
No ↓		
Consider **Meterological Conditions** within the **Delineated Treatment Area.**		

Integrated Vector Management
Adult Mosquito Guidelines

USDS, Catch Basin and Freeway Drain Treatment Criteria

Criteria	*Evaluation*	*Decision*
Historical mosquito breeding site?	Consult historical records, if yes →	Treat with appropriate larvicide every 10-14 days during mosquito season
No ↓		
Standing water present and/or water flowing into site?	Yes→	Treat with appropriate larvicide and schedule inspection in 10-14 days.
No ↓		
Adult mosquitoes seen leaving system.	Yes→	Adulticide storm drain and schedule additional treatment for 10-14 days.
No ↓		
Inspect channel every 10-14 days during mosquito breeding season and consider ecologic criteria.		

Flood Channel Treatment Criteria

Criteria	*Evaluation*	*Decision*
Historical mosquito breeding site?	Consult historical records, if yes →	Collect and identify larvae from site at beginning of mosquito season. Treat with appropriate larvicide every 10-14 days during mosquito season.
No ↓		
Standing water present?	Yes→	Consider ecologic criteria. Treat with appropriate larvicide and schedule inspection in 10-14 days.
No ↓		
Inspect channel every 10-14 days during mosquito breeding season and consider ecologic criteria.		

Integrated Vector Management
Adult Mosquito Guidelines

Initiation Criteria

Criteria	*Evaluation*	*Decision*
#1 Human illness caused by a mosquito-borne pathogen within the District boundaries?	Yes→	Determine level of mosquito activity.
No ↓		
#2 Mosquito-borne pathogen detected in a dead or live bird or another animal within the District boundaries?	Yes→	Determine level of mosquito activity.
No ↓		
# 3 Evidence of a recent serological conversion by a mosquito-borne pathogen in a sentinel chicken or other animal within the District boundaries?	Yes→	Determine level of mosquito activity.
No ↓		
#4 Mosquito-borne pathogen isolated from a mosquito within the District boundaries.	Yes→	Determine level of mosquito activity.
No ↓		
#5 Evidence of a non-native, introduced mosquito species within Distict boundaries.	Yes→	Determine level of mosquito activity.
No ↓		
#6 CDC/CO_2 trap or Gravid Trap collection within the District boundaries of :	50 or more **female** *Cx. tarsalis*, and/or **75 female** *Cx. quinquefasciatus*, *Cx. stigmatastoma* *Cx. erythrothorax,* or *Anopheles* per collection **per trap nights**, and/or→ **5** or more **female** of any *Aedes or* 10 of a *Culiseta* species per collection **per trap nights**, and/or→ **100** or more total **female** mosquitoes per collection **per trap nights**→	Delineate treatment area and consider treatment method.
50 female *Cx. tarsalis,* and/or less than 7**5 female** *Cx. erythrothorax, Cx. stigmatastoma, Cx. quinquefasciatus* or *Anopheles* per collection **per trap nights**, and/or less than 5 **female** of any *Aedes* or 10 of a *Culiseta* species per collection **per trap nights**, and/or less than **100** or more total **female** mosquitoes per collection **per trap nights.** ↓		
#7 Presence of adult mosquitoes in an USDS, catch basin, or freeway drain.	**1** or more *Culex* species →	USDS Treatment Criteria.
↓		
#8 Mosquitoes creating a public health nuisance at a residence.	**1** or more **female** mosquito(s) collected by a homeowner or on a homeowner's property→	Delineate treatment area and consider treatment method.
↓		
Adult mosquito sample not collected.		
Do Not Initiate Adult Mosquito Management		

5/11/10

Integrated Vector Management
Adult Mosquito Guidelines

Continuance Criteria

Criteria	*Evaluation*	*Decision*
CDC/CO_2 trap or Gravid Trap collection with	**25** or more **female** *Cx. tarsalis, Cx. erythorthorax, Cx. stigmatastoma Cx. quinquefasciatus*, or *Anopheles* per collection per **trap night,** and/or → **5** or more **female** of any *Aedes* or **10** *Culiseta* per collection per **trap night,** and/or → **25** or more total **female** mosquitoes per collection per **trap night** →	Consider Meterological Conditions in the Treatment Area.
less than **25 female** *Cx. tarsalis, Cx. erythorthorax, Cx. stigmatastoma, Cx. quinquefasciatus,* or *Anopheles* per collection per **trap night,** and/or less than **5 female** of any *Aedes* or **10** *Culiseta* per collection per **trap night,** and/or less than **25** total **female** mosquitoes per collection per **trap night** ↓		
Presence of adult mosquitoes in an USDS, catch drains	**1** or more *Culex* species →	USDS Treatment Criteria.
↓		
Do Not Institute Adult Mosquito Management		

Integrated Vector Management
Adult Mosquito Guidelines

Termination Criteria

Criteria	*Evaluation*	*Decision*
Date?	after December 1st →	Terminate Adult Mosquito Control Applications within the delineated treatment area.
before December 1st ↓		
CDC/CO_2 Light trap or Gravid Trap collection with	less than **15** or more **female** *Cx. tarsalis, Cx. quinquefasciatus, Cx. erythrothorax, or Cx. stigmatastoma, or Anopheles* per collection for per **trap night**, and/or→ less than **1 female** of any *Aedes* or **5** *Culiseta* species per collection for per **trap night**, and/or → less than **25** total **female** mosquitoes per collection for **per trap night** →	Terminate Adult Mosquito Control Applications within the delineated treatment area.
15 or more **female** *Cx. tarsalis, Cx. quinquefasciatus, Cx. erythrothorax, or Cx. stigmatastoma* per collection per **trap night**, and/or **1** or more **female** of any *Aedes or* **5** *Culiseta* species per collection per **trap night**, and/or **25** or more total **female** mosquitoes per collection per **trap night** ↓		
Environmental conditions?	10 consecutive nights unfavorable for ULV treatments →	Terminate Adult Mosquito Control Applications within the delineated treatment area.
Favorable for adult mosquito management ↓		
Continue to Consider Continuance Criteria		

Integrated Vector Management
Adult Mosquito Guidelines

Determine Level of Mosquito Activity

Criteria	*Evaluation*	*Decision*
Malaria case? Mosquito Not Present ↓ Do Not Inititiate Adult Mosquito Management	*Anopheles freeborni* present in a trap within 1/4 mile radius of human case	Delineate Treatment Area.
WNV, WEE, SLE, or other mosquito-borne virus case? Mosquito Not Present ↓ Do Not Institute Adult Mosquito Management	*Cx. tarsalis, Cx. quinquefasciatus,* or another mosquito species that can vector a virus pathogen within a one mile radius of a human case.	Delineate Treatment Area.
Collection of an invasive disease vector within District boundaries.	1 specimen of a **female** invasive disease vector.	Delineate Treatment Area.

Surveillance Indicators

WNV, SLE or, WEE

Criteria	*Critical Value*
Positive mosquito pool	Ct value <30 for E Primer set or < 35 for NS1 Primer set
Positive dead bird (kidney)	Ct value <30 for E Primer set or < 37 for NS1 Primer set
Positive dead bird (BIC)	Ct value <30 for E Primer set or < 37 for NS1 Primer set
Wild bird seroconversion rate	> 5% of population sampled from a site
Human infection/blood donor	Determined by OCHCA and reported to OCVCD

Malaria

Criteria	*Critical Value*
Malaria parasite.	1 *Plasmodium* spp. as determined by appropriate analysis.

Mosquito Abundance

Criteria	*Definition*
Historical mosquito breeding site.	Consistant mosquito collections at a site in previous years.
Trap night	One trap set for one night. Ten trap nights equals one trap set for ten nights or ten traps set for one night.

Integrated Vector Management
Black fly Guidelines

Black Fly Site Assessment

Criteria	*Evaluation*	*Decision*
Have black flies been identified by laboratory staff?	No→	Do not treat.
Yes ↓		
Does development site contain black fly habitat (flowing water)?	No→	Do not treat.
Yes ↓		
Are their active bird nests?	Yes→	Do not disturb habitat. Consult with District Biologist.
No ↓		
Are endangered species present?	Yes→	Consult supervisor about habitat. Avoid taking endangered species. Sample development site.
No ↓		
Environmentally sensitive habitat?	Yes→	Consult supervisor about habitat. Avoid damage to sensitive areas. Sample development site.
No ↓		
Consider black fly treatment		

Integrated Vector Management
Black fly Guidelines

Black Fly Site Treatment

Criteria	*Evaluation*	*Decision*
Does development site contain black fly habitat (flowing water)?	No→	Do not treat.
Yes ↓ Water quality		
Fresh ↓ Apply appropriate **Public Health Pesticide.**		

Integrated Vector Management
Fly Control Guidelines

Fly Site Assessment

Criteria	*Evaluation*	*Decision*
Have fly larvae been identified from source?	No→	Collect larvae at source for identification.
Yes ↓		
Can source be modified or reduced?	No→	Treat with PHP.
Yes ↓		
Modify or reduce fly source. Return to monitor fly production in 3-5 days.		

Integrated Vector Management
Red Imported Fire Ant Control Guidelines

Definitions

Large treatment site – A RIFA treatment site that is > 1 acre: school, park, golf course, rights-of-way, or multiple family housing such as apartments, duplexes, townhomes, condominiums, or mobile homes.

Mound treatment – A pesticide application of ant bait that eliminates a RIFA colony within 1-3 days.

Mound drench treatment – A pesticide application of a liquid residual insecticide that eliminates a RIFA colony immediately.

PCOs – A Pest Control Operator as licensed by the California Department of Consumer Affairs, Structural Pest Control Board.

Residential site – A single-family home RIFA treatment site.

Stinging incident – An incident where a person is stung multiple times by ants.

Additional Technical Considerations

RIFA Treatment Manual

The RIFA Treatment Manual contains more details and technical specifications for RIFA surveillance, site assessment and treatment. The Manual is provided to all technicians treating for RIFA and is available from the Operations Department on request.

RIFA Public Health Pesticide Use and Resistance Management

1. Consult pesticide label before treatment.
2. Apply pesticides on a rotational basis, as determined by the Director of Operations.
3. If resistance and/or bait aversion is suspected in the field, laboratory and operations staff should be notified for follow-up.

Factors That May Influence the Implementation or Modification of the Program

1. Availability of suitable pesticide bait.
2. Susceptibility of RIFA populations to pesticide bait.
3. Environmental conditions not listed in the guidelines.
4. Availability of District funding or resources.
5. Legislation, regulation, or precedential case authority.
6. Unforeseen biological conditions.
7. Presence or absence of swarming ants and/or a stinging incident.
8. Introduction of an invasive disease vector of public health importance.

Integrated Vector Management
Red Imported Fire Ant Control Guidelines

RIFA Site Assessment & Treatment

Criteria	*Evaluation*	*Decision*
Is property adjacent to waters of the United States?	Yes	Conduct surveillance for RIFA, refer to RIFA treatment manual, and consult management before treatment
No ↓		
Is property considered an environmentally sensitive site or adjacent to an environmentally sensitive site?	Yes	Conduct surveillance for RIFA, refer to RIFA treatment manual, and consult management before treatment
No ↓		
Are endangered species present?	Yes	Conduct surveillance for RIFA, confirm identification of RIFA, refer to RIFA treatment manual, and consult management before treatment.
No ↓		
Is property a single-family residence?	Yes	Conduct surveillance for RIFA, confirm identification of RIFA, refer to RIFA treatment manual, and apply PHPs according to residential treatment guidelines.
No ↓		
Is property a large treatment site (> 1 acre): park, golf course, apartment complex, or condominium complex?	Yes	Conduct surveillance for RIFA, confirm identification of RIFA, consult RIFA treatment manual, and apply PHPs according to large treatment site guidelines.
No ↓		
Is property a school?	Yes	Conduct surveillance for RIFA, confirm identification of RIFA, consult RIFA treatment manual, and apply PHPs according to school treatment site guidelines.
No ↓		
Conduct surveillance for RIFA and consult manager for site treatment protocol.		

Integrated Vector Management
Red Imported Fire Ant Control Guidelines

RIFA Surveillance

Criteria	*Evaluation*	*Decision*
Fire ant mounds visible at site	Yes	Collect a sample and submit to laboratory for identification.
No ↓		
Foraging ants visible at site	Yes	Collect a sample and submit to laboratory for identification.
No ↓		
Place RIFA surveillance lure to collect foraging ants.	Ants on lure	Collect a sample and submit to laboratory for identification.
No ants found on lure ↓		
Site considered free of RIFA		

Integrated Vector Management
Red Imported Fire Ant Control Guidelines

Residential Treatment

Criteria	*Evaluation*	*Decision*
Is site a single-family residence?	No	Refer to District RIFA program.
Yes ↓		
The District RIFA Program conducts initial inspection and treatment within 3 business days.		Conduct **site assessment**. Collect ant sample to confirm RIFA identification by the District. Broadcast treatment with RIFA pesticide ant bait in accordance with pesticide label.
↓		
Referral to PCO for 2nd treatment (month 3)		Broadcast treatment with RIFA pesticide ant bait in accordance with pesticide label.
↓		
RIFA complaint by resident	Yes	OCVCD conducts treatment in accordance with pesticide label.
No ↓		
3rd treatment by PCO (month 6)		Broadcast treatment with RIFA pesticide ant bait in accordance with pesticide label.
↓		
The District post-treatment survey (month 9-12).	RIFA Absent	Site is removed from the residential treatment cycle.
RIFA present ↓		
Begin Residential Treatment Cycle		

Integrated Vector Management
Red Imported Fire Ant Control Guidelines

Large Area RIFA Treatment

Criteria	*Evaluation*	*Decision*
Is site > 1 acre: school, golf course, park, apartment, condominium or rights-of-way?	No	The District RIFA staff will investigate site and determine treatment protocol.
Yes ↓		
Conduct site assessment & RIFA surveillance.	RIFA not present	Provide education to property owner.
RIFA present at site ↓		
Initial treatment		Collect sample to confirm identification. Apply RIFA pesticide bait according to label specifications.
↓		
2nd treatment		Apply RIFA pesticide bait according to label specifications.
↓		
3rd treatment		Apply RIFA pesticide bait according to label specifications.
↓		
The District posttreatment survey (month 9-12).	RIFA Absent	Site is removed from the RIFA Large Site Treatment Cycle.
RIFA present ↓		
Begin RIFA Large-Site Treatment Cycle.		

Integrated Vector Management
Rat Control Guidelines

Additional Technical Considerations

Bait Station Placement – Generally, only two bait stations are placed on a property after the property owner has been instructed to abate rodent harborage and food sources, and signed a Release of Liability form (Appendix I). Bait stations should be placed outside of structures in areas accessible only to rodents. Bait stations should be appropriately labeled and tamper-proof in accordance with rodenticide label requirements. Bait stations should be serviced every six months.

Rat Control & Rodent Disease Surveillance – The District only provides control for rats (*Rattus* spp.) to residents in Orange County. The District conducts surveillance for rodent-borne diseases in Orange County.

Environmentally Sensitive Areas - When properties are adjacent to environmentally sensitive areas, traps should be used prior to bait station placement.

Rodenticide Use and Resistance Management

1. Consult rodenticide label before treatment.
2. Apply rodenticides on a rotational basis as determined by the Director of Operations.
3. If resistance is suspected in the field, laboratory and operations staff should be notified for follow-up.

Factors That May Influence the Implementation or Modify the Program

1. Availability of a suitable rodenticide.
2. Susceptibility of rodent populations to rodenticides.
3. Environmental conditions not listed in the guidelines.
4. Availability of District funding or resources.
5. Legislation, regulation, or precedential case authority.
6. Unforeseen biological conditions.
7. Presence or absence of rodent-borne disease.
8. Introduction of an invasive disease vector of public health importance.

Integrated Vector Management
Rat Control Guidelines

Rodent Control Site Assessment

Criteria	*Evaluation*	*Decision*
Is homeowner, or adult > 18 years old, available for consulation?	No	Reschedule inspection if possible.
Yes ↓		
Interview homeowner about rat activity on their property. ↓		
Conduct inspection of property looking specifically for rodent harborage, food sources, structural issues allowing rodents access to home, and rodent droppings.	Yes	Discuss findings with homeowner, provide educational materials, consider rodent **bait station placement**.
No ↓		
Do not install bait stations and/or remove bait stations and schedule an inspection for 6 months.		

Integrated Vector Management
Rat Control Guidelines

Rodent Bait Station Placement

Criteria	*Evaluation*	*Decision*
Are rats entering the building?	Yes	Do not place bait station.
No ↓		
Signs of active rodent infestation	Yes	Distribute educational materials and encourage abatement of rodent harborage and food source. Consider rodent bait station placement only after abatement and Release of Liability Form is signed.
No ↓		
Does property have pets and/or small children?	Yes	Distribute educational materials and only place bait station out of reach of pets and small children after Release of Liability Form is signed.
No ↓		
Is adjacent property contributing to a rodent infestation?	Yes	Distribute educational materials and attempt contact of neighbor. Consider rodent bait station placement only after Release of Liability Form is signed.
No ↓		
Is the property adjacent to an environmentally sensitive habitat?	Yes	Distribute educational materials and encourage abatement of rodent harborage and food source. Consider rodent bait station placement only after abatement and after Release of Liability Form is signed.
No ↓		
Consider rodent bait station placement only after abatement and after Release of Liability Form is signed.		

Rat Control Release of Liability

K'WEST PRINTING (714) 997-9630

ORANGE COUNTY VECTOR CONTROL DISTRICT
13001 Garden Grove Blvd., Garden Grove, CA 92843-2102
Phone: (714) 971-2421 • (949) 654-2421
www.ocvcd.org

RELEASE OF LIABILITY

Date

ZONE NO.	MAP AREA

Thomas Bros. Guide

PAGE NO.	GRID

SERVICE REQUEST NUMBER

The undersigned does hereby RELEASE the ORANGE COUNTY VECTOR CONTROL DISTRICT and its officers, agents, and employees from any and all liability arising out of claims or damage pertaining to the placement of rodenticide on the property address listed below.

The undersigned acknowledges that the rodenticide is a poison that should be considered dangerous and may be lethal. Keep all children and pets away from this rodenticide bait.

X _____
Occupant's Signature

WARNING AND AGREEMENT

THE RODENTICIDE BAITS USED IN ROOF RAT EXTERMINATION CONTAIN POISONS AND SHOULD BE CONSIDERED DANGEROUS AND CAN BE LETHAL IF INGESTED. KEEP ALL CHILDREN AND PETS AWAY FROM PLACED RODENTICIDE BAIT.

If accidentally swallowed by humans, domestic animals, or pets, rodenticides used in roof rat control can reduce the clotting ability of blood and cause internal hemorrhaging. In such cases, immediate medical help should be sought. The antidote recommended for this type of anticoagulant rodenticide is intravenous and oral administrations of Vitamin K combined with blood transfusions. This is the indicated treatment for hemorrhage caused by accidental ingestion of anticoagulant rodenticides.

☐ Dog(s) and/or other domestic pet(s) presently reside on this property. I have been warned of the dangers of this rodenticide being ingested by dog(s) and other domestic pet(s). I will keep my pets away from the rodenticide bait and containers. X _____ Occupant's Signature	☐ No dogs reside on property.

I request that the ORANGE COUNTY VECTOR CONTROL DISTRICT take such steps as are necessary to control roof rat infestation and give my permission for the use of rodenticide bait on my property. I have read the warnings as to the dangers inherent with the use of rodenticide bait and hereby release the ORANGE COUNTY VECTOR CONTROL DISTRICT from any liability for injury, death, and/or damage that may arise from such use.

I agree to warn all persons coming on to my property of the presence of rodenticide thereon, and also agree to indemnify, defend, and hold ORANGE COUNTY VECTOR CONTROL DISTRICT harmless from any claim, liability, injury, death, and/or damage resulting from or caused by the use of said rodenticide.

I further agree to follow the recommendations made by the VECTOR CONTROL INSPECTOR in regard to roof rat control and prevention. In the event that I sell or vacate this property, or feel that the rat problem has abated, I will notify the ORANGE COUNTY VECTOR CONTROL DISTRICT for proper disposal of any existing rodenticide placed on my property.

I understand that in the event that the recommendations presented by the VECTOR CONTROL INSPECTOR are not followed, that no further rat control measures will be taken by the ORANGE COUNTY VECTOR CONTROL DISTRICT.

I have been advised to rat-proof the structures on my property and agree that the ORANGE COUNTY VECTOR CONTROL DISTRICT has no obligation to remove any carcasses from my property.

X _____
Occupant's Signature

_____
Occupant's Name (Please Print)

_____
Street Address Apt. No.

_____
City Zip Code

_____
Telephone Number

_____
Inspector's Name Phone Ext. No.

DO NOT RELOCATE BAIT BLOCKS OR BAIT STATIONS.

