Alameda County Mosquito Abatement District

John R. Rusmisel
District Manager
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September 20, 2011

Philip Isorena
State Water Resources Control Board
1001 I street
Sacramento, CA 95814

Subject: Amended PAP for Water Quality Order No. 2011-0002DWQ, General Permit No. CAG 99004

Dear Mr. Isorena:

The Alameda County Mosquito Abatement District previously submitted an NOI with PAP and fees for the above referenced NPDES permit. Due to a letter from BayKeepers challenging the information in our PAP we are resubmitting a new Pesticide Action Plan.

Please advise us if there is any additional information that you require from us.

Respectfully,

John R. Rusmisel
District Manager

Alameda County Mosquito Abatement District – Pesticide Application Plan (PAP)
June 2011

1. **Description of the target area and adjacent areas, if different from the water body of the target area;**

The Alameda County Mosquito Abatement District (ACMAD) provides its services to the entire geographical area occupied by Alameda County except for the city of Albany. Specifically, ACMAD's territory is bordered by Albany to the north, San Francisco Bay to the west, Contra Costa County and San Joaquin County to the east, and Santa Clara County to the south. Please see attached map, Figure 1.

Any body of water left standing for 72 to 96 hours provides potential habitat for mosquito production and therefore may require treatment by ACMAD with larvicides. These waters may include mitigated wetlands, seasonal wetlands, tidal marshes, storm water BMPs, ponds, lakes, creeks, rivers, flood control channels, low areas, road ditches, catch basins, etc. These sources may be either permanent or temporary, so providing an all-inclusive list is neither feasible nor practical. See Table 1 for a list of target areas.

2. **Discussion of the factors influencing the decision to select pesticide applications for mosquito control;**

For the most comprehensive understanding of these factors, please see the manual, "Best Management Practices for Mosquito Control in California." The control strategy favored by ACMAD is to target mosquitoes in the larval stage, before they become adults. Before any larvicides are applied, control may first be attained through environmental management – either source elimination (e.g., turning over containers holding water), source reduction (e.g., constructing drainage ditches to drain flooded areas), or source maintenance (e.g., water management or vegetation management). In the event that environmental management is not possible, larvae may be controlled through the use of the mosquitofish, *Gambusia affinis*. In an effort to limit the potential impact of these fish on endangered species, ACMAD's policy is to plant these fish only in target areas that are man-made and enclosed from natural bodies of water, e.g., domestic fish ponds, horse troughs, and unused swimming pools. When mosquito fish are not appropriate to effect control, ACMAD will resort to biologically-based larvicides (often called "bio-rational" products). Bacteria-based larvicides function as a stomach or nerve toxin; others - insect growth regulators -are chemicals that interfere with mosquito development. If late instar (nonfeeding) larvae or pupae are present, surface agents (mineral oils or mono molecular films that prevent larvae from breathing) may be used. ACMAD does not use organophosphates for the control of larval (or adult) mosquitoes.

In rare cases where a larvicide treatment failed or failed to occur, adulticides may be used. Adulticides are infrequently used by ACMAD, and are pyrethrin or pyrethroid-based compounds. Adulticiding may be considered in the following two scenarios: 1. Adult mosquitoes from a specific geographical area have tested positive for West Nile Virus (or another mosquito-borne pathogen) putting human health at risk. In this case, ACMAD would use truck mounted foggers to control adult mosquitoes. This scenario has yet to occur in Alameda County. 2. Adult floodwater mosquitoes (*Aedes* species) appear in significant concentrations near residential areas and cause high levels of annoyance to the public and

complaints to the District. In this case, ACMAD typically uses a small, handheld portable fogger, rather than a truck mounted sprayer.

The decision to actually treat an area for mosquito breeding is based on several factors, including: 1. Is the species a capable disease vector, or does it create an annoyance to humans? 2. Do the larvae occur in a high enough density to warrant a treatment? 3. Is the target area within the flight range of human habitation? 4. Are there any endangered species present in the target area? If the answer to questions #1-3 is yes, a treatment is performed. A yes answer to questions #1-3 and question #4 means that a treatment may be performed with special considerations (e.g., a restriction in equipment or material applied). See the diagram "Treatment Decision Model for Mosquito Sources," page 45 in the document "The Alameda County Mosquito Abatement District Control Program" for more details.

