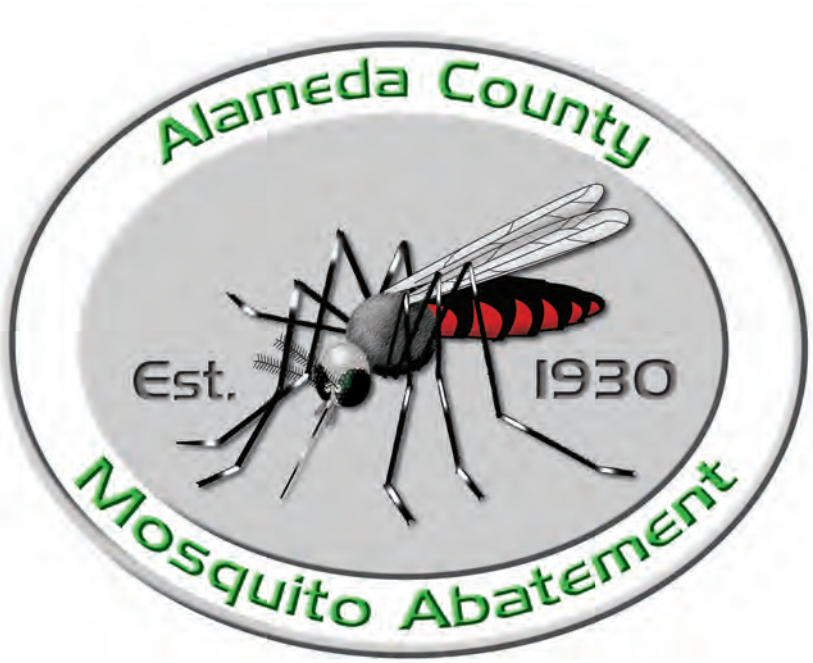
THE ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT CONTROL PROGRAM



September 2011
Alameda County Mosquito Abatement District
23187 Connecticut Street
Hayward, California 94545-1605

THE ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT CONTROL PROGRAM

Key Staff

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Alameda County Mosquito Abatement District

Mission and Vision Statement

ACMAD is a public agency serving the people of Alameda County, With responsibilities for:

- *controlling mosquitoes to enhance public health and comfort;*
- *acting as an information resource on mosquito biology, control and prevention; insect identification; and associated disease transmission; and*
- *operating in a safe, ecologically-sound and publicly accessible manner.*

In an era of constant change and increasing complexities, we the employees of ACMAD are dedicated to fulfilling these responsibilities by:

- *being a proactively adaptive learning organization;*
- *working together in an atmosphere of collaboration, trust, and mutual respect;*
- *developing technical and organizational skills to increase both personal as well as District effectiveness; and*
- *cooperating with other stake holders to develop appropriate long-term mosquito control strategies.*

We are committed to constantly monitoring and continually improving our performance through a process of shared decision-making.

Created May 4, 1994

GENERAL INFORMATION ABOUT THE DISTRICT

The Alameda County Mosquito Abatement District (ACMAD) is an independent, non-enterprise, special district, one of only twenty-one independent special districts in Alameda County.

ACMAD serves a population of 1,540,000 over an area of 812 square miles (all of Alameda County except the City of Albany).

Services are provided at a cost of approximately $5 per single family dwelling per year (2010-2011).

The District was formed in 1930 to control mosquitoes in Alameda County. Prior to that time hordes of vicious mosquitoes infested large sections of the county, particularly during the summer and fall months. The mosquitoes were so numerous that they hampered the sale of residential property, reduced labor efficiency, and kept people from using golf courses, playgrounds and parks.

The District is governed by a Board of Trustees comprised of representatives appointed from each member city and the County-at-large (14 total Trustees). The Trustees serve two-year terms and receive an in-lieu of travel expense of $100.00 per month for attending business meetings of the Board. The Board meets on the second Wednesday of each month at the District's office in Hayward at 5:00 p.m.