BAIT PLACEMENT DIAGRAM

(FRONT)

Number of Bait Blocks Placed: Chlorophacinone_____Bromadiolone_____

Date Replaced _____ Date Removed _____

Number of Bait Stations Placed: ☐ Number of Bait Stations Replaced: ☐ Number of Bait Stations Removed: ☐

White Copy - Administrative Yellow Copy - Occupant Pink Copy - Inspector

5/11/10

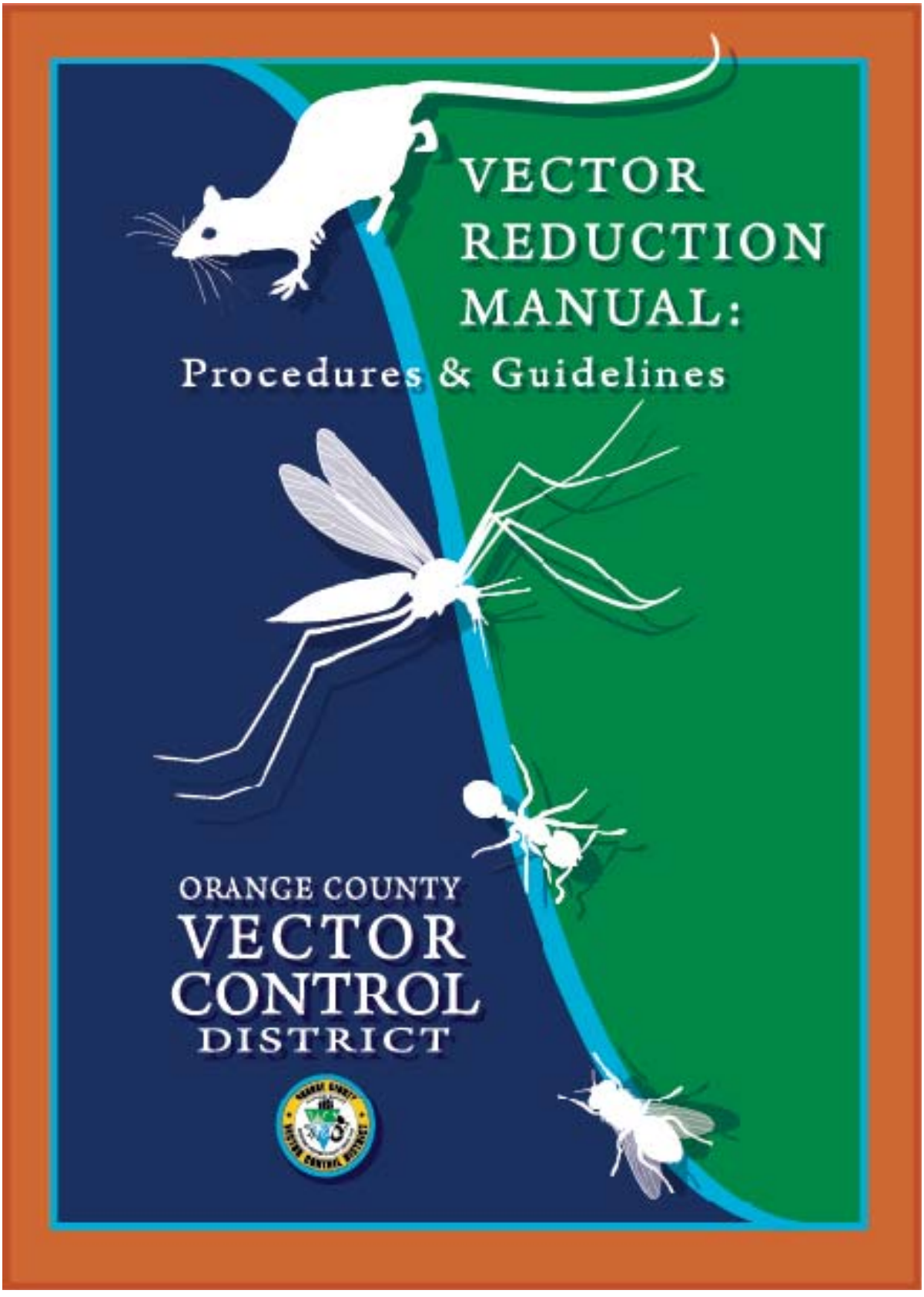
Appendix II

California Mosquito-Borne Virus Surveillance and Response Plan

Separate Document

Appendix C

VECTOR REDUCTION MANUAL


VECTOR
REDUCTION
MANUAL:
Procedures & Guidelines
ORANGE COUNTY
VECTOR
CONTROL
DISTRICT

Vector Reduction Guidelines

The Vector Reduction Guidelines contained in this manual are assembled from a number of sources including scientific literature, state and inter-agency documents, pesticide label and use requirements, and from experienced vector control professionals. The intended use of this document is to provide general guidance, not site-specific requirements. The Vector Reduction Guidelines that are most applicable to a specific vector-breeding source may be selected from the list and incorporated into a specific Vector Management Plan for a specific source in consultation with District personnel.

Vector Reduction Program

VECTOR REDUCTION PROGRAM POLICIES

The Orange County Vector Control District (the District) recognizes that cooperative land management practices can reduce vector[1] populations. Long-term costs are reduced because smaller populations require less staff time and lower pesticide use. These practices help to protect public health and are an integral part of the District's Integrated Vector Management (IVM) approach to mosquito and vector control.

Integrated Vector Management is a process that focuses on site-specific, scientifically sound strategies to manage vector populations. These policies and procedures have been adopted by the District as effective control measures for vectors. Landowners and land managers can use these guidelines to address vector control problems that are identified by the District.

Integrated Vector Management techniques vary at each site depending on the conditions found at the site. These techniques are commonly grouped into four categories:

1. Cultural Control – Change the behavior of people so that their actions prevent the development of vector populations or the transmission of vector-borne disease.
2. Source Reduction or Physical Control – Environmental manipulation that results in a reduction of vector development sites.
3. Biological Control – Use of biological agents to limit vector populations
4. Chemical Control – Pesticides that target different life stages of vector populations

The Vector Reduction Guidelines referred to in this document are the recommended land management practices that can provide a reduction in vector populations by various means including: reducing or eliminating breeding areas, or harborages, increasing the efficacy of biological controls, increasing the efficacy of chemical controls, and improving access for control operations. These Vector Reduction Guidelines have been developed based on the District's experiences with stakeholder groups including landowners, land managers, regulatory agencies, and other interest groups. As a result of this process, the District is prepared to offer practical and appropriate Vector Reduction Guidelines for the variety of land uses that exist in Orange County. Not all vector reduction guidelines included in this document will apply equally to all vector sources; however, they serve as a starting point in the cooperative development of a site-specific Vector Management Plan.

The District encourages those responsible for Significant Vector Sources on properties under their control to develop and implement a cooperative Vector Management Plan with the District

[1] A vector means any insect or other animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury including, but not limited to, mosquitoes, flies, red imported fire ants, and rats.

to avoid the need for the formal enforcement actions authorized under the California Health and Safety Code (HSC). In some situations, the District must employ the HSC in order to ensure safe conditions and to carry out its public responsibilities. However, it has been the District's experience that a cooperative approach to source reduction results in effective and long-lasting vector management.

The Vector Reduction Guidelines are designed to address vector sources including, but not limited to, managed wetlands, stormwater structures, wastewater facilities, residential properties, cemeteries, and golf courses. Many of these sources provide favorable habitats for vectors and produce significant vector populations.

Vector populations in Orange County can be reduced through the widespread implementation of vector reduction strategies and techniques. The policies and procedures outlined in this document specifically target Significant Vector Sources, but can be applied to any vector sources.

In circumstances where the implementation of a Vector Management Plan would cause economic hardship or technical difficulties, the District may choose to offer assistance in the form of technical advice, or other resources. Vector reduction projects can be planned in stages to provide time for budgeting considerations and obtaining any necessary regulatory permits. The level of assistance offered will be determined on a case-by-case basis.

SIGNIFICANT VECTOR SOURCES

Significant Vector Sources will be identified based on the following criteria:

- Vector production from the source is more than similar land uses, and exceeds treatment thresholds outlined in the Vector Management Plan;
- Treatment costs incurred by the District are increased due to problems caused by management practices;
- The source is in close proximity to areas of significant population density; and/or
- Vector Reduction Guidelines exist to address the land management practices and can be reasonably utilized to reduce vector production, harborage, or other vector favorable conditions.

If left untreated, a Significant Vector Source would be considered a public nuisance as defined in the California Health and Safety Code (HSC) §2002(j). Sources adjacent to and within population centers will be selected for inclusion in the Vector Reduction Program. Other factors, such as treatment costs, vector-borne disease status, vector species produced, and the efficacy of available treatment options will be considered when evaluating a Significant Vector Source, as defined above.

Surveillance data will be used to determine vector abundance prior to, and after implementation of, the Vector Management Plan for a Significant Vector Source. When mosquitoes are the problem, a combination of larval dip data and adult mosquito surveillance data will be used to assess vector abundance. When rats are the problem, signs of a rodent infestation, such as feces and gnawing, availability of food sources, and potential harborage will be used. If Red Imported Fire Ants (RIFA) are the cause of a Significant Vector Source, mound counts and presence of foraging workers will be used to assess Vector Management Plan success. Adult flies and presence of larval fly sources will be used to assess a significant fly source. In cases where existing data or current sampling methods are not sufficient to determine the efficacy of a particular Vector Management Plan, a specific monitoring plan will be established to meet the needs of the Significant Vector Source.

Management practices that contribute to increased vector production include, but are not limited to, poor water management, lack of emergent vegetation control, buildup of debris that restricts water conveyance, poor condition of water conveyance or drainage structures, practices that impede access to the source, and lack of notification of practices that would affect vector control operations.

VECTOR MANAGEMENT PLAN

Once the District has identified a Significant Vector Source, staff will present a draft Vector Management Plan to the responsible party, in consultation with state and federal biologists, if appropriate, proposing a course of action based on one or more Vector Reduction Guidelines that, if implemented, can reduce or eliminate the Significant Vector Source.

The draft Vector Management Plan will contain at least the following:

- Justification for requested actions.
- Description of the proposed Vector Reduction Guidelines, including specific guidance regarding method and timing of implementation.
- District resources available to assist with Vector Reduction Guideline implementation.
- Assessment method.

The responsible party will have the opportunity to review and comment on the draft plan. Reasonable adjustments may be negotiated between the responsible party and the District to achieve a mutually agreeable plan. A reasonable time limit will be set at the beginning of the negotiation phase, at which time the District will finalize any unresolved issues at its discretion. This time limit may be extended if all parties agree that there is reasonable cause to do so.

If the responsible party is unwilling to accept the terms of this cooperative process, the District will proceed to the legal Vector Abatement Process under the California Health and Safety Code

§2060-2067 and District Resolution No. 340: Orange County Vector Control District's Nuisance Abatement Procedures (see Appendix 1).

CHARGES FOR TREATMENT COSTS

The District is authorized by the Health and Safety Code to recover treatment costs for vector control operations. Since properties in the District pay for a base level of vector control through the payment of property taxes, the District would consider charging for treatment costs that are above and beyond the normal level of treatment required by a similar vector source with a similar land use. Since one of the primary goals for the Vector Reduction Program is to reduce pesticide use in Orange County, the District would only consider accepting charges for additional treatment in lieu of implementing Vector Reduction Guidelines on a case-by-case basis for a limited time. As new Vector Reduction Guidelines are developed and efficacy of existing Vector Reduction Guidelines are researched further, the expectation would be that the charges for pesticide treatment would be replaced by non-pesticide based, long-term Vector Management Plans.

APPEAL PROCESS

The responsible party may submit comments in writing to the Director of Operations before the implementation deadline indicated on the draft Vector Management Plan presented to the responsible party in Step #2 on Figure 1 (Flow Chart). After review, the Director of Operations will issue a determination which may include; 1) no change in the content of the draft Vector Management Plan; 2) an extension of the implementation deadline; 3) a waiver of fees; or 4) other appropriate action, such as the implementation of an abatement process leading to civil action (see Appendix 1).

If the responsible party is a state agency, appeals may be made to the State Department of Public Health, pursuant to the California Health and Safety Code.

VECTOR REDUCTION PROGRAM IMPLEMENTATION PROCESS FOR SIGNIFICANT VECTOR SOURCES

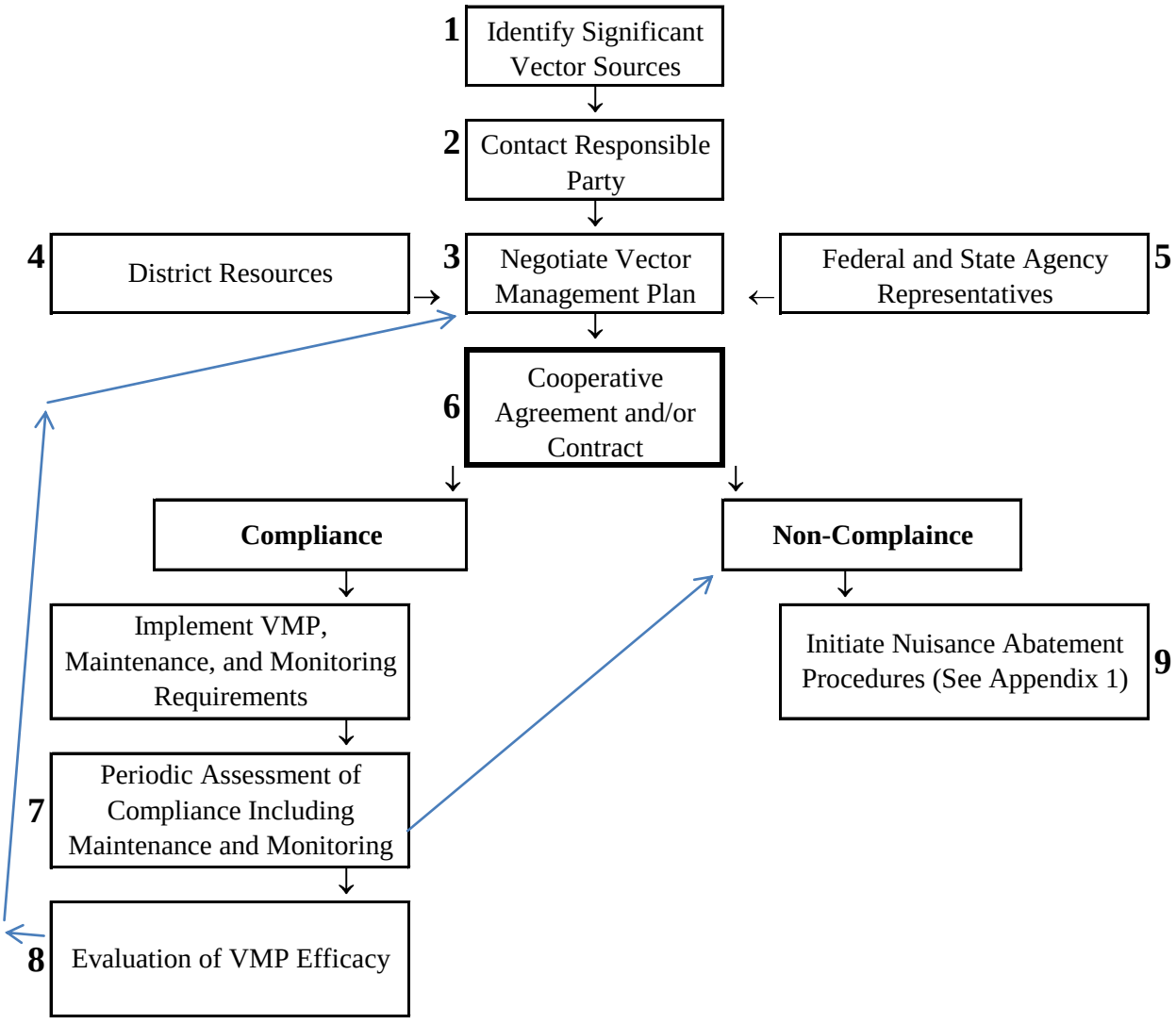
The following items represent a chronological progression of the Vector Reduction Program actions after a Significant Vector Source is identified.

Note: The numbered items correspond to the numbers on Figure 1.

1. **Identify a Significant Vector Source** – The District will identify Significant Vector Sources based on the previously defined criteria.
2. **Contact Responsible Party** – The District will contact the responsible party (as defined in the California Health and Safety Code §2060) of properties in Orange County that have been identified as a Significant Vector Source, that if untreated, would become a public nuisance. The District will also contact state and federal agencies that have a vested interest in the property, such as a conservation easement, habitat management plan, or other habitat maintenance agreement. A draft Vector Management Plan will be provided to the responsible parties. This plan will include an explanation of why the site was determined to be a Significant Vector Source, including vector surveillance data, if requested.
3. **Negotiate Vector Management Plan** – The District will work with the responsible party to determine a course of action to address the vector source including specific Vector Reduction Guidelines, implementation timeline, maintenance requirements, and monitoring plan. A defined negotiation period will be designated at the start of the negotiations.
4. **District Resources** – At the discretion of the District, resources may be made available to assist in complying with the Vector Management Plan requirements. In cases where District resources are used, specific maintenance requirements will be specified in the cooperative agreement, and will be signed by the responsible party and the District. In some cases, the District will use a Vegetation Agreement or Source Reduction Agreement to establish a contract with the property owner. The Agreement will contain the name of the responsible party, location of the property, description of the work to be done, the cost of the work, if any, to be paid by the responsible party, and requirements for maintenance to be performed by the responsible party. These agreements shall be subject to the same requirements as any other agreement covered by these policies.
5. **Coordinate and Assist with Other Regulatory Agencies** – Coordinate with other local, state, federal, and conservation agencies during the negotiation process to avoid or address any potential regulatory conflicts with the draft Vector Management Plan.
6. **Cooperative Agreement and/ or Contract** – A cooperative agreement and/or contract will formalize the relationship between the District and the responsible party. This document will also outline the consequences of non-compliance with the Vector Management Plan under the California Health and Safety Code.
7. **Monitoring** – After successful implementation of the requirements, regular inspections of the property will be conducted to assess continued maintenance and compliance with the site's Vector Reduction Guidelines as identified in the Vector Management Plan. The District reserves the right to renegotiate the Vector Management Plan if it is determined that adequate vector control is not being achieved. In this case, the process would return to Step 2. As long as the responsible party is in compliance with the terms of the cooperative agreement, no additional charges or penalties will be assessed by the District.

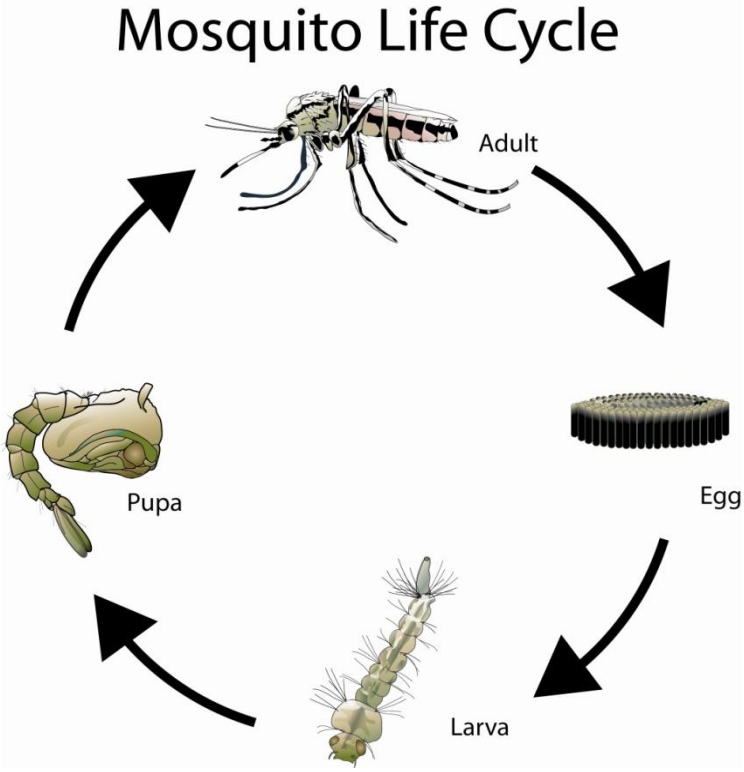
8. **Evaluation of Vector Management Plan Efficacy** – An effective vector control plan requires regular assessment and adaptive management to address changing conditions or unforeseen effects. The District will evaluate each Vector Management Plan to determine if the Vector Reduction Guidelines are meeting the needs of both the responsible party and the District. Based on this evaluation, either party may initiate a review of the Vector Management Plan pursuant to the terms of the cooperative agreement.
9. **Abatement Process** – if the responsible party does not take corrective action or does not provide a reasonable explanation for the continued lack of compliance with the cooperative agreement, the case may be brought to the District Manager pursuant to the District's Nuisance Abatement Procedures (see Appendix 1) to begin the Formal Abatement process as defined in HSC §2061.

Figure 1. Vector Reduction Program Implementation Process Flow Chart



MOSQUITO REDUCTION GUIDELINES

There are over 20 species of mosquitoes that occur in Orange County. Fortunately, only 13 species are of significant concern in our area. It is important to realize that each species of mosquito has different habitat requirements and behaviors that affect its ability to transmit disease, bite humans, and be controlled by a specific Vector Reduction Guideline.



Mosquito Biology

All mosquitoes share a similar life cycle with an aquatic stage (larvae) and an aerial stage (adult). Nearly all Vector Reduction Guidelines focus on managing the aquatic stage of the mosquito by creating conditions that are less favorable for mosquito development. This usually involves manipulating the amount or timing of standing water, decreasing the amount of vegetation in and around the standing water, and creating situations where natural or introduced predators can consume the mosquito larvae. Since each species of mosquito has slightly different habitat requirements, it is important to understand which mosquitoes favor which habitats to understand how a particular mosquito reduction guideline reduces the population.

To understand mosquito reduction guidelines, it is useful to think of mosquitoes as belonging to one of the following three categories.

Standing –Water Mosquitoes prefer water commonly found in ornamental ponds, unmaintained swimming pools, freeway drains, stormwater systems, natural waterways, and flood control channels.