3. Pesticide products or types expected to be used and if known, the method in which they are applied, and if applicable, the adjuvants and surfactants used;

The following list of products may be used by the District for larval or adult control. This list is directly from Attachment E and F within the NPDES Permit for Biological and Residual Pesticide Discharges to Waters of the U.S. for Vector Control Applications. All of these products are used according to label directions and may be applied by ground (hand, truck, ATV, backpack, etc.) or by air (helicopter or fixed wing aircraft).

List of Permitted Larvicide Products

Larvicide Product Name	Registration Number
Vectolex CG Biological Larvicide	73049-20
Vectolex WDG Biological Larvicide	73049-57
Vectolex WSP Biological Larvicide	73049-20
Vectobac Technical Powder	73049-13
Vectobac-12 AS	73049-38
Aquabac 200G	62637-3
Teknar HP-D	73049-404
Vectobac-G Biological Mosquito Larvicide Granules	73049-10
Vectomax CG Biological Larvicide	73049-429
Vectomax WSP Biological Larvicide	73049-429
Vectomax G Biological Larvicide/Granules	73949-429
Zoecon Altosid Pellets	2724-448
Zoecon Altosid Briquets	2724-375
Zoecon Altosid Liquid Larvicide Mosquito Growth Regulator	2724-392

Larvicide Product Name	Registration Number
Zoecon Altosid XR Entended Residual Briquets	2724-421
Zoecon Altosid Liquid Larvicide Concentrate	2724-446
Zoecon Altosid XR-G	2724-451
Zoecon Altosid SBG Single Brood Granule	2724-489
Mosquito Larvicide GB-1111	8329-72
BVA 2 Mosquito Larvicide Oil	70589-1
BVA Spray 13	55206-2
Agnique MMF Mosquito Larvicide & Pupicide	53263-28
Agnique MMF G	53263-30
Abate 2-BG	8329-71
5% Skeeter Abate	8329-70
Natular 2EC	8329-82
Natular G	8329-80
Natular XRG	8329-83
Natular XRT	8329-84
FourStar Briquets	83362-3
FourStar SBG	85685-1
Aquabac xt	62637-1
Spheratax SPH (50 G) WSP	84268-2
Spheratax SPH (50 G)	84268-2

List of Permitted Adulticide Products

Adulticide Product Name	Registration Number
Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7395	1021-1570
Evergreen Crop Protection EC 60-6	1021-1770
Pyrenone Crop Spray	432-1033
Prentox Pyronyl Crop Spray	655-489
Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7396	1021-1569
Aquahalt Water-Based Adulticide	1021-1803
Pyrocide Mosquito Adulticide 7453	1021-1803
Pyrenone 25-5 Public Health Insecticide	432-1050

Adulticide Product Name	Registration Number
Prentox Pyronyl Oil Concentrate #525	655-471
Prentox Pyronyl Oil Concentrate or 3610A	655-501
Permanone 31-66	432-1250
Kontrol 30-30 Concentrate	73748-5
Aqualuer 20-20	769-985
Aqua-Reslin	432-796
Aqua-Kontrol Concentrate	73748-1
Kontrol 4-4	73748-4
Biomist 4+12 ULV	8329-34
Permanone RTU 4%	432-1277
Prentox Perm-X UL 4-4	655-898
Allpro Evoluer 4-4 ULV	769-982
Biomist 4+4	8329-35
Kontrol 2-2	73748-3
Scourge Insecticide with Resmethrin/Piperonyl Butoxide 18%+54% MF Formula II	432-667
Scourge Insecticide with Resmethrin/Piperonyl Butoxide 4%+12% MF Formula II	432-716
Anvil 10+10 ULV	1021-1688
AquaANVIL Water-based Adulticide	1021-1807
Duet Dual-Action Adulticide	1021-1795
Anvil 2+2 ULV	1021-1687
Zenivex E20	2724-791
Trumpet EC Insecticide	5481-481
Fyfanon ULV Mosquito	67760-34

4. Description of ALL the application areas and the target areas in the system that are being planned to be applied or may be applied. Provide a map showing these areas;

Any site that holds water for more than 96 hours (4 days) can produce mosquitoes. Source reduction is the Alameda County Mosquito Abatement District's preferred solution, and whenever possible the District works with property owners to effect long-term solutions to reduce or eliminate the need for continued applications as described in item 2 above. Mosquito breeding sources and areas that require adult mosquito control are difficult to predict from year to year based on the weather and variations in local environmental conditions. See attached map of Alameda County and Table 1, the list of target areas within ACMAD's territory. The typical sources treated by this District include:

Agricultural	Natural	Domestic	Commercial
Stock Ponds	Creeks	Fish ponds	Catch basin
Duck Ponds	Creek potholes	Septic tanks	Storm drain
Agricultural drains	Marsh, tidal	Wells	Gravel pit
Watering troughs	Marsh, reclaimed	Swimming pools	Ditch
	Marsh, fresh	Spa	Sewer pond
	Lakes	Bird baths	Utility vaults
	Ponds	Flooded basement	Cemetery urns
	Tree holes	Containers	Sumps
	Rain pools	Overwatering	Sewer lines
	Seepage	Storm water basins	Canal
			Used tires
			Broken pipes

5. Other control methods used (alternatives) and their limitations;

With any mosquito or other vector source, Alameda County Mosquito Abatement District's first goal is to look for ways to eliminate the source, or, if that is not possible, for ways to reduce the vector potential. The most commonly used methods and their limitations are included in the "Best Management Practices for Mosquito Control in California." Specific methods used by the District include stocking mosquitofish (*Gambusia affinis*), educating residents that mosquitoes develop in standing water and encouraging them to remove sources of standing water on their property, and working with property owners to find long-term water management strategies that meet their needs while minimizing the need for public health pesticide applications. Although mosquitofish are extremely useful, they are limited in their applicability. Typical limitations that may occur include: they cannot be added to natural bodies of water, mosquitofish cannot tolerate polluted target areas, mosquitofish may become preyed upon, target areas may not support mosquitofish due to its size or water chemistry, etc. Educating residents is an important first measure, but once educated, the landowner still needs to take the appropriate actions to eliminate standing water. Removing standing water from a property is always the preferred solution. However, such measures often prove to be costly and or impractical. If a pesticide-free

alternative does not adequately reduce the risk of mosquito production, pesticides are considered, beginning with those that have the least biological impact.

6. **How much product is needed and how this amount was determined;**
The need to apply product is determined by surveillance. Actual use varies annually depending on the mosquito activity. The pesticide amounts presented below were taken from the Alameda County Mosquito Abatement District's 2010 Pesticide Use Report (PUR) as an estimate of pesticide use in 2011. Other public health pesticides in addition to those listed here may be used as part of the District's best management practices.

Treatments applied in Alameda County 2010

Material	Amount	Area treated	Applic Rate	No. of Applic.
Agnique MMF	20 oz	3089.0 sq ft	284.7 fl oz/acre	22
Altosid Briquets	652 oz	2.2 acre	299.0 oz/acre	146
Altosid Liquid conc.	825 oz	824.6 acre	1.0 fl oz/acre	151
Altosid Pellets	3803 oz	113.3 acre	33.6 oz/acre	87
Altosid WSP	22 oz	2.0 acre	11.1 oz/acre	6
Altosid XR briquets	4358 oz	5.8 acre	571.4 oz/acre	429
Altosid XR-G	432 oz	11.0 acre	39.3 oz/acre	1
BVA 2 Oil	47 gal	15.7 acre	3.0 gal/acre	14
Golden Bear Oil	1898 gal	530.4 acre	3.6 gal/acre	751
Natular XRT	16 lb	0.2 acre	92.4 lb/acre	9
Scourge 4%	11 oz	13.5 acre	0.8 fl oz/acre	2
Vectobac 12AS	122 gal	1237.3 acre	0.1 gal/acre	362
Vectobac G	5500 lb	609.8 acre	9.0 lb/acre	597
Vectolex CG	2994 lb	283.3 acre	10.6 lb/acre	706
Vectolex WDG	251 lb	631.2 acre	0.4 lb/acre	347
Vectolex WSP	81 lb	133.1 acre	0.6 lb/acre	467
VectoMax CG	271 lb	22.6 acre	12.0 lb/acre	41

7. **Representative monitoring locations* and the justification for selecting these monitoring locations**
Please see the MVCAC NPDES Coalition Monitoring Plan