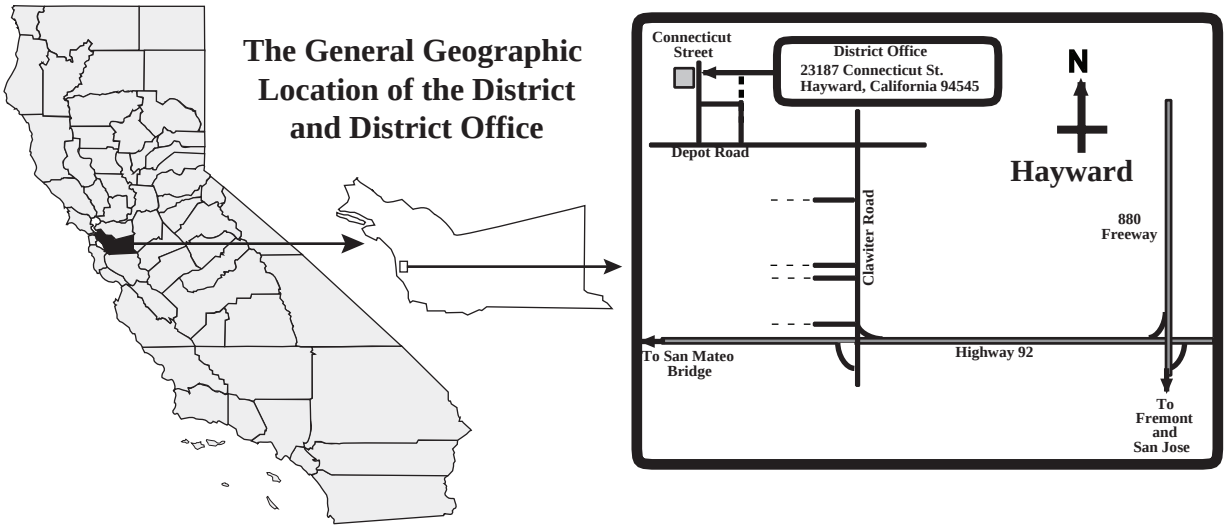
Funding is provided by a combination of *ad valorem* property tax, a special tax authorized by voters in 1982, and a benefit assement tax authorized by more than two thirds of the voters in 2008. The District has lost 36 per cent of property tax revenues since fiscal year 1993/1994 when the state permanently shifted those funds to schools.

We currently employ a full time staff of fourteen. Our field employees are certified by the California Department of Public Health in mosquito and vector control. The certification requires a minimum of 40 hours of continuing education every two years. Five of our staff have degrees in Entomology (1 with a Ph.D), four others have Biology degrees (1 with a masters), and one has an M.B.A. (2011)

The District has a fleet of specialized mosquito control vehicles including four Argo All Terrain Vehicles for marsh inspections and treatments, two right-side-steering vehicles for treating stormdrains, and one six-wheeled Polaris All Terrain Vehicle for inspections and treatments.

It is the overall goal of the District to provide for the public's health and comfort by carrying out a program of mosquito abatement which is responsive to the public, cost effective, compatible with the environment, and consistent with land use planning or zoning. The District assists land owners and agencies in preventive planning, and the management or elimination of mosquito breeding areas.

GENERAL LOCATION OF THE DISTRICT



DISTRICT POWERS

The Alameda County Mosquito Abatement District ("District") is a regulatory agency formed pursuant to section 2000 et seq. of the California Health and Safety Code Section. Pursuant to Section 2040-2045, the District may do all of the following:

(a) Conduct surveillance programs and other appropriate studies of vectors and vectorborne diseases.
(b) Take any and all necessary or proper actions to prevent the occurence of vectors and vectorborne diseases.
(c) Take any and all necessary or proper actions to abate or control vectors and vectorborne diseases.
(d) To purchase the supplies and materials, employ the personnel, and contract for the services that may be necessary or proper to carry out the purposes and intent of this chapter.
(e) To build, repair, and maintain on any land the dikes, levees, cuts, canals, or ditches that may be necessary or proper to carry out the purpose and intent of this chapter.
(f) To engage necessary personnel, to define their qualifications and duties, and to provide a schedule of compensation for the performance of their duties.
(g) To participate in, review, comment, and make recommendations regarding local, state, or federal land use planning and environmental quality processes, documents, permits, licenses, and entitlements for projects and their potential effects on the purposes and intent of this chapter.
(h) A district may contract with other public agencies and federal agencies to provide any service, project, or program authorized by this chapter within the district's boundaries. A district may contract with other public agencies to provide any service, project, or program authorized by this chapter within the boundaries of the other public agencies and federal agencies.