Common Mosquito Reduction Guidelines:

a. Drain standing water.
b. Reduce or eliminate emergent vegetation in and along the edges of the water.
c. Hold water level constant to encourage natural predators or biological control agents (e.g. mosquito fish).
d. Contact the District to coordinate mosquito prevention with other mosquito control operations.

Container Mosquitoes prefer contained areas of water, such as tree holes, buckets, tires, etc. Some standing water mosquitoes will also develop in containers.

Common Mosquito Reduction Guidelines:

a. Drain containers of standing water.
b. Cover, overturn, or create drainage holes that prevent standing water in the container.
c. Identify and prevent water from refilling containers.
d. Contact the District to coordinate mosquito prevention with other mosquito control operations.

Salt Water Mosquitoes lay their eggs on moist soil. When they become submerged, due to tidal fluctuations, the eggs hatch.

Common Mosquito Reduction Guidelines:

a. Flood when air temperatures do not encourage rapid mosquito development (late fall rather than summer).
b. Reduce or eliminate emergent vegetation.
c. Flood quickly to encourage all eggs to hatch at once and minimize the need for multiple larvicide applications.
d. Contact the District to coordinate mosquito prevention with other mosquito control operations.

RESIDENTIAL AND COMMERCIAL MOSQUITO SOURCES

Common Mosquito Development Sites

- Backyard Sources
- Low Impact Developments (e.g., Rain Barrels)
- Pools & Spas
- Ornamental Ponds & Water Features
- Tire storage
- Unmaintained swimming pools and spas
- Decorative ponds and fountains
- Bird baths
- Water–filled containers
- Clogged rain gutters
- Poorly designed or damaged landscape irrigation systems
- Cemetery vases
- Koi ponds
- Stored or waste tires
- Small Drains

Common Mosquito Species

- Cleaner water sources: *Culex tarsalis.*
- Water with more organic material*: Culex quinquefasciatus, Culex stigmatosoma,* and *Culiseta incidens.*

Special Concerns

Urban and suburban mosquito sources are especially problematic because they produce mosquitoes in areas of high population density where many people live and work. This can quickly lead to vector–borne disease transmission since the vector (mosquito) and host (human) are often in close proximity. These sources may be in and around private residences which are not easily seen or accessed by District staff. Economic or social changes in a neighborhood can result in an increase in mosquito sources, such as unmaintained swimming pools and spas. Fortunately, many of the Mosquito Reduction Guidelines for residential areas are relatively inexpensive and easy to implement.

General Mosquito Reduction Principles

1. Prevent or eliminate unnecessary standing water that remains for more than 96 hours.
2. Maintain irrigation systems to avoid excess water use and runoff into storm drains.
3. Maintain water features such as ponds and fountains to circulate water with pumps that run at least eight hours a day. If the feature has no pump, water should be changed every 96 hours to prevent mosquito breeding and/or pesticide treatment may be necessary.

4. Maintain access for District staff to monitor and treat mosquito breeding sources.
5. Contact District staff for technical guidance or assistance in implementing Vector Reduction Guidelines for large mosquito breeding sources.
6. If unable to control mosquito breeding contact, the District for advice and help.

Residential and Commercial Mosquito Reduction Guidelines

RC-1 Drain all containers of standing water, including pet dishes, potted plant drip trays, boats, birdbaths, and tires and buckets at least once per week. Mosquitoes can develop in as little as a 1/8" of standing water. Be aware of containers and objects that are subject to collecting water. If possible, drill drainage holes, cover, or invert any container, or object, that holds standing water and must remain outdoors. Be sure to check for containers or trash in places that may be hard to see, such as under bushes or buildings.

RC-2 Dispose of unwanted or unused artificial containers, and properly dispose of old tires.

RC-3 Maintain pools and spas. Use skimmers and filter systems to remove egg rafts and mosquito larvae.

RC-4 If a pool or spa is not going to be operational for any reason, notify the District so that the pool or spa can be inspected regularly and treated with an appropriate larvicide and/or stocked with mosquito fish, if needed. These services are provided at no additional charge and are supported by property taxes.

RC-5 Notify the District of any ponds or water features (including ponds with ornamental fish such as Koi or goldfish) with permanent water. Allow District Inspectors to inspect and periodically stock mosquito fish or other biological control, as necessary, for the control of mosquito larvae.

RC-6 Landscape irrigation drainage should be managed such that no water stands for more than 96 hours.

RC-7 All underground drain pipes should be laid to grade to avoid low areas that may hold water for longer than 96 hours.

RC-8 Maintain rain gutters and other gutter structures by removing leaves, debris, and standing water from these features, as necessary, following rain events.

RC-9 Provide safe access for District staff to all pools, spas, ponds, landscape irrigation structures, catch basins, storm drains, drainage pipes, sewer cleanouts, or any other potential mosquito breeding source.

RC-10 Repair leaks or damaged drainage system components to prevent standing water for more than 96 hours.

RC-11 Notify District staff of any condition that may produce mosquitoes on the property such as flooding, broken pipe, damaged septic tank cover, or a leaking outdoor faucet if it results in standing water for more than 96 hours.

RC-12 Small Drains – screen and keep free of water and debris.

Low Impact Developments (e.g., Rain Barrels)

RB-1 Prevent mosquito breeding in rain barrels by properly screening all openings to prevent mosquito access to the stored water. If larvae are observed in a rain barrel, contact the District.

Ornamental Ponds and Water Features

P-1 All ponds should be surrounded by land of adequate width to allow safe passage of District staff and/or equipment.

P-2 Banks should be steeply sloped and lined to three feet below the water level with a suitable material such as concrete or clay, or be regularly treated with residual herbicides to ensure permanent weed prevention[2].

P-3 To minimize invasive emergent vegetation in ponds, use a slope angle of at least 2:1. Bank slopes of 2.5:1 to 4:1 (vertical: horizontal) and minimum depths of four to five feet to significantly reduce bottom-rooted aquatic plants.

P-4 Large ponds and lakes should have raised embankments a minimum width of 12 feet and be adequately constructed to support maintenance vehicles.

P-5 Ponds or ornamental water features should be stocked with mosquito fish when possible. Contact the District for an assessment.

P-6 Vegetation should be controlled regularly to prevent overgrowth of emergent vegetation and vegetative barriers for District access. This includes vegetation control to maintain access to lanes and paths, interior pond embankments, and any weed growth that might become established within the pond.

Tire Storage

TS-1 Never allow water to accumulate in tires. Tires should be stored in a covered location or covered by a tarp in order to prevent accumulation of water.

[2] Per National Pollutant Discharge Elimination System (NPDES) authorization, or other approval if needed.

TS-2 Tires should never be stored in a pile. Tires should be stored on racks or in a stack not more than two rows wide.

TS-3 Tires should be stored in a manner that allows inspections of each individual tire.

TS-4 Waste tires should be picked up by the proper disposal entity on a regular basis.

TS-5 Those responsible for stored tires should inspect and dump out any water that may have accumulated inside tires on their premises on a weekly basis.

TURF AND LANDSCAPE

Common Mosquito Development Sites

- Sprinklers & Irrigation Systems
- Small Drains
- Nurseries
- Cemeteries
- Golf Courses
- Equestrian Facilities
- Parks
- Agriculture

Common Mosquito Species

- Cleaner water sources: *Culex tarsalis.*
- Water with more organic material*: Culex quinquefasciatus, Culex stigmatosoma,* and *Culiseta incidens.*

Special Concerns

Turf and landscape sources are especially important because they occur near areas of high population density and contain vector sources (e.g., ponds, vases, plant containers) that may not be easily accessible to the District. These sources occur in areas where people recreate and/or work during dusk and dawn which are periods of high mosquito activity. Additionally, these sources can add significant water to the underground storm drain system, thereby increasing vector habitat.

General Mosquito Reduction Principles

1. Prevent or eliminate unnecessary standing water that remains for more than 96 hours.
2. Maintain irrigation systems to avoid excess water use and runoff into storm drains.
3. Maintain water features, such as ponds and fountains, to circulate water with pumps avoid stagnate water conditions. If the feature has no pump, water should be changed every 96 hours to prevent mosquito breeding and/or pesticide treatment may be necessary.
4. Maintain access for the District to monitor and treat mosquito breeding sources.
5. Contact the District for technical guidance or assistance in implementing mosquito reduction strategies for larger mosquito breeding sources.
6. If unable to control mosquito breeding, contact the District.

Sprinkler & Irrigation Systems

SL-1 Landscape irrigation drainage should be managed such that little or no water enters the stormwater system.

SL-2 Avoid over-irrigation to prevent accumulation of wastewater that results in pooling and runoff.

SL-3 All underground drain pipes should be laid to grade to avoid areas that may hold water.

SL-4 Repair leaks or damaged drainage system components to prevent standing water.

Nurseries

N-1 Follow all recommendations for mosquito breeding reduction in sprinkler and irrigation sources.

N-2 Inspect to ensure that all containers drain properly and contain no standing water, including potted plants and potted plant bases.

N-3 Inspect plants imported from outside of Orange County for standing water and/or mosquito eggs (e.g., *Aedes albopictus*).

N-4 Notify the District immediately if employees are being bitten by mosquitoes.

N-5 Back-fill tire ruts and other low areas that hold water for more than 96 hours.

N-6 Keep drainage ditches free of excessive vegetation and debris to promote rapid drainage.

N-7 Repair and seek to improve irrigation systems to increase water use efficiency.

Cemeteries

C-1 Empty all flower vases weekly.

C-2 Seek alternatives to in-ground or mounted flower vases which hold water for more than 96 hours.

C-3 Switch flower vases to wire stands that hold flowers or plants above ground surface.

C-4 Notify District staff immediately if employees or visitors are bitten by mosquitoes.

Golf Courses

GC-1 Land grades should have sufficient fall to prevent mid-field ponding, especially in soils with high clay content.

GC-2 Irrigate only as frequently as is needed to maintain proper soil moisture. Check soil moisture regularly.

GC-3 Manage irrigation to prevent ponding of water.

GC-4 Drains should have gradients from 1 in 40 to 1 in 110 to provide good water flow and be maintained free of clogs and vegetation.

GC-5 Do not over fertilize. Over-fertilization can leach into irrigation run-off which may facilitate mosquito production in ditches and/or become contamination further downstream.

GC-6 Keep equipment off soil when the ground is soft. Mosquito habitat is created when water collects in tire ruts.

GC-7 Refer to Pond section for information regarding reduction of mosquito breeding in water hazards.

Equestrian Facilities

EF-1 Identify areas on the property where water can accumulate and remain standing for more than 96 hours. Mark these areas on a site map and assess them after rainfall or irrigation.

EF-2 Eliminate containers that accumulate and hold water for more than 96 hours. When containers cannot be eliminated, drain standing water every 96 hours, or place mosquito fish.

Agriculture

A-1 Water allotments to farming operations should be limited to reasonable needs for the size of fields, type of soil, and crop requirements.

A-2 Plantings watered by drip irrigation should be checked to ensure that the system is not over watering and causing standing water that could produce mosquitoes.

A-3 Land grades should have sufficient fall to prevent mid-field ponding, especially in soils with high clay content, except where drip irrigation is being used.

A-4 Graded ditches should be located at the low ends of fields for draining and proper management of rainwater runoff and tail water.

A-5 Remove vegetation and other blockages from V ditches on the property on a regular basis to prevent stagnant water from pooling and becoming a mosquito breeding site.

A-6 Provisions should be made to drain irrigation ditches, pipelines, and other features of water after each use to prevent mosquito breeding habitats.

A-7 Animal confinement operations should be designed with sloped loafing and feeding corrals for proper drainage. If water troughs are being used, they should be monitored to detect potential mosquito production.

A-8 Inform the District of organic agriculture practices so that the District can provide control.

STORMWATER SYSTEMS AND URBAN RUNFOFF

Common Mosquito Development Sites

- Detention/retention basins
- Treatment wetlands
- Catch basins/storm drains
- Underground water storage devices
- Underground drain systems
- Clogged sediment screens
- Blocked culverts
- Roadside ditches

Common Mosquito Species

- Above ground/clean–water sources: *Culex tarsalis.*
- Underground/polluted or nutrient rich water*: Culex quinquefasciatus, Culex stigmatosoma,* and *Culiseta incidens.*

Special Concerns

Management of mosquitoes and other vectors in stormwater management structures, such as flood control basins and other structural stormwater Best Management Practices (BMPs) is critical for protecting public health. With careful planning, such structures can be designed, built, operated, and maintained in a manner that minimizes opportunities for the proliferation of vectors. The District stresses the importance of identifying and resolving potential mosquito sources in stormwater structures at the planning stages of new development.

General Mosquito Reduction Principles

1. Maintain access for District staff to monitor and treat mosquito breeding sources.
2. Consider mosquito reduction standards during the design and construction of stormwater infrastructure and allocate funds to maintenance of the infrastructure.
3. Manage sprinkler and irrigation systems to minimize runoff entering stormwater infrastructure.
4. Avoid intentionally running water into stormwater systems (e.g., washing sidewalks and driveways, washing cars on streets, etc.).
5. Minimize emergent vegetation and surface debris in the water.
6. Provide the District access to accumulated water allowing for mosquito treatment and control.

Above Ground Structures

AG-1 Build shoreline perimeters as steep and uniform as practicable to discourage excessive plant growth.

AG-2 Whenever possible, maintain stormwater ponds and wetlands at depths in excess of four feet to limit the spread of invasive emergent vegetation, such as cattails (*Schoenoplectus* spp.) and bulrush (*Typha* spp.).

AG-3 Eliminate floating vegetation conducive to mosquito production (e.g., water hyacinth *Eichhornia* spp., duckweed *Lemna* and *Spirodela* spp., and filamentous algal mats).

AG-4 Perform routine maintenance to reduce and contain emergent plant densities to facilitate the ability of mosquito predators (i.e., fishes) to move throughout vegetated areas.

AG-5 Keep or make shorelines accessible for periodic maintenance, control, and removal of emergent vegetation, as well as for routine mosquito monitoring and abatement procedures, if necessary.

AG-6 Design in drainage systems and obtain necessary approvals for all stormwater ponds and wetlands to allow for complete draining when needed for periodic maintenance and silt removal.

AG-7 The effective swath width of most backpack or truck–mounted larvicide sprayers is approximately 20 feet on a windless day. Because of these equipment limitations, all–weather road access (with provisions for turning a full size work vehicle) should be provided along at least one side of large above–ground structures that are less than 25 feet wide.

AG-8 Access roads should be built as close to the shoreline as possible. Vegetation or other obstacles should not be permitted between the access road and the stormwater treatment device that might obstruct the application of larvicides to the water. Access roads and paths need to be maintained and free of vegetation overgrowth.

AG-9 Vegetation should be controlled (by removal, thinning, or mowing) periodically to prevent barriers to access.

AG-10 Design structures so they do not hold standing water for more than 96 hours. Special attention to groundwater depth is essential to prevent groundwater seepage and permanent standing water.

AG-11 Allow water to flow by gravity through the structure by use of a hydraulic grade line. Pumps are not recommended, are subject to failure, and often require sumps that hold water.

AG-12 Avoid the use of loose riprap or concrete depressions that may create and hold standing water.

AG-13 Avoid barriers, diversions, or flow spreaders that may retain standing water.

AG-14 Use concrete or liners in shallow areas to discourage unwanted plant growth where vegetation is not necessary.

AG-15 Where feasible, compartmentalize managed treatment wetlands so that the maximum width of ponds does not exceed two times the effective distance (40 feet) of land–based application technologies for mosquito control agents.

AG-16 Incorporate features that prevent or reduce the possibility of clogging discharge orifices (e.g., debris screens). The use of weep holes is not recommended due to rapid clogging.

AG-17 Design distribution piping and containment basins with adequate slopes to drain fully and prevent standing water. The design slope should take sediment accumulation into consideration between maintenance periods. Compaction during grading may also be needed to avoid slumping and settling.

AG-18 Catch Basins, drop inlets, storm drains, and other structures originally designed to fully drain water should be regularly checked and maintained to function as designed.

AG-19 Basins designed to be dry, but remain wet, should be corrected by retrofit, replacement, repair, or more frequent maintenance.

AG-20 Coordinate cleaning of catch basins, drop inlets, or storm drains with mosquito treatment operations.

AG-21 Enforce the prompt removal of silt screens installed during construction when no longer needed to protect water quality.

Underground Structures (Sumps, vaults, drop inlets, catch basins, driveway sump drains)

US-1 Completely seal structures that retain water permanently or longer than 96 hours to prevent entry of adult mosquitoes.

US-2 Stormwater structures utilizing covers should be tight fitting, with maximum allowable gaps 1/16 inch, to exclude entry of adult mosquitoes.

US-3 If the sump, vault, or basin is sealed against mosquitoes, with the exception of the inlet and outlet, submerge the inlet and outlet completely to reduce the available surface area of water for mosquito egg–laying (female mosquitoes can fly long distances through pipes to access water).

US-4 Design structures with the appropriate pumping, piping, valves, or other necessary equipment to allow for easy dewatering of the unit.

Flood Channels

FC-1 Provide proper grades to ensure that water flows freely.

FC-2 Low-flow channels should be maintained free of debris.

FC-3 Perform regular maintenance to remove vegetation, debris, trash, and sediment accumulated inside the channel to ensure that water flows freely.

FC-4 Remove or trim vegetation that overhangs the channel to minimize the amount of material that naturally falls into the channel.

FC-5 Avoid the use of loose rock riprap that may create and hold standing water.

FC-6 Maintain clear access along the entire length of the channel for the District to conduct surveillance and control activities.

Natural Watercourses

NW-1 Perform frequent maintenance as needed to trim or remove vegetation, debris, trash, and sediment accumulated inside the natural watercourse to ensure that water flows freely.

NW-2 Perform routine maintenance to reduce emergent plant densities to facilitate the ability of mosquito predators (e.g., fishes) to move throughout vegetated areas.

NW-3 Assure accessibility to maintenance and vector control crews for periodic maintenance, control, and trimming or removal of emergent vegetation, as well as for routine mosquito monitoring and abatement procedures, if necessary.

NW-4 Coordinate with Orange County Flood Control Division on areas under their jurisdiction for maintenance. Report blockages and problematic vegetation to Orange County staff to perform needed maintenance.

Freeway Drains

FD-1 Provide proper grades to ensure that water flows freely and does not stand for more than 96 hours.

FD-2 Perform frequent maintenance as needed to remove vegetation, debris, trash, and sediment accumulated inside the drain to ensure water flows freely.

FD-3 Remove or trim vegetation that overhangs the freeway drain to minimize the amount of material that naturally falls into the structure.

FD-4 Avoid the use of loose rock riprap that may hold standing water.

FD-5 Maintain clear access along the entire length of the freeway drain for District staff to conduct surveillance and control activities.

Wastewater Management

WM-1 Monitor all treatment ponds for mosquito larvae – particularly in areas of emergent vegetation.

WM-2 Remove emergent vegetation from edges of aerated ponds.

WM-3 Immediately incorporate sludge into soil through plowing or disking.

WM-4 Ensure all water distributed onto evaporation ponds dries completely in less than 96 hours.

WM-5 Check abandoned ponds or tanks weekly to ensure they are completely dry.

WM-6 Prevent the formation of any crust on treatment ponds or tanks.

WETLANDS

Common Mosquito Development Sites

- Permanent wetlands for habitat or species conservation
- Constructed vernal pools and other wetlands
- Seasonal wetlands
- Tidal marshes

Common Mosquito Species

- Permanent wetlands: *Culex tarsalis, Culex erythrothorax, and Culiseta incidens*.
- Seasonal wetlands: *Aedes* species.

Special Concerns

Wetlands vary depending on the management goals for the habitat, and may be subject to additional regulations, including state and federal conservation easements and policies, and habitat mitigation or management plans. Vector Reduction Guidelines attempt to balance the management goals of land managers, land owners, and other regulatory agencies with the ultimate goal of creating and maintaining habitat that is least-suitable for mosquito breeding. The District is committed to working with wetland managers and state and federal regulatory agencies to implement mosquito control practices in a proactive and cooperative manner.

General Mosquito Reduction Principles

1. Maintain access for District staff to monitor and treat mosquito breeding sources.
2. Minimize emergent vegetation and surface debris on the water.
3. Contact the District for technical guidance, assistance in implementing vector reduction guidelines, or to coordinate flood/treatment schedules with mosquito control operations.

Design and Maintenance

DM-1 Maintain all open ditches by regularly removing trash, silt, and vegetation, including roots to maintain efficient water delivery and drainage.

DM-2 Provide reasonable access along existing roads and levees to allow the District access for monitoring, and control activities. Make shorelines of natural, agricultural, and constructed water bodies accessible to crews for periodic maintenance, control, and removal of emergent vegetation.

DM-3 Inspect, repair, and clean water-control structures of debris. Remove silt and vegetation build–up in front of structures that impede drainage or water flow. Completely close, board, or fill in to prevent unnecessary water flow, except where water circulation is necessary.

DM-4 Perform regular pump efficiency testing and make any necessary repairs to maximize output, if pumps are required.

DM-5 Ensure adequately sized water control structures are in place. Increase size and number of water control structures, if necessary, to allow for complete draw–down and rapid flooding.

DM-6 Inspect and repair roads and levees, at least annually.

DM-7 Design managed wetland projects to include independent inlets and outlets for each wetland unit.

DM-8 Construct or enhance swales so they are sloped from inlet to outlet and allow the majority of the wetland to be drawn down.

DM-9 Excavate deep channels or basins to maintain permanent water areas (> 2.5 feet deep) within a portion of seasonal managed wetlands. This provides year–round habitat for mosquito predators which can inoculate seasonal wetlands when they are irrigated or flooded.