8. **Evaluation of available BMPs to determine if there are feasible alternatives to the selected pesticide application project that could reduce potential water quality impacts;**
Alameda County Mosquito Abatement District strives to use the most environmentally low impact control strategies as possible, as discussed in items #2 and #5. The preferred sequence of mosquito control is: education - physical control- biological control, i.e., mosquitofish – larvicding with biorationals – larviciding/pupaciding with monomolecular films or surfactants –adulticiding. It is the goal of the Alameda County Mosquito Abatement District program to minimize any impact on water quality. For example, after educating the party responsible for creating a breeding source, and after rejecting physical and biological control as viable control measures, a technician's first choice is to use a biorational larvicide such as *Bacillus thuringensis israelensis* (BTI). This material is commercially available in many forms – liquids, granules, or pellets, and all are regarded as environmentally safe. It

leaves no residues and is quickly biodegraded. At the application rates used for mosquito control, BTI is unlikely to have any measureable effect on water quality. Another bacterial product - spinosad –is a fermentation product of a naturally- occurring bacteria. It too is generally regarded as environmentally safe, leaving no residues and readily biodegrading. A third biorational larvicide with low environmental impact is one containing the active ingredient methoprene. This chemical mimics mosquitoes' natural growth regulator, and has no significant impact on water quality. It is rapidly degraded in the environment and is not known to have persistent or toxic breakdown products. All ACMAD field technicians are trained to understand the importance of first choosing treatment strategies that minimize the impacts on water quality.

9. Description of the BMPs to be implemented. The BMPs shall include at a minimum:

The Alameda County Mosquito Abatement District's BMPs are described in item #2 above. Specific elements have been highlighted below under items a-f.

a. **measures to prevent pesticide spill;**
   All pesticide applicators receive annual spill prevention and response training. District employees ensure daily that application equipment is in proper working order. Spill mitigation devices are placed in all vehicles and pesticide storage areas.

b. **measures to ensure that only a minimum and consistent amount is used**
   Application equipment is calibrated at least annually as required by the Department of Pesticide Regulations (DPR) and the terms of a cooperative agreement with the California Department of Public Health (CDPH).

c. **a plan to educate Coalition's or Discharger's staff and pesticide applicator on any potential adverse effects to waters of the U.S. from the pesticide application;**
   This will be included in our pesticide applicators annual pesticide application and safety training, continuing education programs, and/or regional NPDES Permit training programs.

d. **descriptions of specific BMPs for each application mode, e.g. aerial, truck, hand, etc.;**
   The Alameda County Mosquito Abatement District calibrates truck-mounted and handheld larviciding equipment each year to meet application specifications. Supervisors review application records daily to ensure appropriate amounts of material are being used. Ultra-low volume (ULV) application equipment is calibrated for output and droplet size to meet label requirements. Aerial larviciding equipment is calibrated by the Contractor. Aerial adulticide equipment is calibrated regularly and droplet size will be monitored by the District to ensure droplets meet label requirements. Airplanes used in urban ULV applications and the primary airplane used for rural ULV application is equipped with advanced guidance and drift management equipment to ensure the best available technology is being used to

place product in the intended area. If a secondary airplane is used in rural ULV applications it will be equipped with an advanced guidance system.

e. **descriptions of specific BMPs for each pesticide product used; and**
Please see the "Best Management Practices for Mosquito Control in California" for general pesticide application BMPs, and the current approved pesticide labels for application BMPs for specific products.

f. **descriptions of specific BMPs for each type of environmental setting (agricultural, urban, and wetland).**
Please see Item #2. The Alameda County Mosquito Abatement District has three major environmental types –urban/suburban, marsh, and creek/woodland. In our urban setting, education of the homeowner is our number one priority. For example, "dump and drain" backyard containers, adding mosquitofish to fish ponds and neglected swimming pools, and encouraging homeowners to prevent landscape water running off into storm drains are typical strategies to limit mosquito breeding. ACMAD's education program is extensive and includes: an informative website, participation in County fairs and shows, school and service organization presentations, newspaper, bus, BART (Bay Area Rapid Transit) and radio ads, and television appearances. In marsh environments, the District personnel perform vegetation removal to enhance tidal flow, thereby minimizing mosquito production. Frequent inspection of marsh areas is done during mosquito breeding seasons. This allows technicians to utilize bacterially-based larvicides or growth regulators before mosquitoes can reach adult size. Marsh areas are capable of producing large numbers of mosquitoes. ACMAD has participated in the planning of several marsh restoration projects, in an effort to minimize some of this mosquito breeding. In creek settings, creek beds are inspected after winter rains have subsided, water flow diminishes, and pockets of mosquito breeding are found along the creek's margins. Again, bio-rational pesticides are the first choice of larvicide used. Rarely, if ever, do entire creeks receive a treatment.