In accordance with Section 2053 of the California Health and Safety Code:

(a) A district may request an inspcetion and abatement warrant pursuant to Title 13 (commencing with Section 1822.50) of Part 3 of the Code of Civil Procedure. A warrant issued pursuant to this section shall apply only to the

exterior of places, dwellings, structures, and premises. The warrant shall state the geographic area which it covers and shall state its purposes. A warrant may authorize district employees to enter property only to do the following:

(1) Inspect to determine the presence of vectors or public nuisances.
(2) Abate public nuisances, either directly or by giving notice to the property owner to abate the public nuisance.
(3) Determine if a notice to abate a public nuisance has been complied with.
(4) Control vectors and treat property with appropriate physical, chemical, or biological control measures.

(b) Subject to the limitations of the United States Constitution and the California Constitution, employees of a district may enter any property, either within the district or property that is located outside the district from which vectors may enter the district, without hinderance or notice for any of the following purposes:

(1) Inspect the property to determine the presence of vectors or public nuisances.
(2) Abate public nuisances pursuant to this chapter, either directly or by giving notice to the property owner to abate the public nuisance.
(3) determine if a notice to abate public nuisance has been complied with.
(4) Control vectors and treat property with appropriate physical, chemical,or biological control measures.

THE VALUE OF AN ORGANIZED MOSQUITO CONTROL DISTRICT

The question periodically arises as to why there is a need for a mosquito control district. Today most residents of Alameda County do not notice large numbers of mosquitoes. Many people have moved from parts of the country where there are large numbers of mosquitoes, and have the impression that California does not have mosquitoes! Mosquito control is sometimes perceived as unnecessary. At the District, the hope is that the perception and the low levels of mosquitoes are because of our continuous and ongoing efforts controlling the thousands of mosquito sources located in the County. Some of the reasons that it is valuable to have an organized, ongoing mosquito control district are:

Source Management: Most large mosquito sources (salt marshes, creeks, storm drain systems, gravel pits, etc.) are for the most part, permanent features of our landscape. These require continuous monitoring and control to maintain low mosquito populations. The ability of a control district to better manage the sources of mosquitoes is related to:

Access: The District has the legal ability to enter onto private and public properties in order to inspect for or control mosquitoes. Private citizens and private companies lack this ability and therefore are unable to apply control to properties they do not own or for which they are not contracted to provide control. The District very rarely needs to enforce its legal ability because the services are provided at no additional cost to property owners and in a spirit of cooperation.

Specialized Equipment: Related to access is the need for specialized equipment to accomplish inspections and control. A mosquito control district can own and maintain needed equipment.

Community Wide Sources: Many of the sources of mosquitoes are publicly owned or are widespread throughout the community. These sources are owned by a variety of entities (cities, flood control districts, utility companies, park districts, water districts, etc.) and would require that each entity provide personnel and resources to control mosquitoes. Often mosquito problems originate many miles from residents' homes (e.g. salt marsh mosquitoes migrating to the hill areas). Control of mosquitoes on community-owned sources would require additional tax revenues to cover the costs. It is more economical to have a small District staff to manage all of the community sources than to have many separate staffs for control. Often, mosquito biting complaints occur miles from the actual mosquito production (e.g. salt marsh mosquitoes migrating to the hill areas).

Prevention of Sources: The District focus is on larval mosquito control, not adult mosquito control and the minimizing of sources that produce mosquitoes. The District reviews development plans and provides information to ensure that any potential mosquito problems are minimized. The District provides information to the public on the prevention of mosquitoes on private property and provides advice on project construction and maintenance.