Vegetation Management

VM-1 Control floating vegetation conducive to mosquito production (e.g., water hyacinth, water primrose, parrot's feather *Eichhornia* spp., duckweed *Lemna* and *Spirodela* spp., and filamentous algal mats).

VM-2 Perform routine maintenance to reduce problematic emergent plant densities and to remove dead top-killed vegetation from periodic freezing weather conditions to facilitate the ability of mosquito predators (e.g., fishes) to move throughout vegetated areas and allow good penetration of pesticides.

Water Management

WM-1 Maintain stable water level by ensuring constant flow of water into pond or wetland to reduce water fluctuation due to evaporation, transpiration, outflow, and seepage.

WM-2 Delay fall flooding to avoid increasing late–season mosquito production (Kwasny et. al., 2004).

WM-3 Flood managed wetlands as fast as possible and as deep as possible (18–24”). Shallow water levels can be maintained during winter months.

WM-4 Maintain permanent or semi–permanent water where mosquito predators can develop. Discourage the use of broad spectrum pesticides.

WM-5 Where feasible, have an emergency plan that provides for immediate drainage into acceptable areas, if a public health emergency occurs.

Coordination with District

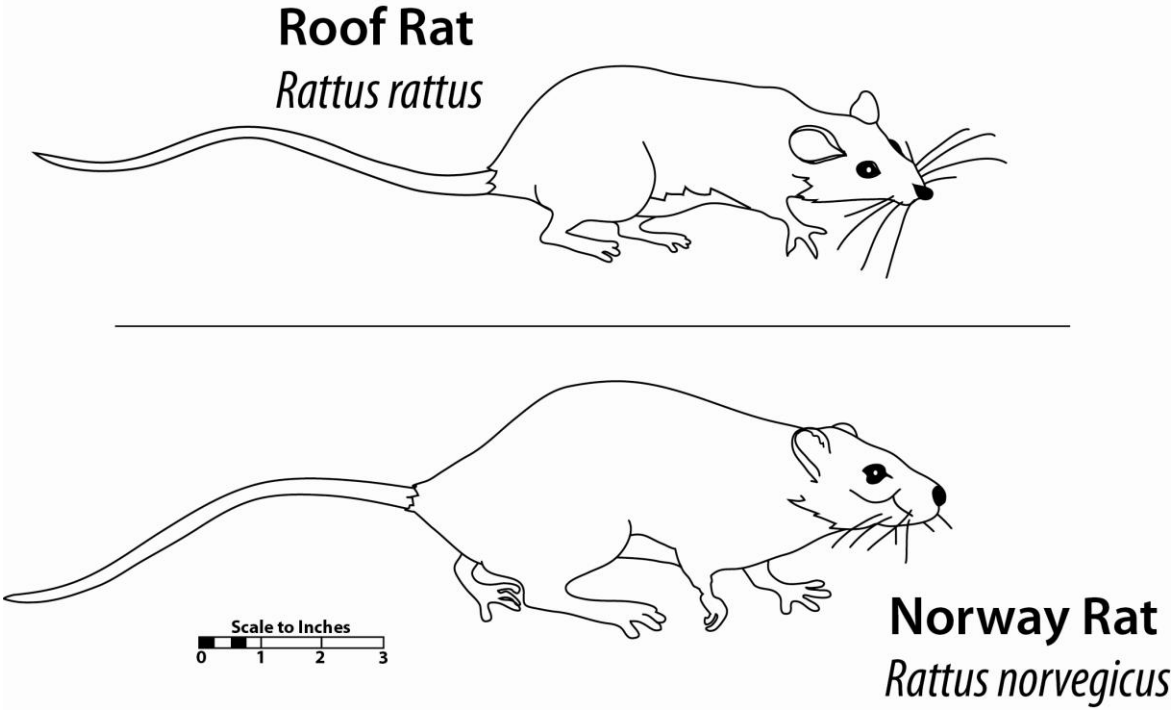
CD-1 Consult with the District on agency-sponsored habitat management plans on private lands (and on the timing of wetland flooding on public and private lands); urge private landowners to do the same.

CD-2 Identify problem locations that produce mosquitoes, with the aid of the District, and work to implement mosquito reduction guidelines. Identify potential cost–share opportunities prior to implementing mosquito reduction guidelines.

CD-3 Consult with the District on the design of restoration and enhancement projects that have the possibility of affecting mosquito production or control operations.

RAT REDUCTION GUIDELINES

Rat Species:
Norway rat: *Rattus norvegicus*
Roof rat: *Rattus rattus*



Rat Biology

Rats are mostly active at night. They have poor eyesight, but they make up for this with their keen senses of hearing, smell, taste, and touch. Rats constantly explore and learn about their environment, memorizing the locations of pathways, obstacles, food and water, shelter, and other elements in their domain. They quickly detect and tend to avoid new objects placed into a familiar environment. Thus, objects, such as traps and baits often are avoided for several days or more following their initial placement. Both Norway and roof rats may gain entry to structures by gnawing, climbing, jumping, or swimming through sewers and entering through the toilet or broken drains.

Roof rats *(Rattus rattus)*, sometimes called ship rats or house rats, are the most common rat in Orange County. Unlike Norway rats, sometimes called brown or sewer rats, their tails are longer than their heads and bodies combined. Roof rats are very agile climbers and usually live and nest above ground in shrubs, trees, and dense vegetation such as ivy. In buildings, they are most often found in enclosed or elevated spaces in attics, walls, false ceilings, and cabinets.

Norway rats *(Rattus norvegicus)* are stocky burrowing rodents that dig burrows into the ground or take advantage of existing burrows of other animals. The burrows are found along building

foundations, beneath rubbish or woodpiles, and in moist areas in and around gardens and fields. While Norway rats are more powerful swimmers, roof rats are more agile and are better climbers. Rats may grab food and carry it off to feed elsewhere. Rats of either species, especially young rats, can squeeze beneath a door with only a 1/2-inch gap. If the door is made of wood, the rat may gnaw to enlarge the gap, but this may not be necessary.

Norway rats eat a wide variety of foods but mostly prefer cereal grains, meats, fish, nuts, and some fruits. When searching for food and water, Norway rats usually travel an area of about 100 to 150 feet in diameter; seldom do they travel any further than 300 feet from their burrows or nests. Roof rats eat a wide variety of foods, but prefer fruits, nuts, berries, slugs, and snails. The average female Norway rat has four to six litters per year and may successfully wean 20 or more offspring annually. The average number of litters a female roof rat has per year depends on many factors, but generally is three to five with from five to eight young in each litter.

Roof rats are especially fond of avocados and citrus and often eat fruit that is still on the tree. When feeding on a mature orange, they make a small hole through which they completely remove the contents of the fruit, leaving only the hollowed out rind hanging on the tree. Their favorite habitats are attics, trees, and overgrown shrubbery or vines. Roof rats prefer to nest in locations off the ground and rarely dig burrows.

Roof rats routinely travel up to 300 feet for food. They may live in the landscaping of one residence and feed at another. They can often be seen at night running along overhead utility lines or fence tops. They have an excellent sense of balance and use their long tails for balance while traveling along overhead utility lines. They may live in trees or in attics and climb down to a food source.

Special Concerns

The roof rat is the major pest species in Orange County. This agile rat frequently enters buildings and moves about neighborhoods using utility lines and fences as runways. They prefer to feed on wild bird seed, pet food, and many of the fruits and nuts (including those that people do not eat) commonly found in residential backyards. Rats and their fleas are capable of transmitting a variety of human diseases making them vector species. Among the diseases transmitted by rats, plague is perhaps the best known and the most serious. The potential of a plague outbreak increases as rat populations increase. Rats can also transmit a variety of bacteria, including rat bite fever and food-borne illness. Rats have no control over their bowels so the presence of droppings is a sure sign of rat activity, as is gnaw marks on food sources, and ingress and egress into buildings.

Guidelines for the Prevention of Rat Infestations

1. Eliminate food and water sources (e.g., pet food, bird food, snails, bird bath, and close garbage cans).
2. Exclude rats from structures.
3. Control rat populations through trapping and rodenticide bait use.
4. Remove rat harborage (e.g., overgrown plants, wood piles, abandoned sheds, old furniture).

Elimination of Food & Water Sources

RF-1 Remove potential food sources from the premises. This includes pet foods, bird seed left out for birds, snails, and dog and cat feces that can be eaten by rats.

RF-2 Maintain fruit trees and fruiting ornamentals. Routinely harvest ripe fruit and dispose of all fruit that has fallen to the ground

RF-3 Maintain vegetable gardens. Routinely harvest produce from gardens.

RF-4 Store pet food in metal containers with tight sealing lids indoors and do not leave uneaten pet food, or water, outdoors overnight.

RF-5 Keep trash cans closed at all times with tightly fitted lids.

RF-6 Repair leaky faucets and eliminate any other unnecessary standing water

Rat Control

RC-1 Trap rats if they are inside a residence or building. Poisoning with rodenticide bait indoors is not recommended because a rat may die inside an inaccessible area of the structure and create an odor and fly problem.

RC-2 Place traps near nesting areas, or where rats are likely to hide. Do not place traps where children or pets will disturb or be harmed by them.

RC-3 Use the following guidelines when placing poison baits outside; 1) Use tamper-resistant bait stations; 2) Secure bait stations so they cannot be carried away or moved and so bait will not spill out; 3) Place bait stations in areas where rats are found, such as behind shrubbery. These formulations are *POISONOUS* and must be placed where pets and children cannot reach them.

Remove Harborage

RS-1 Remove harborage and nesting areas after the rats have been controlled. It is important to wait until after the rats have been eliminated because they will disperse into the surrounding area when the harborage is disturbed during removal.

RS-2 Periodically thin, trim or eliminate completely Algerian ivy, palm trees, yucca, bougainvillea, and other dense shrubbery away from roofs, walls, fences, utility poles, and trees and/or eliminated completely.

RS-3 Stack firewood and lumber piles at least 18" off the ground and 12" away from fences and walls.

RS-4 Close off all openings to potential harborage areas that cannot be removed (like structures), with 1/4 inch hardware cloth screen or stainless steel scrubbing pads. Harborage areas can include barbecues, pool heaters, air conditioners, old furniture, block wall fences, pool sheds, water heater closets, hose storage, crawl areas, attics, and vents.

Excluding Rats From Structures

RP-1 Screen all access openings with 1/4 inch galvanized hardware cloth and inspect at least once a year for condition. Common rat access points to structures include gaps under doors, turbine vents, roof openings, attic louvers and wire openings, pipe openings, gaps between roof and chimney, warped or missing shingles, air conditioning pipe openings, air ducts, and missing or torn vent covers.

RP-2 Seal gaps around pipes and electrical conduits, and weatherproof cracks around doors and windows.

RP-3 Keep tree limbs away from the eaves, roof, and exterior walls of the house.

Maintaining a Rat Free Property

RF-1 Eliminate harborage and food and water sources after rats have been exterminated.

Proper Disposal of a Rat Carcass

CD-1 Using a plastic bag, place your hand in the bag like a glove, pick up the carcass with the bag, invert the bag or turn bag inside out, tie a knot at the end of the bag, place bag in another bag, and dispose of rat in a trash container with a secure lid.

RED IMPORTED FIRE ANT REDUCTION GUIDELINES

Ant Species: *Solenopsis invicta*

Red Imported Fire Ant (RIFA) Biology

The life span of RIFA workers depends on their size. Minor workers may live 30 to 60 days, media workers 60 to 90 days, major workers 90 to 180 days, and queens may live two to six years. Complete life cycle from egg to adult takes between 22 and 38 days. Mating flights are the primary means of colony propagation, secondarily, budding can occur in which a portion of a split off satellite colony becomes an autonomous unit. After the colony reaches one year of age, reproductive alates are produced. Six to eight mating flights consisting of up to 4,500 female or queen alates each occur between the spring and fall. Mating flights usually occur midday on a warm (>74ºF/24ºC), sunny day following rain. Mating occurs during flight and the males die soon after mating with females. In the southern United States, as many as 97,000 queens may be produced per acre of infested land per year. By six months the colony has reached several thousand workers and the mound can be seen in a field or lawn. Colonies of this size generally contain a few large workers (major workers), many medium sized workers (media workers), and a majority of small workers (minor workers). The queen is the single producer of eggs and is capable of producing as many as 1,500 eggs per day. Mature RIFA colonies may contain as many as 240,000 workers with a typical colony consisting of 80,000 workers. The food collection of foraging workers consists mostly of insects and earthworms. RIFA have also been known to attack immobile and dead vertebrates. Workers also collect honeydew and will forage for sweets, proteins, and fats in homes. Fire ants will attach to the skin using their mandibles and will subsequently lower the tip of their abdomen to inject the stinger into the victim. Thus, fire ants both bite and sting, but only the sting is responsible for the painful burning and pustule.

Special Concerns

The RIFA is a quarantined pest in California and is subject to various federal and state laws and regulations. A native of South America, this imported fire ant was first introduced in the southeastern United States and eventually found its way into Orange County. The colony or nest is very distinctive and easily recognized as a loosely compacted, finely granular dome (18 inches in diameter and six to ten inches high) of soil that somewhat resembles wet coffee grounds. This mound will become hardened as rain and sprinkler waters dries on its surface. Lawn mowing often chops and spreads the mound so be aware that it may take many shapes. Gopher mounds may be similar in size to a RIFA mound but have larger (coarser) soil particles and rocks than RIFA mounds. This ant is considered a vector because, unlike most ants, it delivers a venomous sting that produces immediate pain, a burning/ itching sensation, and raised pustules that often last for several days. The venom is relatively toxic and potentially lethal to pets, wildlife, and sensitized humans. Because of the number and severity of their stings, residents of Orange County should be aware of the existence of RIFA on their property and the potential hazards posed by accidental contact.

Guidelines for Red Imported Fire Ant Pre and Post Treatments

Before Survey and/or Pesticide Ant Bait Treatment for RIFA

BR-1 Do not disturb nests and/or foraging workers. RIFA is an aggressive and defensive pest that will bite and sting to defend its self and the colony. Disturbing a mound prior to, or during, a treatment can cause treatments to fail and distract the foraging ants from collecting the bait.

BR-2 Provide the District access to the property for treatment of the fire ant mounds, and/or, if required, the entire property.

BR-3 Sprinkler systems must be turned off the night before the RIFA treatment and not turned on until the day after treatment is complete. The treatment area must be dry for the pesticide ant bait to work effectively.

BR-4 Keep people, pets, and/or companion animals away from the area being treated during the application. People and animals can return to the area immediately after treatment.

After Pesticide Ant Bait Treatment for RIFA

AR-1 Do not irrigate the property for 24 hours after treatment.

AR- 2 Do not apply pesticides to the treated area for one week following treatment.

AR- 3 Do not mow or disturb the area for 24 hours after treatment. Do not use blowers or mowers that may move bait from the treated area, especially within close proximity to a pond or other water feature. The pesticide ant bait is not to come into contact with water, and/or

conditions that favor runoff, areas where surface water is present, or to intertidal areas below the mean high water mark.

Coordination with District

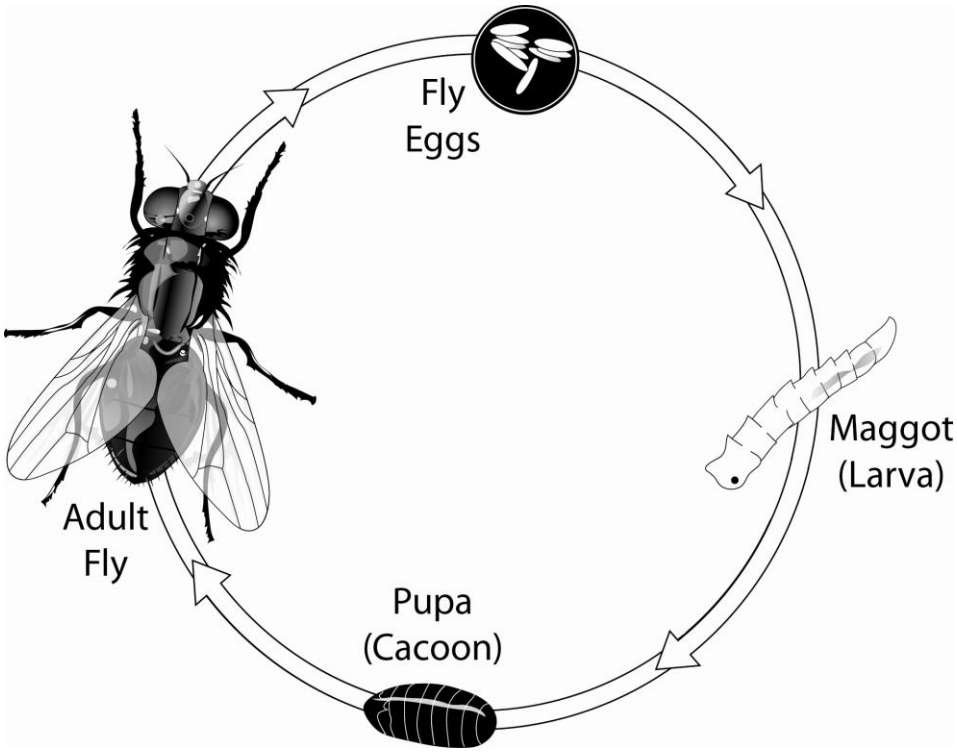
CD-1 Consult with the District on special concerns regarding RIFA and provide access for the District to monitor and treat the site.

CD-2 Working with the District, identify RIFA locations and work to implement the RIFA Reduction Guidelines. Identify potential cost–share opportunities to implement the RIFA Reduction Guidelines.

CD-3 Consult with the District on projects that have the possibility of affecting RIFA populations or control operations.

FLY REDUCTION GUIDELINES

Fly Species:
House Fly: *Musca domestica*
Little House Fly: *Fannia canniculari*s
Blow Flies: *Phormia* spp., *Calliphora* spp., *Phaenicia* spp.
Black Garbage Fly: *Ophyra* spp.
Stable Fly: *Stomoxys calcitrans*
False Stable Fly: *Muscina stabulans*
Flesh Fly: *Sarcophagidae* spp.
Oriental Latrine Fly, *Chrysomyia megacephala*



Fly Biology

Flies undergo complete metamorphosis that includes development from an egg, larva, pupa, and adult. Larval stages of flies are uniquely adapted to living in various sources. Some flies do not lay eggs but deposit live larvae directly to the food source. Eggs deposited by egg laying species usually hatch in one to two days and subsequently grow and molt depending on the existing environmental conditions like temperature, nutrient availability, and competition from other species. The larval development stage usually includes five instars. The final instar eventually ceases feeding and seeks a sheltered area near the source for pupation. When the adult is fully

developed, it emerges from the puparium and crawls to a site to expand its wings and cure the cuticle. The fly then mates and begins laying eggs. Fly populations can reach large numbers quickly, depending on the previously listed environmental conditions. Different species of adult flies are able to fly varying distances from the original source. Often flies are seen resting on southern facing surfaces to warm themselves in the morning. They rest at night in sheltered areas like bushes, trees, and eaves of buildings.

Special Concerns

Flies and fly larva feed on a wide range of food sources including blood, flesh, carrion, fecal material, organic waste products, and decomposing vegetable matter to include composting materials. Because flies feed on these foods, they have the ability to mechanically transmit pathogens and vector-borne diseases to humans. Flies found inside of food establishments are a violation of the California Retail Food Code and can be reported to the Orange County Health Care Agency. Flies have an amazing reproductive capacity that allows them to produce tremendous populations when optimal environmental conditions are present. In situations where flies are breeding prolifically, their populations can reach such high numbers as to become nuisance pests at parks, schools, and in residential neighborhoods. Some fly species are attracted to methane gas and may congregate in an area with a natural gas leak.

Guidelines for the Prevention of Fly Problems

1) Remove or eliminate fly breeding sources.
2) Exclude flies from structures.

Eliminate Fly Breeding Sources

F-1 Place garbage in plastic bags inside of trash receptacles. Keep trash receptacle lids closed.

F-2 Dispose of trash every seven days.

F-3 Pick up pet droppings and place in a sealed plastic bag at least once every seven days. Dog droppings should be picked up daily, while pet birds kept in outdoor aviaries should be cleaned weekly. Cat litter boxes should be changed weekly.

F-4 Do not leave pet food outside, as it can attract flies and serve as a larval fly source.

F-5 Quickly dispose of small animal carcasses such as rats, opossums, and birds by placing them in a plastic bag in the trash. An alternative may be to bury the carcass if space is available and

allowed by local ordinance. Contact the local animal care agency for information on disposing of large animal or pet carcasses.

F-6 Dispose of fruits and vegetables that drop from gardens and trees at least once per week by placing them in a plastic bag in the trash.

F-7 Remove animal manure from property every three days, according to local ordinances.

F-8 Compost decaying vegetable matter in a way that minimizes fly breeding, such as deep burial, tilling, or rapid drying of fruit and vegetable culls.

F-9 Contact the District for an inspection if flies are found on a property.

Exclusion

F-10 Keep the lids on garbage containers closed. Check to make sure there are no openings for fly entry.

F-11 Screen all windows and doors.

F- 12 Keep things that attract flies, such as pet food, bright colors, and attractive scents, away from unscreened doorways.