10. Identification of the problem. Prior to first pesticide application covered under this General Permit that will result in a discharge of biological and residual pesticides to waters of the US, and at least once each calendar year thereafter prior to the first pesticide application for that calendar year, the Discharger must do the following for each vector management area:

a. If applicable, establish densities for larval and adult vector populations to serve as action threshold(s) for implementing pest management strategies;

The Alameda County Mosquito Abatement District staff only apply pesticides to sources of mosquitoes that represent imminent threats to public health or quality of life. The presence of any mosquito may necessitate treatment, however higher thresholds may be applied depending on the District's resources, disease activity, or

local needs. Treatment thresholds are based on a combination of one or more of the following criteria:

- Mosquito species present
- Mosquito stage of development
- Pest, nuisance, or disease potential
- Disease activity
- Mosquito abundance
- Flight range
- Proximity to populated areas
- Size of source
- Presence/absence of natural enemies or predators
- Presence of sensitive/endangered species or habitats.

b. Identify target vector species to develop species-specific pest management strategies based on developmental and behavioral considerations for each species;
See the list, Alameda County MAD's Most Import Mosquitoes , page 25 in the attached document "The Alameda County Mosquito Abatement District Control Program".

c. Identify known breeding areas for source reduction, larval control program, and habitat management; and
Any site that holds water for more than 96 hours (4 days) can produce mosquitoes. Source reduction is the District's preferred solution, and whenever possible the District works with property owners to implement long-term solutions to reduce or eliminate the need for continued applications as described in item #2 above. See the attached copy of the Army Corps of Engineers source permit showing areas worked by ACMAD.

d. Analyze existing surveillance data to identify new or unidentified sources of vector problems as well as areas that have recurring vector problems.
The Alameda County Mosquito Abatement District continually collects adult and larval mosquito surveillance data, dead bird reports, and sentinel chicken test results and monitors regional mosquito-borne disease activity in humans, horses, birds, and/or other animals, and uses these data to guide mosquito control activities. ACMAD maintains a computerized database of mosquito breeding sources (target areas) within the county. This data base contains historical information of the source's location, likely mosquito species present, and previous treatments used. Surveillance data is gathered on a daily, weekly, or biweekly basis of specific target areas and compared with historical averages, and remedial action is taken (or not) depending on surveillance results. Technicians continually sample standing water searching for new target areas. The addition of aerial surveillance of "green" mosquito pools has added a new dimension to ACMAD's surveillance program and helped prevent the release of thousands of adult mosquitoes. See the document "The Alameda County Mosquito Abatement District Control Program".

11. Examination of Alternatives. Dischargers shall continue to examine alternatives to pesticide use in order to reduce the need for applying larvicides that contain temephos and for spraying adulticides. Such methods include:

a. Evaluating the following management options, in which the impact to water quality, impact to non-target organisms, vector resistance, feasibility, and cost effectiveness should be considered:

- **No action**
- **Prevention**
- **Mechanical or physical methods**
- **Cultural methods**
- **Biological control agents**
- **Pesticides**

If there are no alternatives to pesticides, dischargers shall use the least amount of pesticide necessary to effectively control the target pest.

The Alameda County Mosquito Abatement District participates in a regional source reduction permit from the US Army Corps of Engineers for the purpose of maintaining existing water circulation ditches and channels to control mosquitoes in the tidal marshes along the SF Bay. See copy of Permit and annual report attached to this document. Also see the document "The Alameda County Mosquito Abatement District Control Program".

The Alameda County Mosquito Abatement District uses the principles and practices of integrated vector management (IVM) as described on pages 26 and 27 of "Best Management Practices for Mosquito Control in California." As stated in item #10 above, locations where vectors may exist are assessed, and the potential for using alternatives to pesticides is determined on a case-by-case basis. Commonly considered alternatives include: 1) Eliminate artificial sources of standing water; 2) Ensure temporary sources of surface water drain within four days (96 hours) to prevent adult mosquitoes from developing; 3) Control plant growth in ponds, ditches, and shallow wetlands; 4) Design facilities and water conveyance and/or holding structures to minimize the potential for producing mosquitoes; and 5) Use appropriate biological control methods that are available. Additional alternatives to using pesticides for managing mosquitoes are listed on pages 4-19 of the "Best Management Practices for Mosquito Control in California."