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Appendix D

ANNUAL PESTICIDE USE BY OCVCD, 2007-2009

OCVCD PESTICIDE USE							
YEAR		2007		2008		2009	
PESTICIDE Name (Concentration)	Manufacturer	Amount	# Applications	Amount	# Applications	Amount Used	# Applications
ADVION® FIRE ANT BAIT	Du Pont	46.88 lbs	41	12.02 lbs	23	70.63 lbs	135
AGNIQUE® MMF	Cognis Corporation	1546.8 oz	204	5210.05 oz	428	5719.8 oz	754
AGNIQUE® MMF G	Cognis Corporation					44 lbs	3
ALTOSID® BRIQUETS (8.62%)	Wellmark International	54.43 lbs	285	76.18 lbs	521	86.1 lbs	753
ALTOSID® LIQ. LARVICIDE (20.0%)	Wellmark International	222 oz	8	41.56 oz	5	101 oz	7
ALTOSID® PELLETS (4.25%)	Wellmark International	849.61 lbs	445	856.31 lbs	524	1075.15 lbs	643
ALTOSID® XR BRIQUETS (2.1%)	Wellmark International	751.52 lbs	1228	1459.86 lbs	2357	1697.97 lbs	2925
AMDRO® PRO (0.73%)	Basf Corporation	5479.72 lbs	2686	6582.8 lbs	2701	6284.39 lbs	2640
AQUA-ANVIL™	Clarke Mosquito Control	30.83 gal	62	157.83 gal	227	99.1 gal	207
AQUA MASTER®	Monsanto					40 oz	3
CONTRAC® ALL WEATHER CAKE (0.005%)	Bell Laboratories, Inc.	7476 lbs	3899	8612 lbs	4765	9243 lbs	4864
CUTRINE®-PLUS	Applied Biochemists	50 oz	1				
DISTANCE® FAB	Valent USA Corporation	529.06 lbs	2146	7166.2 lbs	1888	6348.26 lbs	1852
EXTINGUISH™	Wellmark International	4.83 lbs	5	23 lbs	4		
EXTINGUISH™ PLUS	Wellmark International	931.75 lbs	65	3333.05 lbs	315	5776.8 lbs	699
GOLDEN BEAR-1111 (98.7%)	Clarke Mosquito Control	2002.53 gal	2290	3648.44 gal	5606	2599.92 gal	3131
HONCHO® PLUS	Monsanto	385 oz	18	419 oz	13	61 oz	3
KARMEX®	Griffen			65 lbs	7	10 lbs	1
M-PEDE® (49%)	Mycogen Corporation	186.5 oz	11	69.5 oz	7	15 oz	3
Prescription Treatment® 565 PLUS XLO	Bayer Environmental Science			10 oz	1	40 oz	1
SUSPEND® SC (4.75%)	Bayer Environmental Science	117 oz	11	48 oz	8	17.5 oz	4
VECTOBAC® 12AS (11.61%)	Valent Biosciences	111.62 gal	542	110.8 gal	427	158.84 gal	660
VECTOBAC® G (2.8%)	Valent Biosciences	33943.5 lbs	1971	47371.1 lbs	1945	34034.25 lbs	1749
VECTOBAC® CG (7.5%)	Valent Biosciences	200 lbs	10	272.46 lbs	2671	155.5 lbs	8
VECTOLEX® WDG (51.2%)	Valent Biosciences	605.82 lbs	542	601.08 lbs	427	1292.14 lbs	660

Appendix E

PESTICIDE SPILL RESPONSE PLAN

Orange County Vector Control District

CHEMICAL SPILL CONTINGENCY PLAN

PURPOSE

The purpose of this plan is to protect personnel and the environment in case of a chemical spill involving equipment and/or applicators.

I. SCOPE—SPILLS ON HIGHWAY AND BYWAYS

1. If an applicator of the Orange County Vector Control District

   (OCVCD) is responsible for the release of a hazardous materials, he/she is responsible for taking charge of the situation prior to the arrival of local authorities.

   The applicator will ensure that:

   a. Traffic is diverted and that no one walks on or drives through the spilled material and that,
   b. Immediate steps, utilizing spill control material, be taken to Contain the material at the original site. (See Spill and Clean-up Procedures.)

2. If the spill occurs on a freeway or a road in an unincorporated area, the California Highway Patrol Officer at the scene will assume control of the situation. After he has diverted the traffic around the accident, he will determine the product and call ChemTrec (1-800-424-9300). They will, in turn, notify the OCVCD and request the spill be cleaned up. If the accident occurs on a city street, authorities will assume control and follow a similar procedure.

3. At the first opportunity, the OCVCD applicator will report by phone giving as much information as possible relative to the completion of a "Hazardous Spill Report." If it is not possible for OCVCD personnel to clean up the spill, then a supervisor will direct an appropriate action.

4. Any spill off the premises, particularly on a public road, will probably cause the news media to be alerted. Those OCVCD employees handling the situation should consult with the office prior to commenting to news media.

II. SPILL CLEAN-UP PROCEDURES WILL BE SPECIFIC TO EACH PESTICIDE

Applicators should wear appropriate protective equipment when performing clean-up procedures. You should check with the manufacturer to determine the appropriate means of clean-up before the incident.

SPILL CONTROL AND CLEAN-UP PROCEDURES – OUTSIDE

1. Site and Security. Secure the spill site from entry by unauthorized personnel. If necessary, obtain assistance from the local authorities.

2. Containment and Control. Spilled pesticides must be contained at the original site of the spill. The pesticide must be prevented from entering the storm drains, wells, water systems, and navigable waterways by following these procedures.

   a. Wear appropriate protective equipment from a spill kit.

   b. Prevent further leaking by repositioning the pesticide container.

   c. Prevent the spill from spreading by trenching or encircling the area with a dike of sand, absorbent material, or as a last resort, soil or rags.

d. Cover the spill. If the spill is liquid use an absorbent material. If the spill is dry material, use a polyethylene or plastic tarpaulin and secure. NOTE: Use absorbent materials sparingly as they must be disposed of as hazardous waste.

3. Dry Spills. (dust, wettable powders, granular formulations) should be picked up in the following manner:
   a. Immediately cover powders, dusts, or granular materials to prevent them from becoming airborne. This can be done by placing a polyethylene or plastic tarpaulin over the spilled material. Weight the ends of the tarp, especially the end facing the wind. Begin clean-up operations by systematically rolling up the tarp while simultaneously sweeping up the spilled pesticide using brisk movements in order to keep the dry pesticide from becoming airborne. If indoors, a cover may not be necessary. When practical, a light sprinkling with water may be used instead of a cover.

   b. Collect the pesticide and place it in heavy-duty plastic bags. Properly secure and label the bags, identifying the pesticide and possible hazards. Set the bags aside for later disposal.

4. Liquid Spills. Should be cleaned up by placing an absorbent material over the spilled pesticide. Work the absorbent into the spill using a broom or other tool to force the pesticide. Collect all spent absorbent material and place into a properly labeled leak-proof container.

Appendix F

FULL AIR QUALITY ANALYSIS

AIR QUALITY ANALYSIS

EXISTING CONDITIONS

REGIONAL CLIMATE

The climate of southern California is semi-arid with warm summers, mild winters and infrequent, seasonal rainfall. The climate is heavily influenced by marine air, and areas closer to the coast exhibit less variability in average annual minimum and maximum temperatures than those lying farther inland. Average minimum temperatures occur in January and range from 47 degrees Fahrenheit(F) in Los Angeles down to 36 degrees F in San Bernadino. Recorded maximum temperatures in summer are above 100 degrees F in many areas. The ocean creates high moisture surface air on most days, which contributes to formation of inversion layers, smog and acid rain.

LOCAL CLIMATE

Orange County is characterized by a warm Mediterranean climate. Average lows temperatures range from the high 40s to low 60's while average high temperatures range from high 60's to mid- 80's. Precipitation is heaviest from January to March; average annual precipitation is approximately 13 inches.

REGIONAL AIR BASIN

Orange County falls within the South Coast Air Basin (SCAB), a 6,600-square mile area that includes all of Orange County and the non-desert portions of Los Angeles, Riverside and San Bernadino Counties. The South Coast Air Basin is bounded by the Pacific Ocean and Ventura County on the west, San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east, and San Diego County to the south. The South Coast Air Basin falls under the jurisdiction of the South Coast Air Quality Management District (SCAQMD), which prepares jointly with the Southern California Association of Governments an Air Quality Management Plan that outlines measures to meet California and federal requirements for air quality.

POLLUTANTS OF CONCERN

Pollutants of concern are categorized as coming from stationary sources, mobile sources, or other sources. Stationary sources of air pollution, which include point sources and area sources, are generated by fuel combustion, waste disposal, cleaning and surface coatings, petroleum production, industrial processes, solvent evaporation and other processes. Mobile source emissions refer to emissions generated by operation and evaporation resulting from the use of on- and off-road motor vehicles. Other sources are those sources generated by the natural environment, such as suspension of fine dust particles from the ground surface after high winds.

CRITERIA POLLUTANTS

Ambient air quality standards have been set by both federal and state governments to protect public health. Air pollutants emitted into the air by mobile and stationary sources are regulated by both

federal and state law and are referred to as “criteria air pollutants.” The U.S. Environmental Protection Agency (USEPA) and the California Air Resources Board (CARB) have established ambient air quality standards for common criteria air pollutants (Table 1). These standards represent safe levels that avoid specific adverse health effects associated with each pollutant. California standards represent levels that may not be exceeded whereas federal standards (other than those for ozone, particulate matter and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year.

Ozone is a gas that is not emitted itself but is created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOC) in the presence of sunlight. Motor vehicle exhaust, industrial emissions, gasoline vapors, chemical solvents and natural sources emit NOx and VOC contribute to the formation of ozone at ground-level. While ozone in the stratosphere protects humans and eco-systems from the harmful effect of the sun’s rays, at ground-level it forms smog and may exist in concentrations in the air that are harmful. Urban areas tend to have high levels of ground-level ozone, but some rural areas have increased ozone levels because wind carries ozone and the pollutants that form it hundreds of miles from their original sources. Breathing ozone can trigger a variety of health problems including respiratory problems such as asthma and throat irritation. Repeated exposure may permanently scar lung tissue. It also damages vegetation and eco-systems.

PM10 and PM2.5 "Particulate matter" is a complex mixture of extremely small particles and liquid droplets. Particle pollution is composed of many components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The size of particles in particulate matter pollution is directly linked to their potential for causing health problems. Particles 10 micrometers in diameter or smaller can pass through the throat and nose and enter the lungs, where they can cause serious health effects. USEPA groups particle pollution into two categories: "Inhalable coarse particles" (PM10) are larger than 2.5 micrometers and smaller than 10 micrometers in diameter and fine particulate matter less than 2.5 micrometers in diameter (PM2.5) found in smoke and haze. These particles are emitted from sources such as forest fires, industries and automobiles and can cause damage to the lungs and heart, reduce visibility and damage the environment by contributing to acid rain, depleting soil nutrients, and damaging crops and sensitive eco-systems.

Carbon monoxide (CO) is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. A major source of CO is motor vehicle exhaust; other outdoor sources include industrial processes (e.g., metals processing and chemical manufacturing), residential wood burning, and natural sources such as forest fires. Indoor sources of CO include woodstoves, gas stoves, cigarette smoke, and unvented gas and kerosene space heaters. CO reduces oxygen delivery to the body's organs and can cause death at high levels. At lower levels, it negatively affects the cardiovascular system and the central nervous system. CO contributes to the formation of smog and ground-level ozone.

Nitrogen dioxide (NO_2) is one of a group of highly reactive gases known as nitrogen oxides. While USEPA’s National Ambient Air Quality Standard covers this entire group of NOx, NO_2 is the indicator for the larger group of nitrogen oxides. NO_2 is formed by emissions from cars, trucks and buses, power

plants, and off-road equipment. NO_2 is linked with a number of adverse effects on the respiratory system and contributes to the formation of ground-level ozone and fine particle pollution.

Sulfur dioxide (SO_2) is a highly reactive gas within a group known as "oxides of sulfur." SO_2 emissions result predominantly from fossil fuel combustion at power plants and other industrial facilities. Smaller sources of SO_2 include industrial processes (extracting metal from ore) and burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment. SO_2 is linked with a number of adverse effects on the respiratory system. Even very short term exposure can lead to an array of adverse respiratory effects including increased asthma symptoms.

Lead, a metal found naturally in the environment, also is found in manufactured products. The primary sources of lead emissions have historically been motor vehicles and industrial processes, such as lead smelting, waste incineration, utilities and manufacture of lead-acid batteries. Among lead's adverse effects on health are impairment of the nervous system, kidney function, immune system, the reproductive, developmental and cardiovascular systems. Lead is persistent in the environment and accumulates in soils and sediments and causes a wide range of adverse environmental effects.

Visibility Reducing Particles is a California criteria pollutant category and consists of suspended particulate matter, a complex mixture of tiny particles including dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. These particles containing many different materials such as metals, soot, soil, dust, and salt contribute to the formation of haze and impaired visibility.

Sulfates (SO_4^{2-}), the fully oxidized ionic form of sulfur are another measured criteria air pollutant within the State of California. Emissions of sulfur compounds occur primarily from the combustion of petroleum-derived sulfur-containing fuels (e.g., gasoline and diesel fuels) which are rapidly converted to sulfate compounds in the atmosphere. Exposure to sulfates decreases pulmonary function, aggravates asthmatic symptoms, and an increases risk of cardio-pulmonary disease. Sulfates can also degrade visibility, harm ecosystems, and damage materials and property largely due to their acidity.

Hydrogen Sulfide (H_2S) is a colorless, flammable, extremely hazardous gas that occurs naturally in crude petroleum, natural gas, and hot springs and is produced by bacterial breakdown of organic materials and human and animal wastes (e.g., sewage). Industrial activities of humans, relating to petroleum/natural gas drilling and refining, wastewater treatment, and paper milling, release hydrogen sulfide, which is both an irritant and chemical asphyxiant. The California Board of Public Health adopted and refined an air quality standard at for H2S in the late 1960's.

Vinyl Chloride is a colorless gas produced by the manufacture of polyvinyl chloride (PVC) produces. Major sources are building and construction, the automotive industry, electrical wire insulation and cables, piping, industrial and household equipment, and medical supplies. Vinyl chloride is a known cancer-causing agent that was added by the California Air Resource Board to the list of California criteria pollutants in 1978 and the list of toxic air contaminants in 1990.

Table 1. State and Federal Ambient Air Quality Standards.

Pollutant	Averaging Time	California Standards Concentration	Federal Standards Concentration	Potential Sources
Ozone	1-hour	0.09 ppm	----	Motor vehicles, paints, coatings, solvents
	8-hour	0.070 ppm	0.075 ppm	
Respirable Particulate Matter (PM_{10})	24 hour	50 µg/m^3	150 µg/m^3	Industrial and agricultural activities, construction, transportation
	Annual	20 µg/m^3	-----	
Fine Particulate Matter ($PM_{2.5}$)	24 hour	No separate State standard	35 µg/m^3	Industrial and agricultural activities, construction, transportation
	Annual	12 µg/m^3	15 µg/m^3	
Carbon Monoxide (CO)	8-hour	9.0 ppm	9 ppm	Gasoline, diesel fuel
	1-hour	20 ppm	35 ppm	
Nitrogen Dioxide (NO_2)	Annual (Arithmetic Average)	0.030 ppm	0.053 ppm	Fuel combustion
	1-hour	0.18 ppm	-----	
Sulfur Dioxide (SO_2)	Annual (Arithmetic Average)	-----	0.030 ppm	Combustion of sulphurous fossil fuels
	24-hour	0.04 ppm	0.14 ppm	
	1-hour	0.25 ppm	-----	
Lead	30 day calendar quarter	1.5 µg/m^3 --------	----- 1.5 µg/m^3	Lead smelters, battery manufacturers

Pollutant	Averaging Time	California Standards Concentration	Federal Standards Concentration	Potential Sources
Visibility Reducing Particles	8 hour	Extinction coefficient of 0.23 per km visibility ≥ 10 miles	No federal standard	Wildfires, waste-burning, fugitive dust
Sulfates	24-hour	25 $\mu g/m^3$	No federal standard	Industrial processes
Hydrogen Sulfide	1-hour	0.03 ppm	No federal standard	Paper manufacturing, sewage treatment, landfills, concentrated animal feed operations
Vinyl Chloride	24-hour	0.01 ppm	No federal standard	Manufacture of polyvinyl chloride (PVC) plastic and vinyl products

REGULATORY FRAMEWORK

Air quality within the SCAB is regulated through efforts of federal, state, regional and local government agencies, which work both jointly and independently to improve air quality through legislation, regulations, policies and programs, and education. The Clean Air Act of 1970 (amended 1990) requires the USEPA to develop and enforce regulations to protect the general public from exposure to hazardous airborne contaminants. The California Clean Air Act of 1988 outlines and directs California's air quality goals, planning mechanism, regulatory strategies and standards.

The California Air Resources Board is the agency responsible for air quality monitoring, planning and control throughout California. CARB sets the California air quality standards and control measures, approves the regional air quality management/attainment plans, makes area attainment designations, and establishes new standards for vehicles and fuel specifications to reduce vehicle emissions. The South Coast Air Quality Management District is the regional entity that includes Orange County within its jurisdiction.

AMBIENT AIR QUALITY

Ambient air quality is monitored at air quality stations located throughout Orange County. The stations record levels of ozone, CO2, NO2, So2, PM2.5, PM10 and lead as well as some meteorological data.

Attainment areas are areas with air quality that does not exceed the concentration standards outlined in Table 2. Nonattainment areas are those in which there occurred at least one violation of the air quality standard for that pollutant in the area. A designation of unclassified for an area indicates insufficient monitoring data to support a designation of attainment or non-attainment.

Air basins that are not in attainment with federal standards must submit a State Implementation Plan (SIP) describing how the air basin will achieve federal standards by specified dates.

The SCAB has historically had severe air pollution because it contains the second largest urban area in the U.S. and has meteorological conditions unfavorable to dispersion of emissions. High concentrations of ozone are recorded during spring and summer, while high PM10 and PM2.5 occur year-round but most frequently in fall and winter (SCAQMD 2007). SCAQMD's efforts have resulted in marked improvements in air quality in the SCAB since the 1990's, though the Basin still exceeds the federal 8-hour standard for ozone more frequently than any other location in the U.S. As one of the predominantly urban counties within the SCAB, Orange County's air quality is also poor. Orange County by itself exceeded the federal 8-hour standard for ozone on 9 days in 2007, 18 days in 2008 and 10 days in 2009.

Table 2. South Coast Air Basin Attainment Status.

Pollutant	Attainment Classification California Standard	Federal Standard
Ozone	Nonattainment/Severe 17	Nonattainment
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Attainment	Attainment
PM10	Nonattainment/Serious	Nonattainment
PM2.5	Nonattainment	Nonattainment
Lead	Attainment	Attainment
Sulfates	Attainment	Unclassified*
Hydrogen Sulfide	Unclassified	Unclassified
Vinyl Chloride	Unclassified	Unclassified
Visibility Reducing Particles	Unclassified	Unclassified

*not enough data to make a determination.

EMISSION THRESHOLDS

The SCAQMD has set the following emissions thresholds for emissions related to construction and to operation of projects (SCAQMD 2011). Projects that exceed any of the following thresholds are considered to have a significant impact on air quality.

Table 3. SCAQMD Operational Emissions Thresholds. Part 1.

Mass Daily Thresholds		
Pollutant	Construction	Operation
NOx	100 lbs/day	55 lbs/day
VOC	75 lbs/day	55 lbs/day
PM10	150 lbs/day	150 lbs/day
PM2.5	55 lbs/day	55lbs/day
SOx	150 lbs/day	150 lbs/day
CO	550 lbs/day	550 lbs/day
Lead	3 lbs/day	3lbs/day
Toxic Air Contaminants and Odor Thresholds		
TACS (including carcinogens and non-carcinogens)	Maximum Incremental Cancer Risk ≥ 10 in 1 million Cancer Burden > 0.5 excess cancer cases (in areas ≥ 1 in 1 million Hazard Index ≥ 1.0 (project increment)	
Odor	Project creates an odor nuisance pursuant to SCAQMD Rule 402	

Table 3. SCAQMD Operational Emissions Thresholds. Part 2.

Ambient Air Quality for Criteria Pollutants	
NO2 1-hour average Annual average	SCAQMD is in attainment; project is significant if it causes or contributes to an exceedance of the following attainment standards: 0.18 ppm (state) 0.03 ppm (state)
PM10 24-hour average Annual average	 10.4 µg/m^3 (construction) & 2.5 µg/m^3 (operation) 1.0 µg/m^3
PM2.5 24-hour average	 10.4 µg/m^3 (construction) & 2.5 µg/m^3 (operation)
Sulfate 24-hour average	 1 µg/m^3
CO 1-hour average 8-hour average	SCAQMD is in attainment; project is significant if it causes or contributes to an exceedance of the following attainment standards: 20 ppm (state) 9.0 ppm (federal)

Source: SCAQMD (2011); TAC = Toxic Air Contaminants

IMPACT ANALYSIS

Appendix G of the 2010 CEQA Guidelines specify that a project is considered to have a significant impact on the environment if it would:

(a) conflict with or obstruct implementation of an applicable air quality plan;

(b) violate any air quality standard or contribute substantially to an existing or projected air quality violation;

(c) result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);

(d) expose sensitive receptors to substantial pollutant concentrations; and/or

(e) create objectionable odors affecting a substantial number of people.

The project being analyzed in this EIR document is the vector control program of the Orange County Vector Control District. Therefore, for the purposes of the air quality analysis, only operational emissions associated with the vector control procedures (from vehicle trips) and certain characteristics of the pesticides and their application are considered in the impact analysis.

The OCVCD's vector control operations are in line with the SCAQMD's air quality plan control measures for on-road emissions, which include fleet modernization and vehicle retrofitting. The OCVCD continually seeks to upgrade its automobile fleet and is considering converting to alternative fuels and electric vehicles and follows the pesticide strategies set forth by the California Department of Pesticide Regulation and adopted by CARB and SCAQMD as State Implementation Plan measures.

To analyze the contribution of the vector control in Orange County to local air quality, a simple URBEMIS (version 9.2.4) air quality model was run. At the time of this analysis, OCVCD operated a fleet of 84 light-duty trucks on an average of 185 days per year in the application of chemical for vector control. The average number of miles driven per vehicle per year between 2007 and 2009 was 6,974 miles. This estimate includes a heavy West Nile virus year in 2008. URBEMIS version 9.2.4 software was used to model the operational emissions generated by the OCVCD fleet, which was composed of 85 light-duty trucks with catalyst engines. The daily trip rate was estimated at 10 trips per vehicle per day and fleet characteristics were set to reflect actual characteristics of the OCVCD fleet. All other URBEMIS settings were set to default values. URBEMIS does not allow adjustment of vehicle starts and stops.

The results of the URBEMIS model for criteria air pollutants fell well below SCAQMD thresholds (Table 4), indicating that the vector control operations do not violate any air quality standard by themselves and do not contribute substantially to existing or projected air quality violations or result in a cumulatively considerable net increase of criteria for which Orange County is non-attainment.

Table 4. URBMEIS model results for operational emissions of OCVCD, trip rate 850 (10 trips per vehicle per day, fleet 100% catalyst engine light duty trucks and all other URBEMIS settings).

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
SUMMER TOTALS (lbs/day)	2.92	5.17	55.02	0.08	0.77	0.52	8,050.79
WINTER TOTALS (lbs/day)	3.50	6.46	49.87	0.07	0.77	0.52	7,199.60
ANNUAL (tons/year)	0.57	1.02	9.73	0.01	0.14	0.09	1,417.49

To analyze whether sensitive receptors are exposed to substantial pollutant concentrations by the OCVCD control program, several categories of relevant information must be examined. Sensitive receptors are facilities or land uses (e.g., schools, hospitals and residential areas) that include members of the population who are particularly sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses. The spatial distribution of application of pesticides released as aerosols relative to the distribution of sensitive receptors, the timing and duration of the application of airborne chemicals, and the length of time chemicals remain in the air are important factors to assess potential exposure of this sensitive receptors to airborne pesticides used in vector control. Pollutants from vehicle emissions from the OCVCD fleet can be considered irrelevant to this analysis because the amounts generated relative to overall emissions from vehicle use in Orange County are minimal and the resulting emissions will not be less favorably distributed in relation to sensitive receptors than the mass of vehicle emissions within the County.

Mosquito adulticides and larvicides, the chemicals applied as fine droplets from predominantly from truck-mounted sprayers, are applied are either into largely non-residential areas or open space (e.g., marshes, parks, golf courses) in the case of adulticides or directly into the storm drain system, much of which is enclosed, or onto water surfaces in the case of larvicides. Timing of the application of pesticides, predominantly during the night or early morning further reduces the probability that sensitive receptors will be outside to be exposed to air containing aerosolized pesticides. Pesticides are applied in 'ultra-low volume,' or less than one half gallon per acre as defined by the USEPA, which eliminates fog particles (thermal aerosols) that obscure visibility (Department of Defense 1999). Studies evaluating health risks from applications at these volumes suggest risks are insubstantial (Macedo et al. 2010, Peterson et al. 2006). Finally, the length of time that concentrations of aerosolized pesticides remain in the air is very low, usually less than 1 hour (Schleier and Peterson 2010, Schleier et al. 2008). Most of the chemicals used in vector control are non-volatile or of low volatility, or do not volatilize

significantly if applied in solid form, and are broken down rapidly by contact with sunlight. Methoprene, sumithrin, and pryriproxifen exhibit moderate volatilization but adsorption to soils and/or rapid breakdown in the environment is expected to attenuate conversion of these chemicals to vapor in the atmosphere (Csondes 2004, Sullivan 2000, Agency for Toxic Substances and Disease Registry 2005). None of the chemicals used is listed on CARB's list of toxic air contaminants (CARB 2010). Based on the above reasoning, vector control measures within Orange County do not expose sensitive receptors to substantial pollutant concentrations. Finally, the majority of vector control chemicals are low in odor and application in ultra-low volume eliminates the risk of exposing large numbers of people to objectionable odors.

MITIGATIONS

No mitigations with respect to Air Quality are warranted.

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Users\Eco Analysts\AppData\Roaming\Urbemis\Version9a\Projects\OCVCD.urb924

Project Name: OCVCD

Project Location: Orange County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2.92	5.17	55.02	0.08	0.77	0.52	8,050.79

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2.92	5.17	55.02	0.08	0.77	0.52	8,050.79

Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Users\Eco Analysts\AppData\Roaming\Urbemis\Version9a\Projects\OCVCD.urb924

Project Name: OCVCD

Project Location: Orange County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	3.50	6.46	49.87	0.07	0.77	0.52	7,199.60

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	3.50	6.46	49.87	0.07	0.77	0.52	7,199.60

Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Users\Eco Analysts\AppData\Roaming\Urbemis\Version9a\Projects\OCVCD.urb924

Project Name: OCVCD

Project Location: Orange County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (tons/year, unmitigated)	0.57	1.02	9.73	0.01	0.14	0.09	1,417.49

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (tons/year, unmitigated)	0.57	1.02	9.73	0.01	0.14	0.09	1,417.49

Appendix G

CDPR PRESCRIBE USE LIMITATIONS SEARCH

CALIFORNIA PESTICIDE INFORMATION PORTAL (CALPIP)

Endangered Species Custom Bulletin

Endangered Species Pesticide Use Limits

Step 5. Use Limit Codes for Selected Products

Pesticide use limitations for the products that you have selected, applicable to the species identified in your locations, if they exist, are listed below. Scroll to the bottom of the page to see a description/instruction of the use limits.

For protection of the following species:

- [E] BRAUNTON'S MILK-VETCH
- [E] CALIFORNIA LEAST TERN
- [E] LEAST BELL'S VIREO
- [E] LIGHT-FOOTED CLAPPER RAIL
- [E] PACIFIC POCKET MOUSE
- [E] RIVERSIDE FAIRY SHRIMP
- [E] SALT MARSH BIRD'S-BEAK
- [E] SAN DIEGO FAIRY SHRIMP
- [E] SANTA ANA RIVER WOOLLYSTAR
- [E] SOUTHWESTERN WILLOW FLYCATCHER
- [E] TIDEWATER GOBY
- [E] VENTURA MARSH MILK-VETCH
- [T] CROWNBEARD = BIG-LEAVED CROWNBEARD
- [T] LAGUNA BEACH DUDLEYA = LAGUNA BEACH LIVEFOREVER
- [T] SANTA ANA SUCKER
- [T] SANTA MONICA MOUNTAINS DUDLEYA
- [T] THREAD-LEAVED BRODIAEA
- [T] WESTERN SNOWY PLOVER
- [R] SAN FERNANDO VALLEY SPINEFLOWER
- [R] APHANISMA
- [R] BELDING'S SAVANNAH SPARROW
- [R] BLOCHMAN'S DUDLEYA

- [R] BURROWING OWL
- [R] CALIFORNIA BEARDTONGUE
- [R] CALIFORNIA BLACK RAIL
- [R] CHAPARRAL NOLINA = CHAPARRAL BEARGRASS
- [R] COAST WOOLLY-HEADS
- [R] COULTER'S GOLDFIELDS
- [R] COULTER'S SALTBUSH
- [R] DAVIDSON'S SALTSCALE
- [R] ESTUARY SEABLITE
- [R] FELT-LEAVED MONARDELLA
- [R] HALL'S MONARDELLA
- [R] HEART-LEAVED PITCHER SAGE
- [R] INTERMEDIATE MARIPOSA LILY
- [R] LONG-SPINED SPINEFLOWER
- [R] LOS ANGELES SUNFLOWER
- [R] MALIBU BACCHARIS
- [R] MANY-STEMMED DUDLEYA
- [R] MESA HORKELIA
- [R] NUTTALL'S SCRUB OAK
- [R] ORCUTT'S PINCUSHION
- [R] PARISH'S BRITTLESCALE
- [R] PARRY'S TETRACOCCUS
- [R] PLUMMER'S MARIPOSA LILY
- [R] PROSTRATE NAVARRETIA
- [R] ROBINSON'S PEPPER-GRASS
- [R] SAN BERNARDINO ASTER
- [R] SAN MIGUEL SAVORY
- [R] SANFORD'S ARROWHEAD

- [R] SANTA BARBARA MORNING-GLORY
- [R] SANTIAGO PEAK PHACELIA
- [R] SOUTH COAST SALTSCALE
- [R] SOUTHERN TARPLANT
- [R] STICKY DUDLEYA
- [R] SUMMER HOLLY
- [R] TECATE CYPRESS

That occur in the following selected sections:

County	Township	Range	Sections
30 Orange	02S	09W	31 , 32 , 34 , 35
30 Orange	02S	10W	31 , 32 , 33 , 34 , 35 , 36
30 Orange	03S	08W	06 , 07 , 08 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	03S	09W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	03S	10W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	03S	11W	12 , 13 , 23 , 24 , 25 , 26 , 33 , 34 , 35 , 36
30 Orange	04S	07W	06 , 07 , 08 , 17 , 18 , 19 , 20 , 21 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35
30 Orange	04S	08W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	04S	09W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	04S	10W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	04S	11W	01 , 02 , 03 , 04 , 05 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	04S	12W	24 , 25 , 36
30 Orange	05S	05W	31
30 Orange	05S	06W	06 , 07 , 08 , 17 , 18 , 19 , 20 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	07W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	08W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 ,

			13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	09W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	10W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	11W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 32 , 33 , 34 , 35 , 36
30 Orange	05S	12W	01 , 11 , 12 , 13 , 14 , 24
30 Orange	06S	05W	05 , 06 , 07 , 08 , 09 , 17 , 18 , 19 , 20 , 30 , 31
30 Orange	06S	06W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	06S	07W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	06S	08W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	06S	09W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	06S	10W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 33 , 34 , 35 , 36
30 Orange	06S	11W	01 , 02 , 03 , 04 , 09 , 10 , 11 , 12 , 13 , 14 , 24
30 Orange	07S	06W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 28 , 29 , 30 , 31 , 32 , 33
30 Orange	07S	07W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	07S	08W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35 , 36
30 Orange	07S	09W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 21 , 22 , 23 , 24 , 25 , 26 , 36
30 Orange	07S	10W	01 , 02
30 Orange	08S	06W	04 , 05 , 06 , 07 , 08 , 09 , 16 , 17 , 18 , 19 , 20 , 21 , 30
30 Orange	08S	07W	01 , 02 , 03 , 04 , 05 , 06 , 07 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 17 , 18 , 19 , 20 , 21 , 22 , 23 , 24 , 25 , 26 , 27 , 28 , 29 , 30 , 31 , 32 , 33 , 34 , 35
30 Orange	08S	08W	01 , 02 , 03 , 04 , 05 , 06 , 08 , 09 , 10 , 11 , 12 , 13 , 14 , 15 , 16 , 21 , 22 , 23 , 24 , 25
30 Orange	09S	07W	02 , 03 , 04 , 05 , 09 , 10 , 11 , 15

When using selected products:

Product	Use Limits
CONTRAC ALL-WEATHER CAKE	7
DISTANCE FIRE ANT BAIT	10 , 15 , 16 , 17
M-PEDE	11 , 17
M-PEDE INSECTICIDE	11 , 17
M-PEDE INSECTICIDE-MITICIDE-FUNGICIDE	11 , 17
M-PEDE INSECTICIDE/FUNGICIDE	11 , 17
NATULAR 2EC	10
NATULAR T30	10
NATULAR XRG	10
NATULAR XRT	10
ROUNDUP PRO CONCENTRATE HERBICIDE	11 , 17
ROUNDUP PRO HERBICIDE	11 , 17
SAFECIDE BRAND M-PEDE INSECTICIDE/FUNGICIDE	11 , 17
ZENIVEX E20	10 , 15 , 16 , 17
ZENIVEX E4 RTU	10 , 15 , 16 , 17

That contain these active ingredients (chemicals):

- ALPHA-ISOOCTADECYL-OMEGA-HYDROXYPOLY(OXYETHYLENE)
- PHENOTHRIN
- PETROLEUM DISTILLATES
- INDOXACARB
- POTASH SOAP
- D-TRANS ALLETHRIN
- PYRIPROXYFEN
- PIPERONYL BUTOXIDE, OTHER RELATED
- S-METHOPRENE
- SPINOSAD
- N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE
- METHOPRENE
- MINERAL OIL
- GLYPHOSATE, ISOPROPYLAMINE SALT

Appendix H

DISTRIBUTION OF SELECTED RARE, THREATENED OR ENDANGERED SPECIES IN ORANGE COUNTY FROM HCP/NCCPS

Thread-leaved Brodiaea
Geographic Locations of Major/Important Populations/Key Locations

1. Cristianitos Canyon
2. Cristianitos Canyon/Lower Gabino Canyon
3. East Talega
4. Chiquadora Ridge
5. Lower Arroyo Trabuco
6. Trampas Canyon
7. Middle Gabino

(Note: East Most Location of 2,000 Individuals Avoided per USACE Permit Special Condition I.A.3)

Arroyo Toad
Geographic Locations of Major/Important Populations/Key Locations

1. San Juan Creek
2. Bell Canyon
3. Talega Canyon
4. Lower Cristianitos Creek/Lower Gabino Canyon

(Note: Trampas Canyon [PA 5] Locations will be Avoided per GPA/ZC EIR 4.9-35)

San Diego Fairy Shrimp
Riverside Fairy Shrimp

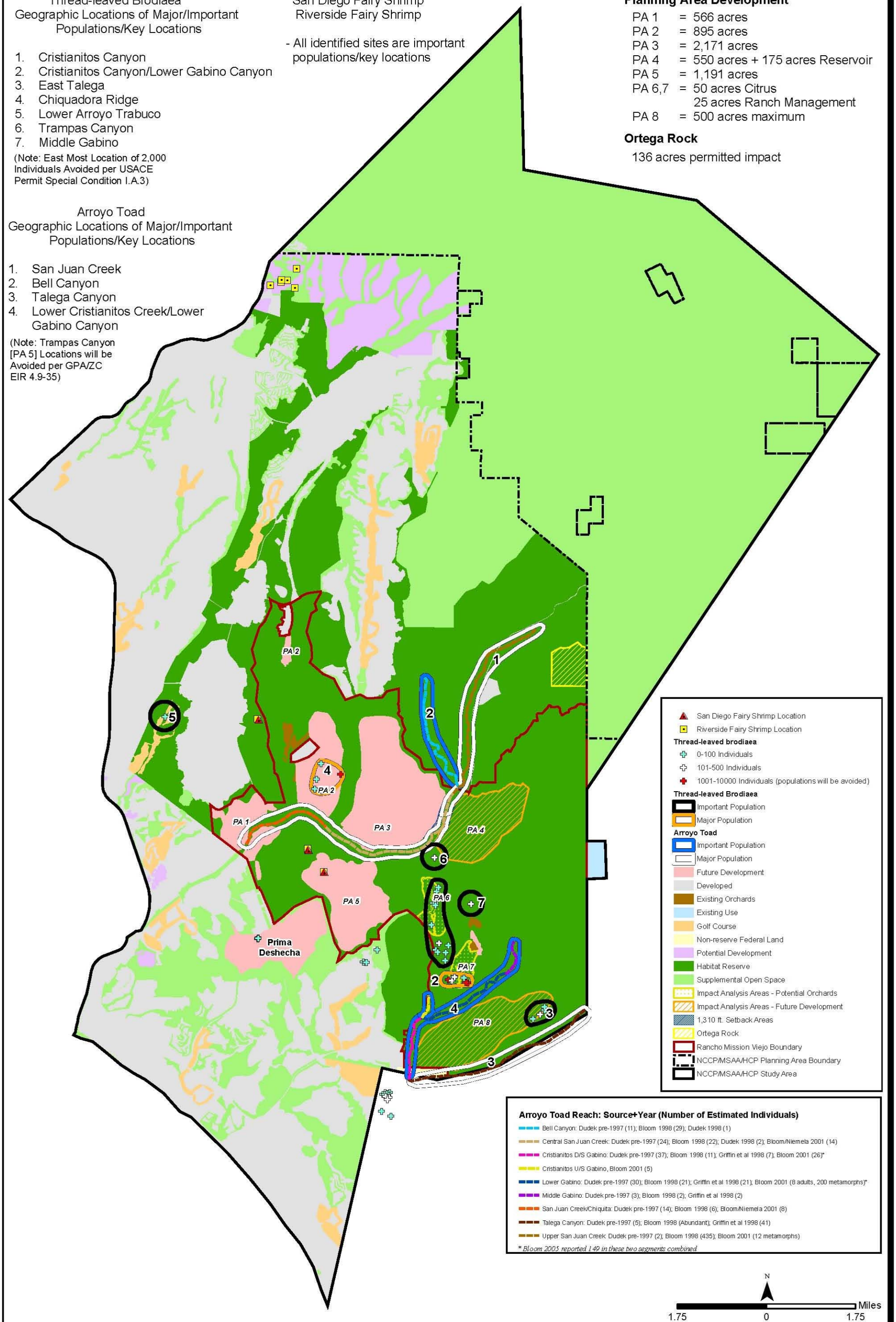
- All identified sites are important populations/key locations

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

FIGURE 173-M

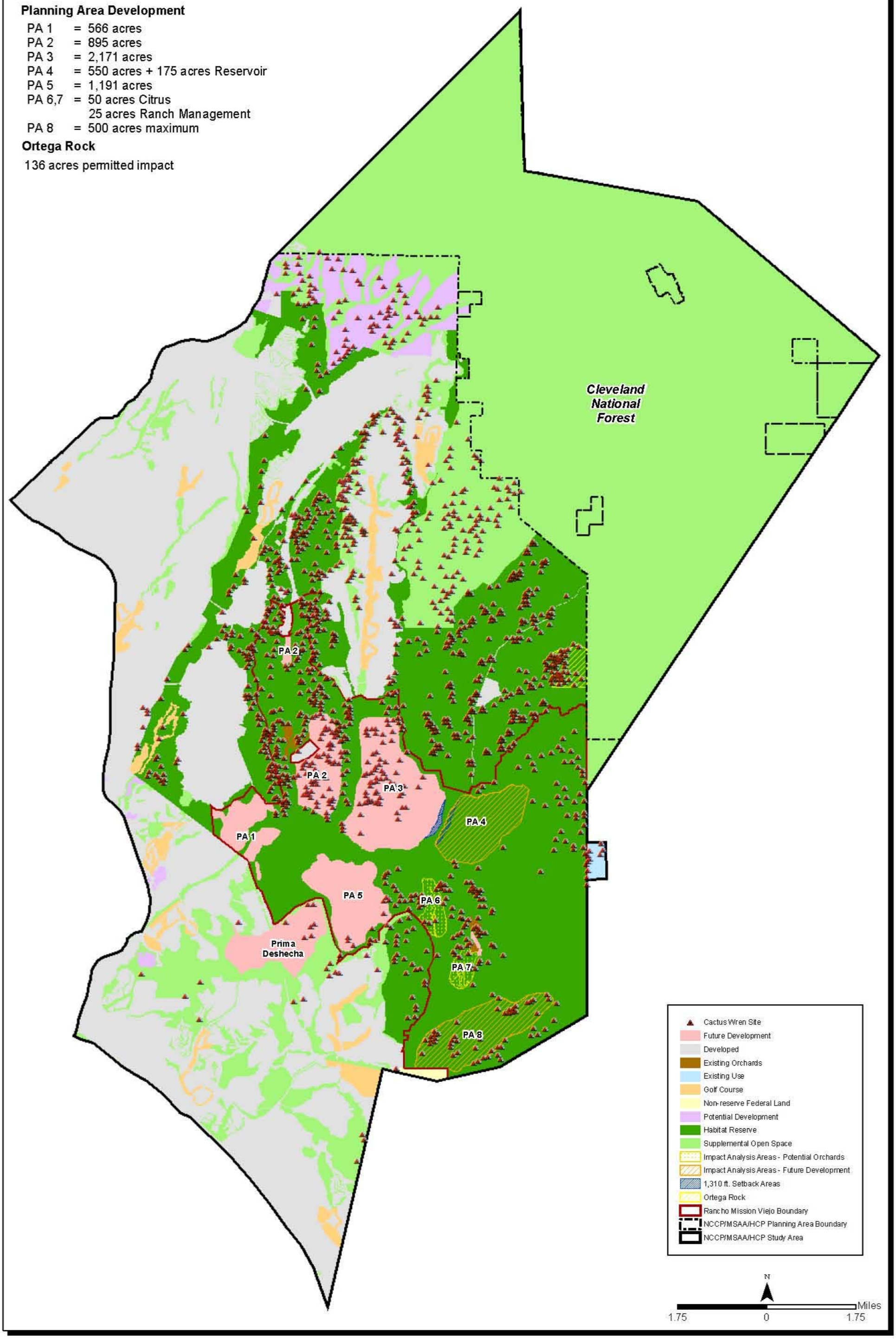
Habitat Reserve with Arroyo Toad, Riverside and San Diego Fairy Shrimp, and Thread-leaved Brodiaea Major/Important Populations in Key Locations