Implementing preferred alternatives depends upon a variety of factors including availability of agency resources, cooperation with stakeholders, coordination with other regulatory agencies, and the efficacy of the alternative. If a pesticide-free alternative does not sufficiently reduce the risk to public health, pesticides are considered, beginning with the least amount necessary to effectively control the target vector.

b. Applying pesticides only when vectors are present at a level that will constitute a nuisance.

The Alameda County Mosquito Abatement District follows an existing integrated vector management (IVM) program which includes practices described in item #2 above. More specific discussion can be found in the document "The Alameda County Mosquito Abatement District Control Program."

A "nuisance" is specifically defined in California Health and Safety Code (HSC) §2002(j). This definition allows vector control agencies to address situations where even a low level of vectors may pose a substantial threat to public health. In practice, the definition of a "nuisance" is generally only part of a decision to apply pesticides to areas covered under this permit. As summarized in the "California Mosquito-borne Virus Surveillance and Response Plan," the overall risk to the public when vectors and/or vector-borne disease are present is used to select an available and appropriate material, rate, and application method to address that risk in the context of our IVM program.

12. Correct Use of Pesticides

Coalition's or Discharger's use of pesticides must ensure that all reasonable precautions are taken to minimize the impacts caused by pesticide applications. Reasonable precautions include using the right spraying techniques and equipment, taking account of weather conditions and the need to protect the environment.

This is an existing practice of the Alameda County Mosquito Abatement District and is required to comply with the Department of Pesticide Regulation's (DPR) requirements and the terms of our California Department of Public Health (CDPH) Cooperative Agreement. All pesticide applicators receive annual safety and spill training in addition to their regular continuing education.

13. If applicable, specify a website where public notices, required in Section VIII.B, may be found.

www.mosquitoes.org

References:

The Alameda County Mosquito Abatement District Control Plan

Best Management Practices for Mosquito Control in California. 2010. Available by download from the California Department of Public Health—Vector-Borne Disease Section at http://www.westnile.ca.gov/resources.php under the heading Mosquito Control and Repellent Information. Copies may be also requested by calling the California Department of Public Health—Vector-Borne Disease Section at (916) 552-9730 or the Alameda County Mosquito Abatement District at (510) 783-7744.

California Mosquito-borne Virus Surveillance and Response Plan. 2010. [Note: this document is updated annually by CDPH]. . Available by download from the California Department of Public

Health—Vector-Borne Disease Section at http://www.westnile.ca.gov/resources.php under the heading Response Plans and Guidelines. Copies may be also requested by calling the California Department of Public Health—Vector-Borne Disease Section at (916) 552-9730 or Alameda County Mosquito Abatement District at (510) 783-7744.

MVCAC NPDES Coalition Monitoring Plan. 2011. [In development at the time of this draft]

Department of the Army Regional Permit No. 4 for Mosquito Abatement Activities, file no. 400304S.

Proposed Source Reduction work for 2010-2011for Regional Permit No.4.

Table 1. List of target areas. Although most creeks have commonly accepted names, this is not the case with tidal and seasonal marshes. ACMAD uses historical names for many of these areas that would be meaningless to others. Therefore, only generalized descriptions of their locations are given. Note that when a target area is treated, only that portion of the area that is breeding mosquitoes is treated, not the entire body of water.

A. Creeks, canals and underground culverts. Only those creeks and their tributaries with known names are listed. For detailed maps of creeks, see http://museumca.org/creeks/resc.html. Those creeks marked with an asterisk have been treated for mosquito breeding in the past.

Cerrito Creek (Berkeley)*

Blackberry Creek (Berkeley)

Marin Creek/Village Creek (Berkeley)*

Cordonices Creek (Berkeley)*

Lincoln Creek/Schoolhouse Creek (Berkeley)

Strawberry Creek (Berkeley)*

Potter Creek (Berekeley)

Derby Creek (Berkeley)

Hardwood Claremont Creek (Oakland)*

Vicente Creek (Oakland)

Temescal Creek (Oakland/Emeryville)*

Glen Echo Creek (Oakland)*

Pleasant Valley Creek (Piedmont)*

Bushy Dell Creek (Piedmont)*

Wildwood Creek (Piedmont/Oakland)*

Trestle Glen Creek (Piedmont/Oakland)*

Indian Gulch Creek (Oakland)*

Shephard Creek (Oakland)*

Palo Seco Creek (Oakland)*

Sausal Creek (Oakland)*

Peralta Creek (Oakland)*

Courtland Creek (Oakland)*

54th Ave Creek (Oakland)*

Seminary Creek (Oakland)*

Lion Creek (Oakland)*

Horseshoe Creek (Oakland)*

Chimes Creek (Oakland)*

Arroyo Viejo Creek (Oakland)*

Elmhurst Creek (Oakland)*

Stonehurst Creek (Oakland)*

San Leandro Creek (Oakland)*

Estudillo Canal (San Leandro)*

Bockman Canal (San Lorenzo)*

San Lorenzo Creek (San Lorenzo/Castro Valley)*

Bolinas Creek (Castro Valley)*

Norris Creek (Castro Valley)*

Chabot Creek (Castro Valley)*

Valley Creek (Castro Valley)*

Castro Creek (Castro Valley)*

Cull Creek (Castro Valley)*

Crow Creek (Castro Valley)*

Palomares Creek (Castro Valley)*

Eden Creek (Castro Valley)*

Hollis Creek (Castro Valley)*

Sulphur Creek (Castro Valley/Hayward)*

Ward Creek (Hayward)*

Zeile Creek (Hayward)*

Dry Creek (Hayward)*

Old Alameda Creek (Union City)*

Patterson Creek (Fremont)*

Crandall Creek (Fremont)

Ardenwood Creek (Fremont)

Sanjon de los Alisos (Newark)

Alameda Creek (Fremont/Union City/Sunol)*

Morrison Creek (Fremont)

Mission Creek (Fremont)*

Laguna Creek (Fremont)*

Washington Creek (Fremont)*

Sabre Cat Creek (Fremont)*

Cañada de Aliso (Fremont)*

Agua Caliente Creek (Fremont)*

Agua Fria Creek (Fremont)

Toroges Creek (Fremont)

Scott Creek (Fremont)*

Big Canyon Creek (Dublin)*

Koopman Canyon Creek (Dublin)*

Clark Canyon Creek (Dublin)*

Martin Creek (Dublin)*

Dublin Creek (Dublin)*

Cottonwood Creek (Dublin)

Collier Canyon Creek (Dublin)*

Tassajara Creek (Dublin/Pleasanton)*

Laurel Creek (Pleasanton)

Gold Creek (Pleasanton)*

Tehan Creek (Pleasanton)*

Sinbad Creek (Pleasanton)*

Alamo Creek (Dublin/Pleasanton/Sunol)*

Chabot Canal (Pleasanton)*

Kottinger Creek (Pleasanton)*

Mission Creek (Pleasanton)*

Sycamore Creek (Pleasanton)*

Happy Valley Creek (Pleasanton)*

Stony Brook Creek (Pleasanton)

Arroyo de la Laguna (Pleasanton)

Arroyo Mocho (Pleasanton/Livermore)*

Arroyo Valle Creek (Pleasanton/Livermore)*

Sheep Camp Creek (Sunol)

San Antonio Creek (Sunol)*

Vallecitos Creek (Sunol)

Sheridan Creek (Sunol)

Pirate Creek (Sunol)

Indian Joe Creek (Sunol)

Leyden Creek (Sunol)

Calaveras Creek (Sunol)

Dry Creek (Livermore)*

Arroyo Seco Creek (Livermore)*

Corral Hollow (Livermore)

Tunnel Creek (Livermore)

Terraville Creek (Livermore)

Trout Creek (Livermore)

Shafer Creek (Livermore)

Valpe Creek (Livermore)

Whitlock Creek (Livermore)

Indian Creek (Livermore)

La Costa Creek (Livermore)