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with Coastal Cactus Wren

FIGURE 195-M

Geographic Locations of Major/Important Populations/Key Locations

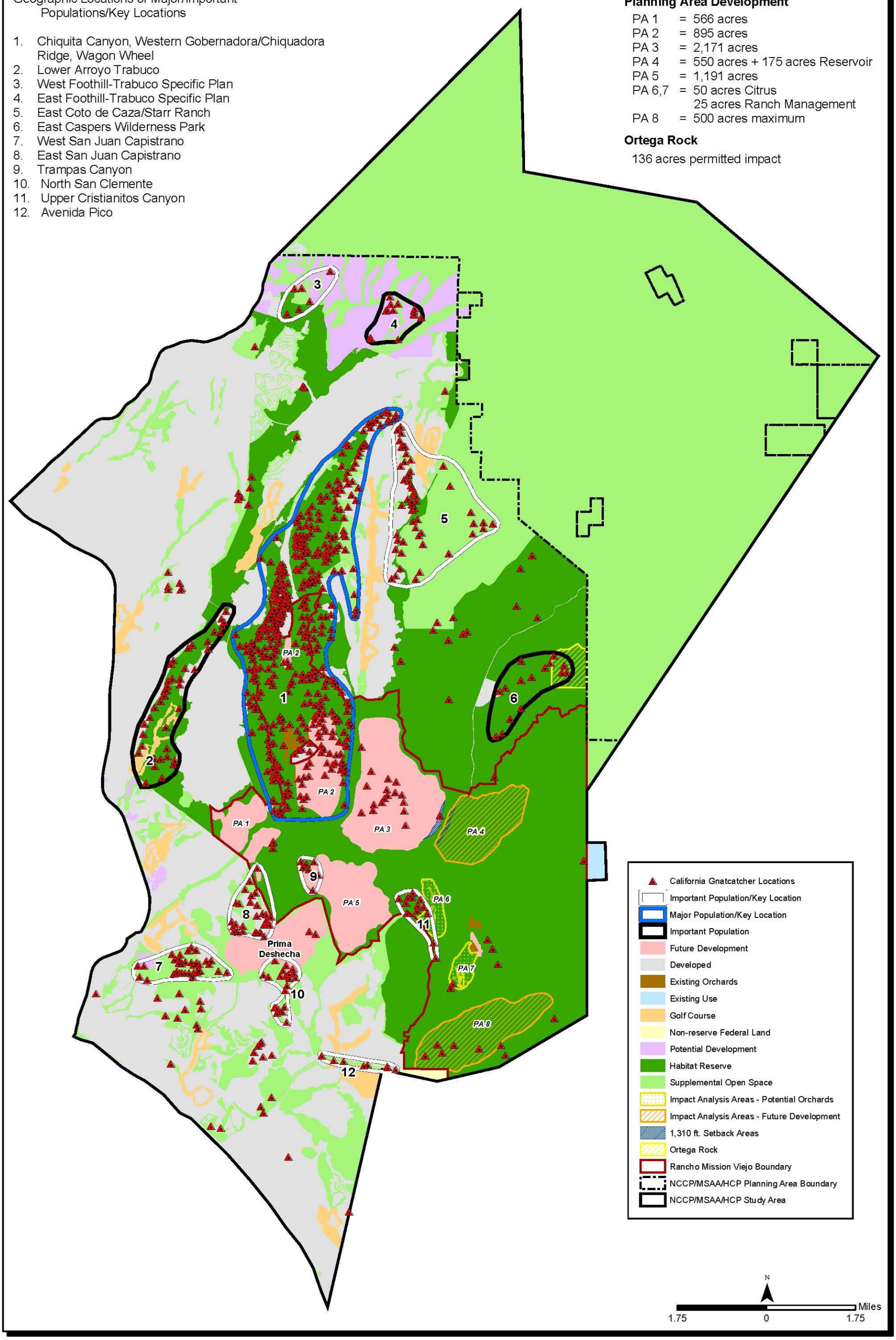
1. Chiquita Canyon, Western Gobernadora/Chiquadora Ridge, Wagon Wheel
2. Lower Arroyo Trabuco
3. West Foothill-Trabuco Specific Plan
4. East Foothill-Trabuco Specific Plan
5. East Coto de Caza/Starr Ranch
6. East Caspers Wilderness Park
7. West San Juan Capistrano
8. East San Juan Capistrano
9. Trampas Canyon
10. North San Clemente
11. Upper Cristianitos Canyon
12. Avenida Pico

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with California Gnatcatcher Major/Important Populations in Key Locations

FIGURE 171-M

Grasshopper Sparrow
Geographic Locations of Major/Important
Populations/Key Locations

1. Chiquita Canyon/Chiquadora Ridge/Gobernadora
2. Radio Tower Road-Prima Deshecha
3. Cristianitos, Lower Gabino/Blind Canyons

Tricolored Blackbird
Geographic Locations of Major/Important
Populations/Key Locations

1. Lower Coto de Caza

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact

PA 1
PA 2
PA 3
PA 4
PA 5
PA 6
PA 7
PA 8
1
2
3
Prima Deshecha

General Location for San Juan Creek Historic Tricolored Blackbird Nest Colony Site
General Location for Riverside Cement Historic Tricolored Blackbird Nest Colony Site
Tricolored Blackbird Site
Grasshopper Sparrow Site
Tricolored Blackbird
Important Population/Key Location
Grasshopper Sparrow
Important Population/Key Location
Major Population/Key Location
Future Development
Developed
Existing Orchards
Existing Use
Golf Course
Non-reserve Federal Land
Potential Development
Habitat Reserve
Supplemental Open Space
Impact Analysis Areas - Potential Orchards
Impact Analysis Areas - Future Development
1,310 ft. Setback Areas
Ortega Rock
Rancho Mission Viejo Boundary
NCCP/MSAA/HCP Planning Area Boundary
NCCP/MSAA/HCP Study Area

N
1.75 0 1.75 Miles

NCCP/MSAA/HCP

Habitat Reserve with Grasshopper Sparrow and Tricolored Blackbird Major/Important Populations in Key Locations

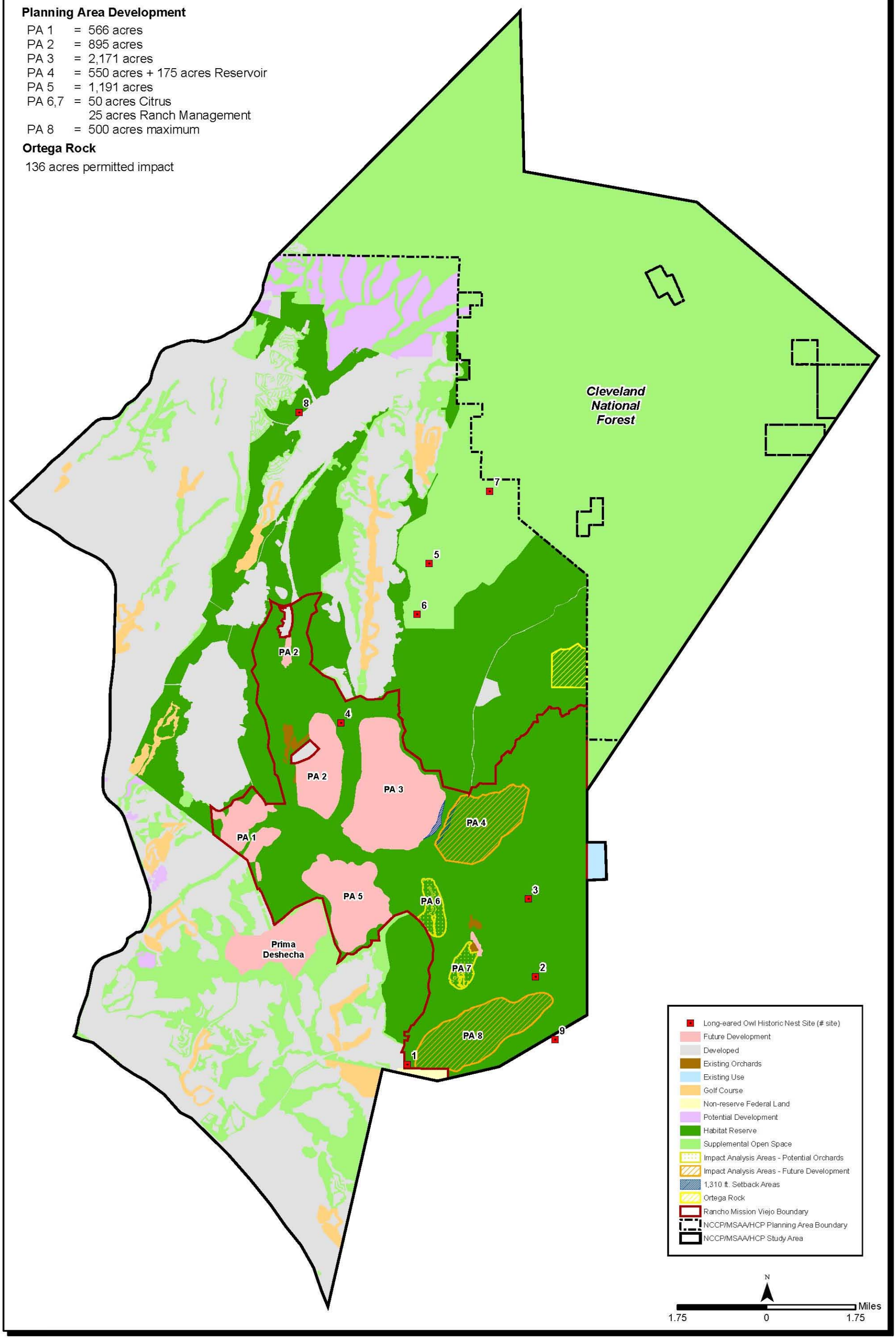
FIGURE
174-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with Long-eared Owl Historic Nest Sites

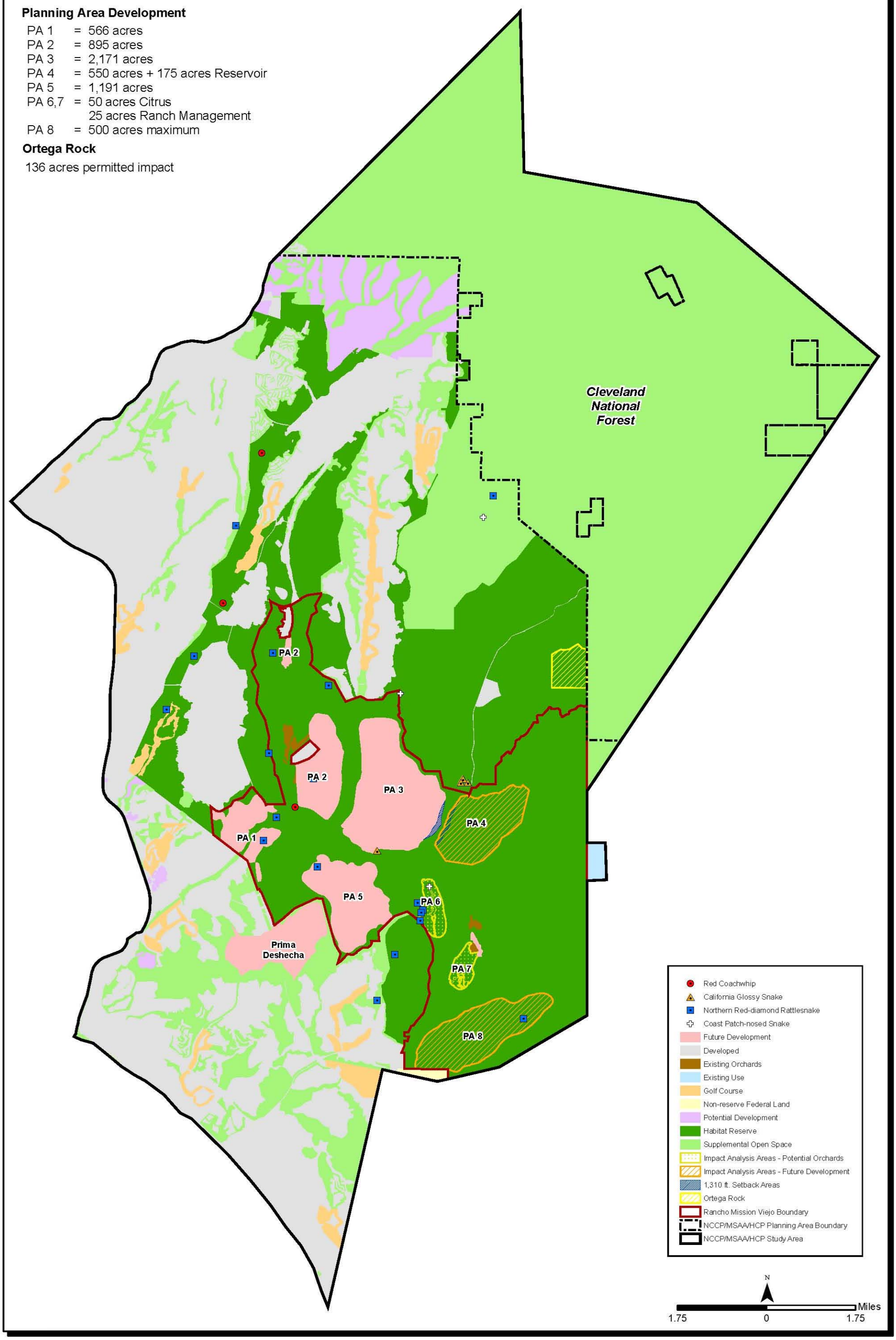
FIGURE 197-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

FIGURE 202-M

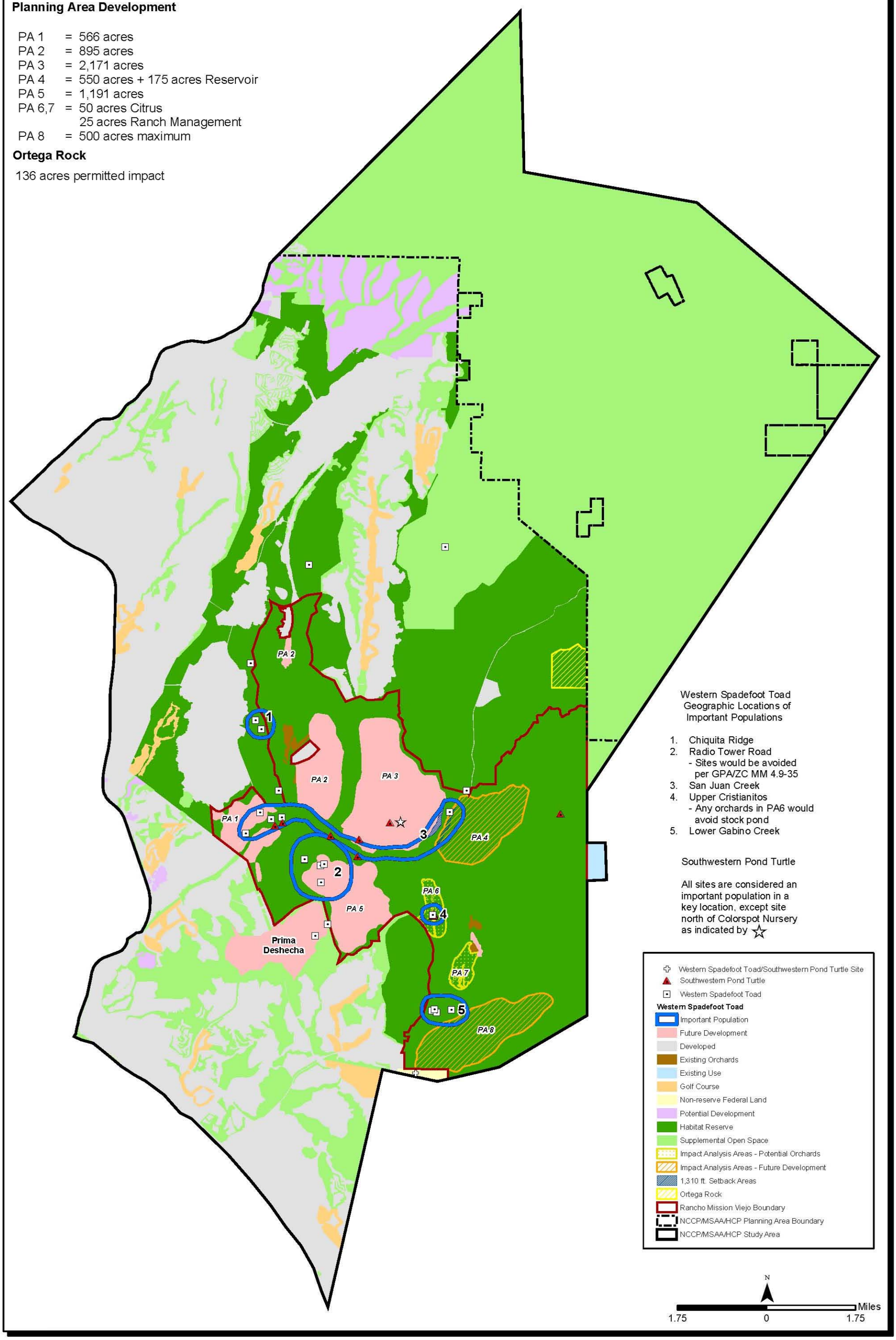
Habitat Reserve with California Glossy Snake, Coast Patch-nosed Snake, Northern Red-diamond Rattlesnake and Red Coachwhip

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



Western Spadefoot Toad Geographic Locations of Important Populations

1. Chiquita Ridge
2. Radio Tower Road
   - Sites would be avoided per GPA/ZC MM 4.9-35
3. San Juan Creek
4. Upper Cristianitos
   - Any orchards in PA6 would avoid stock pond
5. Lower Gabino Creek

Southwestern Pond Turtle

All sites are considered an important population in a key location, except site north of Colorspot Nursery as indicated by ☆

Western Spadefoot Toad/Southwestern Pond Turtle Site
Southwestern Pond Turtle
Western Spadefoot Toad

Western Spadefoot Toad

Important Population
Future Development
Developed
Existing Orchards
Existing Use
Golf Course
Non-reserve Federal Land
Potential Development
Habitat Reserve
Supplemental Open Space
Impact Analysis Areas - Potential Orchards
Impact Analysis Areas - Future Development
1,310 ft. Setback Areas
Ortega Rock
Rancho Mission Viejo Boundary
NCCP/MSAA/HCP Planning Area Boundary
NCCP/MSAA/HCP Study Area

N
1.75 0 1.75 Miles

NCCP/MSAA/HCP

Habitat Reserve with Western Spadefoot Toad and Southwestern Pond Turtle Important Populations

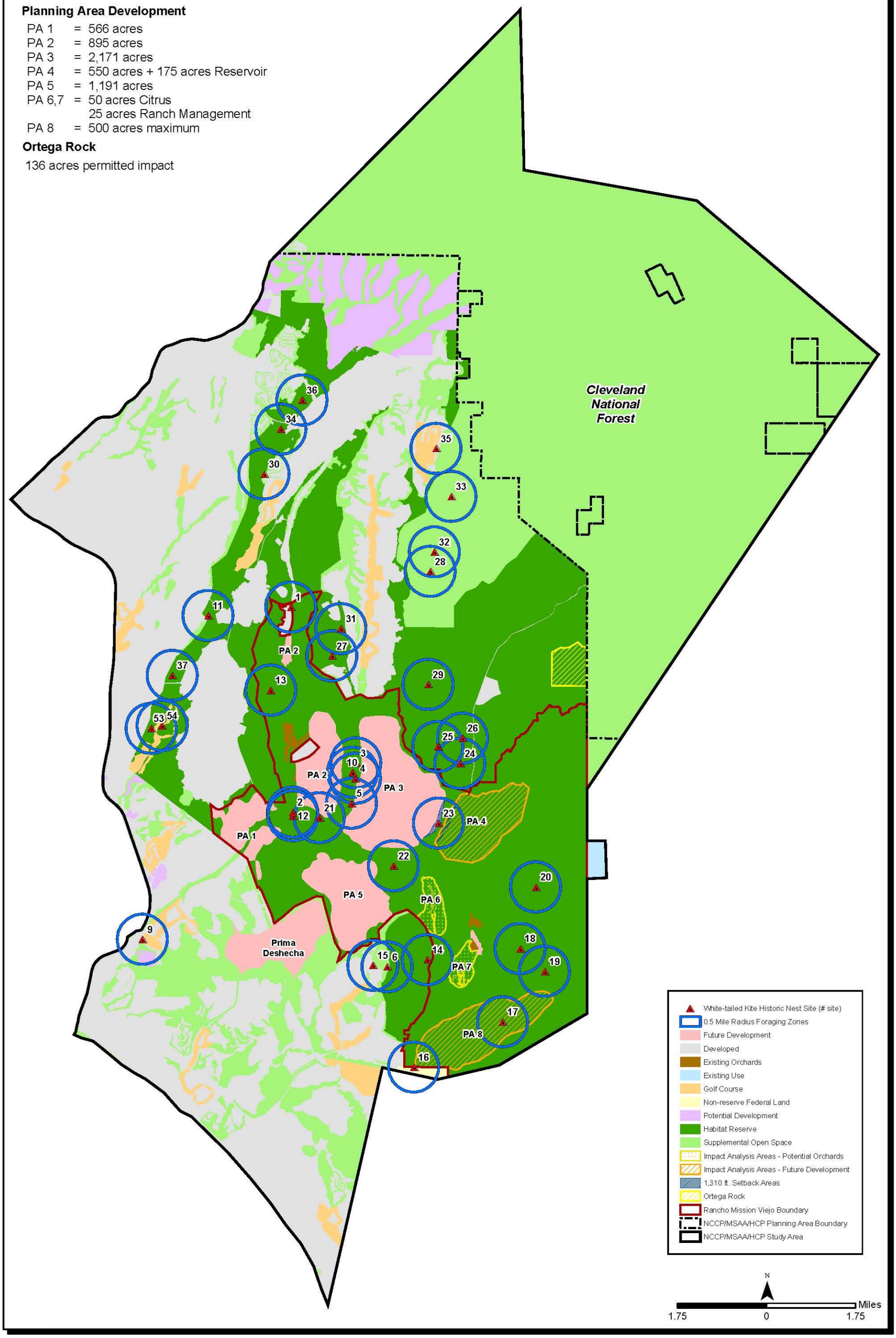
FIGURE 176-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with White-tailed Kite Historic Nest Sites and Potential Foraging Zones