Altamont Creek (Livermore)*

Brushy Creek (Livermore)*

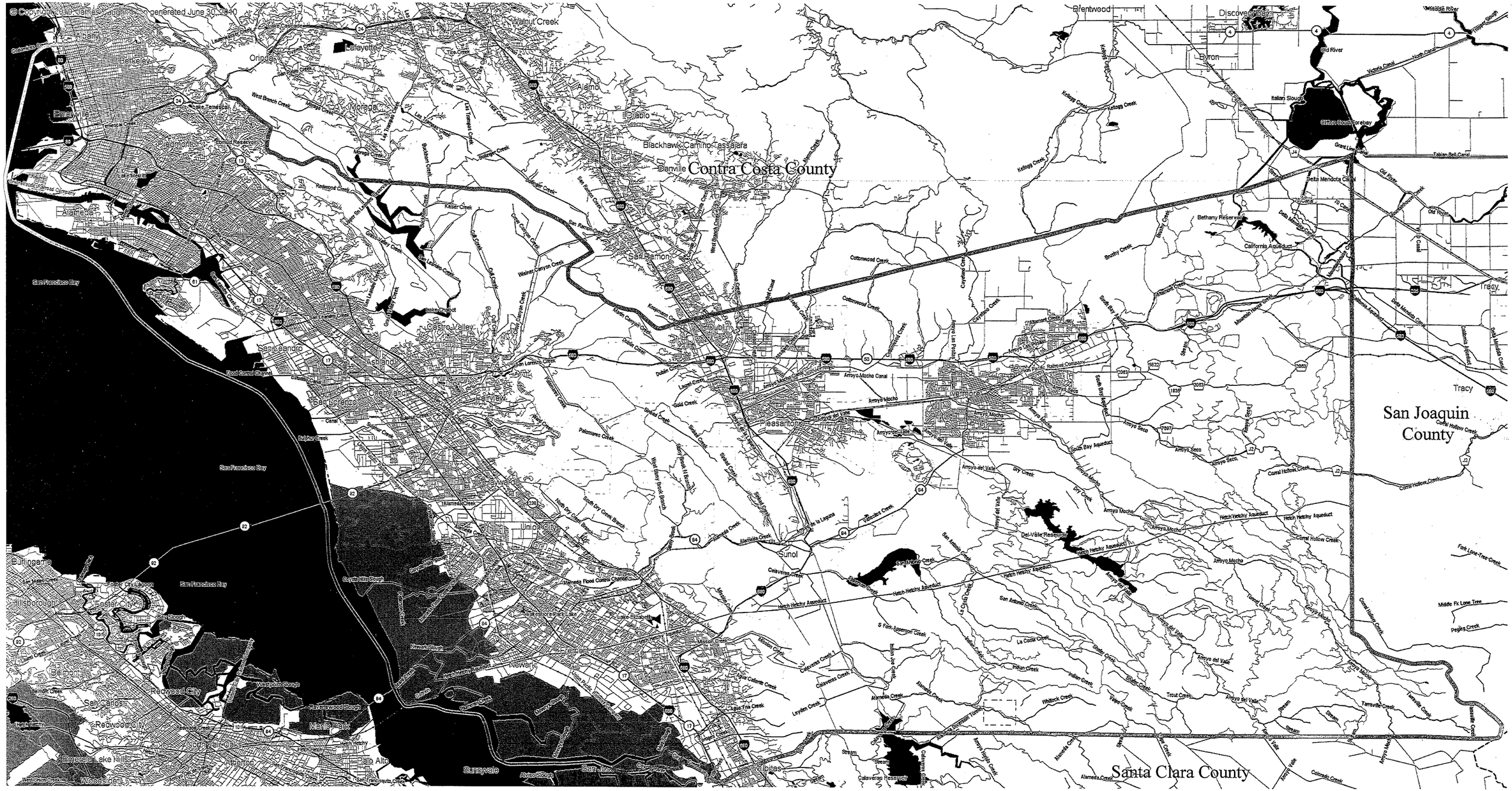
Cayetano Creek (Livermore)*

Arroyo Las Positas (Livermore)*

Mountain House Creek (Mountain House)*

B. Tidal Marshes
   Includes areas west of Highway 80 near Emeryville, west Alameda ("Alameda Point"), Western Hayward (Hayward Regional Shoreline and "Hayward Landing"), Alameda Creek, and marshes immediately adjacent to the Bay in west Newark and Fremont (e.g., Mowry Slough and Albrae Slough), and the Don Edwards San Francisco Bay National Wildlife Refuge.
C. Seasonal Wetlands
   Includes areas west of Highway 80 near Berkeley, west Alameda, areas in and around Oakland International Airport, marshy areas along the Hayward, Newark, and Fremont shorelines, Alameda Creek, Coyote Hills Regional Park, and the Springtown area of Livermore.
D. Lakes and Ponds
   Includes areas in and/or around Lake Merritt (Oakland), Lake Chabot (Castro Valley), Lake Elizabeth (Fremont), Don Castro Regional Recreation Area (Hayward), Cull Canyon Reservoir (Castro Valley), Shadow Cliffs Regional Recreational Area (Pleasanton) and the commercial gravel pit ponds eastward.

Figure 1. Alameda County Mosquito Abatement District's Boundaries Showing Major Waterways



Alameda County Mosquito Abatement District Boundary