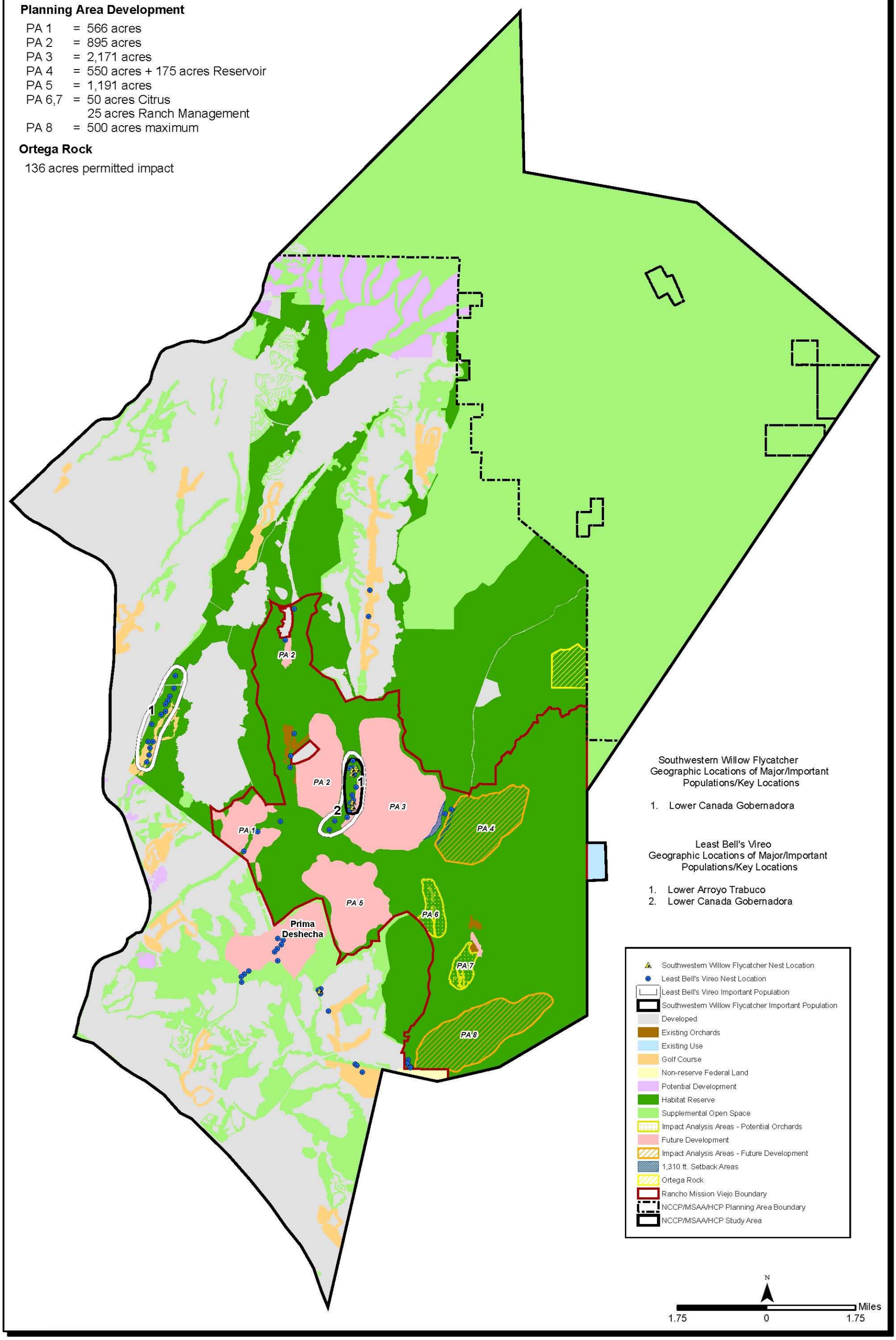
FIGURE 199-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with Least Bell's Vireo and Southwestern Willow Flycatcher Important Populations in Key Locations

FIGURE 172-M

Yellow-breasted Chat
Geographic Locations of
Important Populations

1. Lower Arroyo Trabuco
2. Lower Gobernadora Creek
3. San Juan Creek/Chiquita Canyon
4. San Juan Creek d/s Bell Canyon
5. Lower Cristianitos Creek

Yellow Warbler
Geographic Locations of
Important Populations

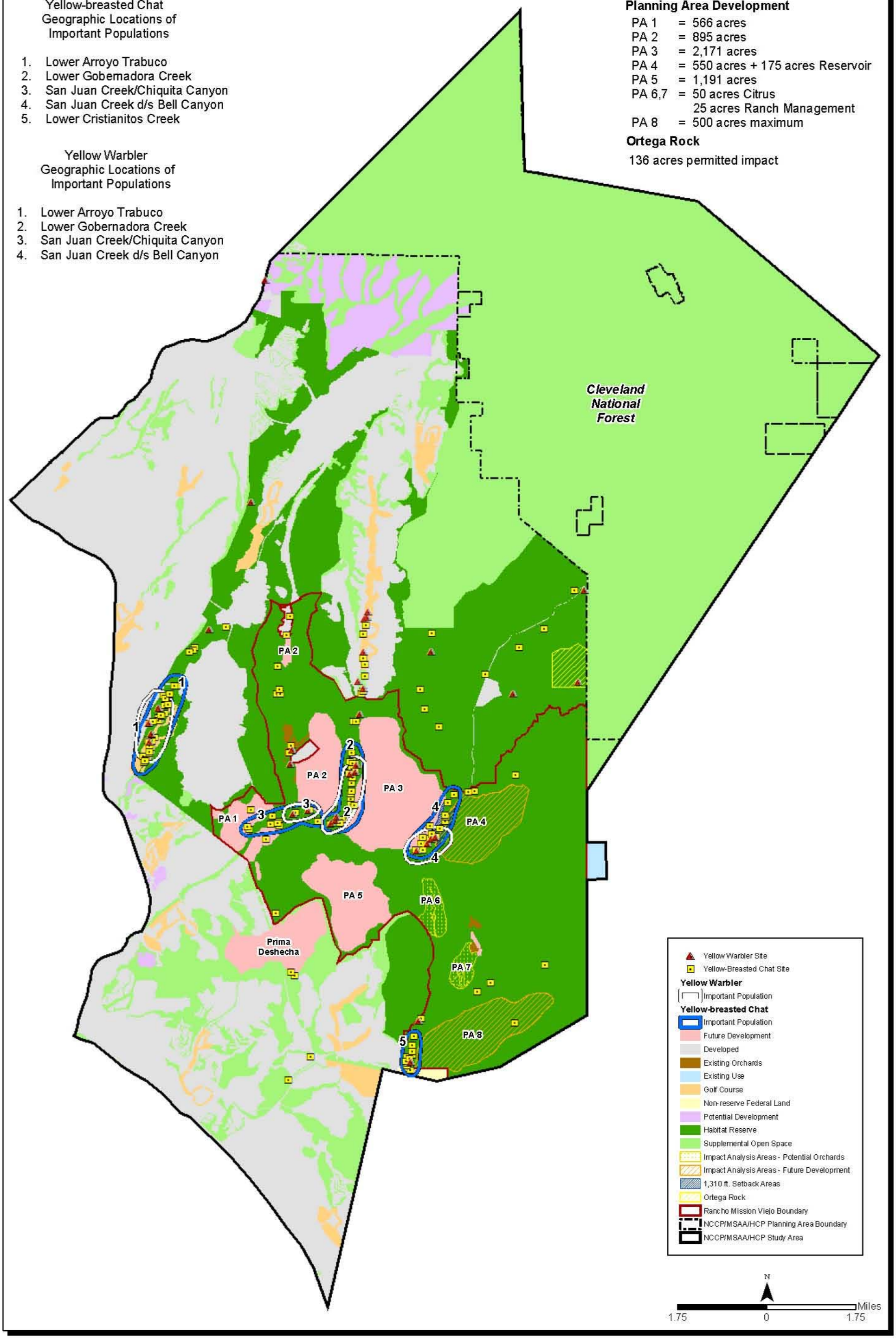
1. Lower Arroyo Trabuco
2. Lower Gobernadora Creek
3. San Juan Creek/Chiquita Canyon
4. San Juan Creek d/s Bell Canyon

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



NCCP/MSAA/HCP

Habitat Reserve with Yellow-breasted Chat and Yellow Warbler Important Populations

FIGURE
175-M

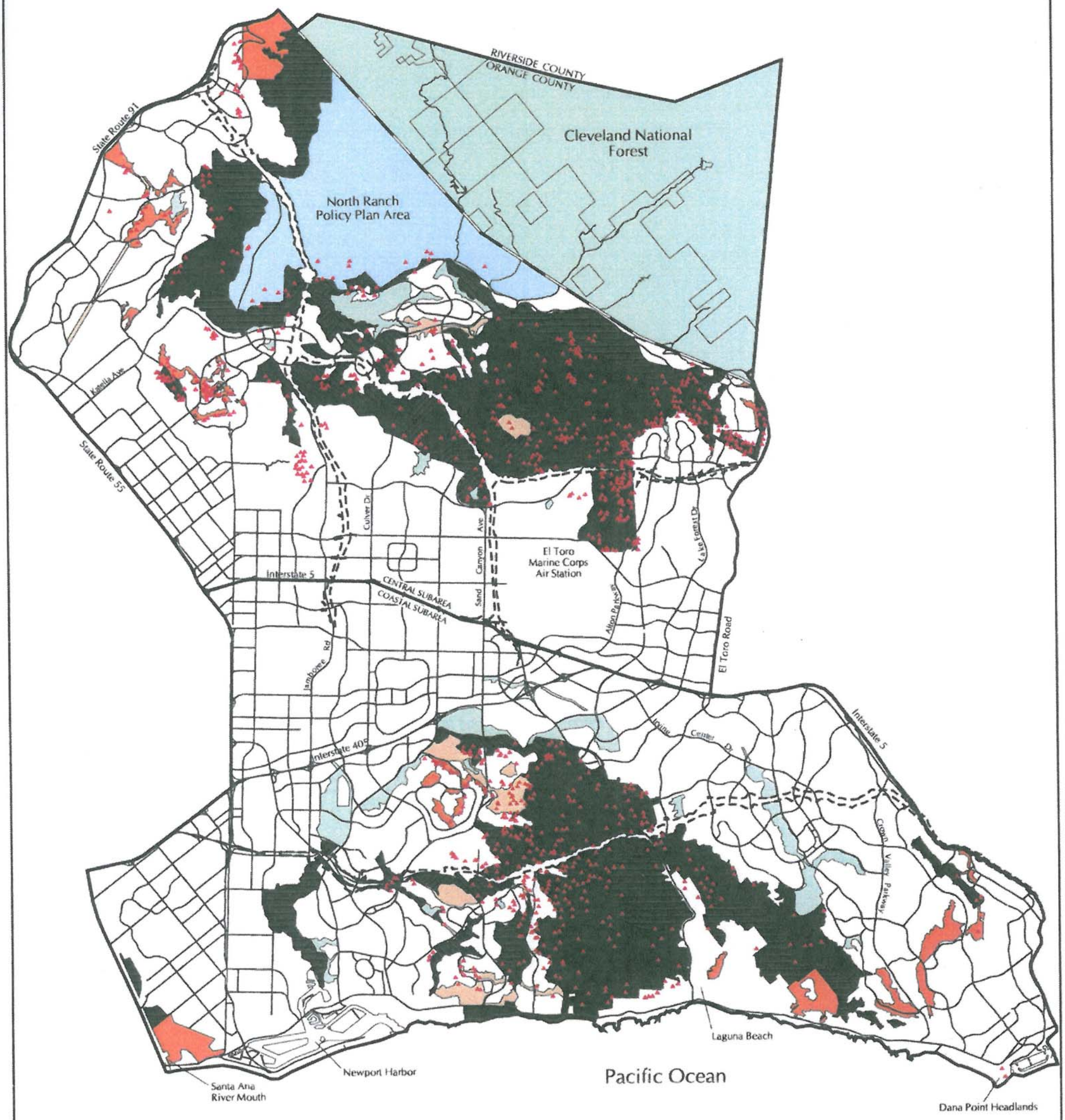


Figure 33

JN 30650 NCCP33.AML 3/28/98

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PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
GIS

Feet
0 3000 6000 8000 12000

400 ACRES
100 ACRES

Cactus Wren Distribution

Central and Coastal Subregion NCCP

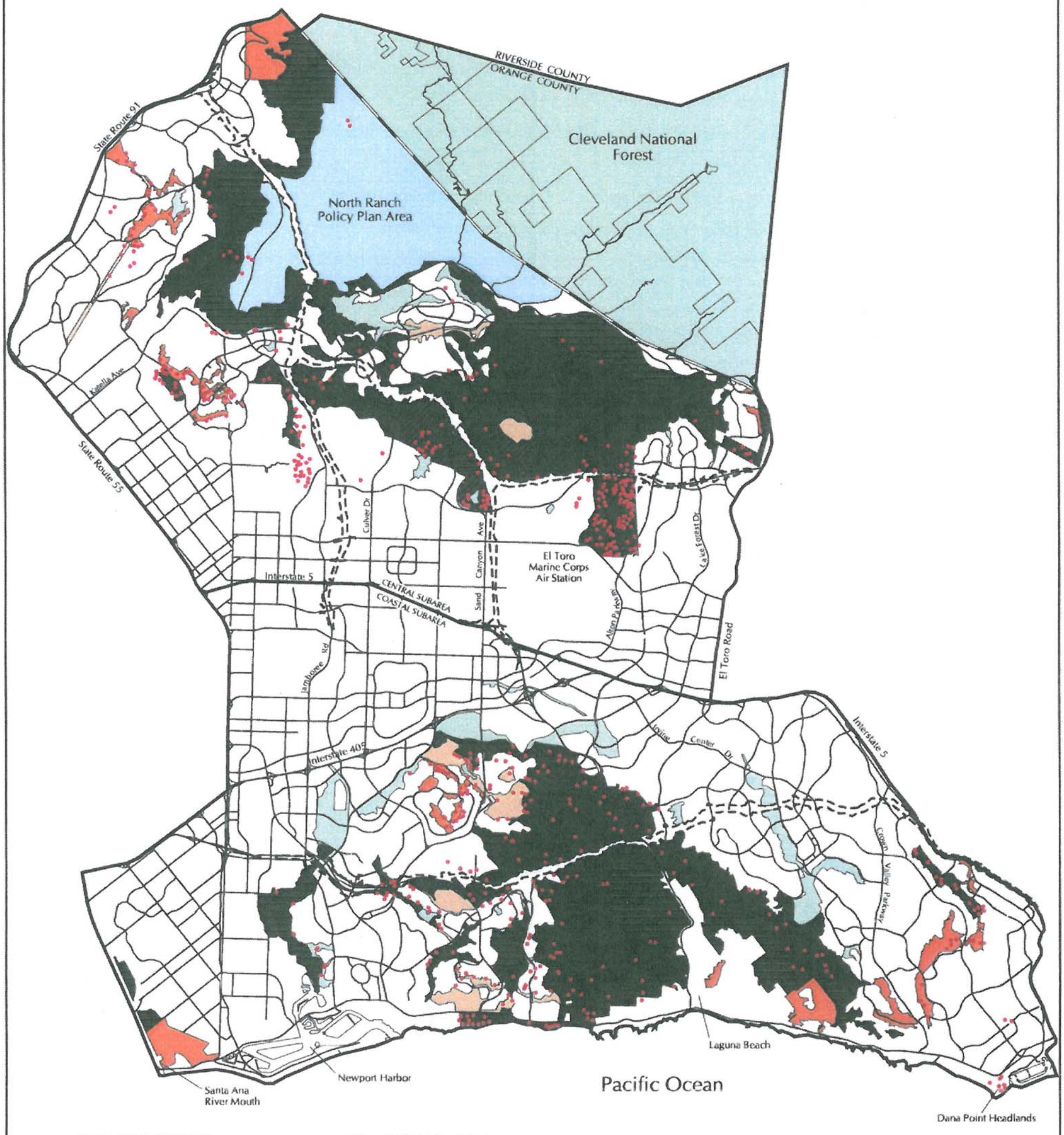

Figure 32

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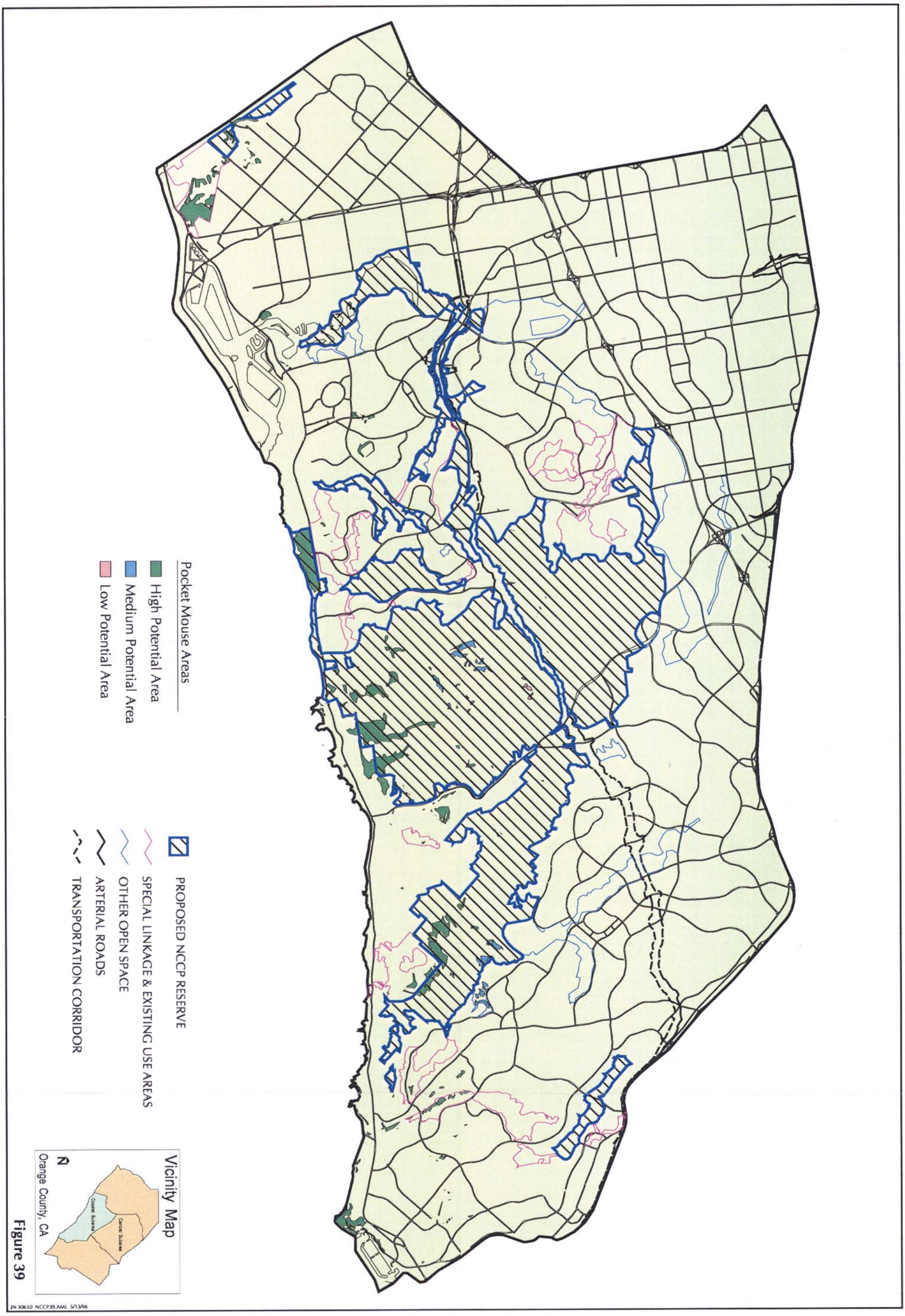
14725 ALTON PARKWAY, IRVINE, CA 92718
(714) 472-3500 FAX (714) 472-8373

Feet
0 3000 6000 9000 12000

400 ACRES
100 ACRES

California Gnatcatcher Distribution

Central and Coastal Subregion NCCP



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14725 ALTON PARKWAY, IRVINE, CA 92718
(714) 472-3505 FAX (714) 472-8373

Feet
0 2000 4000 6000 8000
400 ACRES
100 ACRES

Coastal Subarea
Pacific Pocket Mouse
Potential Occurrence Areas

Appendix I

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