Continuity of Operations: A permanent and ongoing control program can provide management as a process rather than single occurrences. Records of mosquito production are maintained allowing the work to be planned over time to maintain a high level of control.

Knowledge Base: The center of information about mosquito sources and the technology for their control is always available within an ongoing program. Personnel develop knowledge of their areas, the species that create problems and where to locate the sources. The District maintains detailed records of service calls, mosquito sources and potential sources, and can draw on these records to predict future control needs and economically schedule work loads (records exist back to 1930). Many sources are sensitive habitats and require technical knowledge to control without damage to the habitat. The District also maintains a professional library of resources providing access to applicable information.

Trained Personnel: The District recruits and retains well-educated and trained personnel to accomplish the tasks needed in mosquito control. District personnel are State Certified and specially trained. The focus of District personnel is control of the mosquitoes in Alameda County. They become thoroughly familiar with the biology of the local species and the most appropriate and environmentally safe control measures.

Reduction of Pesticide Use: When members of the public are bothered by mosquitoes there is a tendency to want to overuse pesticides. Many residents will have their yards sprayed when mosquitoes are present. The cost of a yard treatment by a private company is about what the resident pays the District for more than 20 years of control! These treatments exacerbate the environment's pesticide load and do little to stop the problem or prevent future occurrences. To the public, areas such as marshes, swamps, lakes, creeks or ponds are viewed as universal mosquito producers. The mosquito control professional maps these sources to locate the usually small area within them that actually requires treatment. This minimizes the costs and impact on the environment by reducing the amount of insecticides needed. The location and treatment of a small larval source may prevent problems for many residents in the area.

Disease Control: An organized district can continually monitor for disease potential and take action before an outbreak occurs. California has a history of encephalitis and malaria outbreaks. By monitoring for the virus that causes encephalitis, the District can take preventative action. The District also monitors cases of malaria arriving in the County to lessen the potential for transmission. In addition, it is possible that other mosquito borne diseases may be introduced into California in the future.

Prevention of Foreign Introductions: With the tremendous amount of international travel and commerce there is always the possibility of foreign mosquito species being introduced into the County. The District monitors for any mosquitoes that are not native to this area. Other parts of the United States now have foreign mosquito species that have been "accidentally" introduced and have the potential to transmit fatal diseases. Larvae and adult mosquitoes are identified in the District laboratory with a careful watch for new introductions.

DISTRICT GOALS AND SERVICES

As an independent non-enterprise special district, the District exists to provide direct service to the public. It is the overall goal of the District to provide for the public's health and comfort by carrying out a program of mosquito abatement which is responsive to the public, cost effective, environmentally safe, and consistent with land use planning or zoning. The District offers a number of direct services to the public:

- Responds to public complaints about mosquitoes or mosquito-like insects in the County and determine the source of the problem to correct as needed.
- Delivers mosquitofish to residents of the County free of charge.
- Monitors populations of disease carrying and pest mosquitoes.
- Inspects and treats mosquito sources.
- Identifies mosquitoes and other insects.
- Maintains an education program to inform the public about mosquito biology and control.

SERVICE CALLS

During each year the District may receive several thousand or more calls from the public for service. District personnel routinely inspect and treat thousands of recorded mosquito sources, but new sources are constantly being found or created. These calls are an important source of information on new mosquito problems and a means of preventing mosquito production. Members of the public are encouraged to call the District for service. Every effort is made to rapidly respond to these calls, usually on the next business day. The District classifies these incoming calls as:

Mosquito Service Requests: These calls are from the public reporting mosquitoes. The caller is asked to provide a specimen and the technician checks for mosquitoes present in the area. Some of these calls are caused by insects which look like mosquitoes such as crane flies, midges or other insects.
Fish Requests: Fish Requests are requests to have fish (*Gambusia affinis*) stocked in ponds or containers.
Prevent: These calls are from the public to inspect water sources for the presence of mosquitoes.
Miscellaneous ID: These calls are for non-mosquito insect identification.

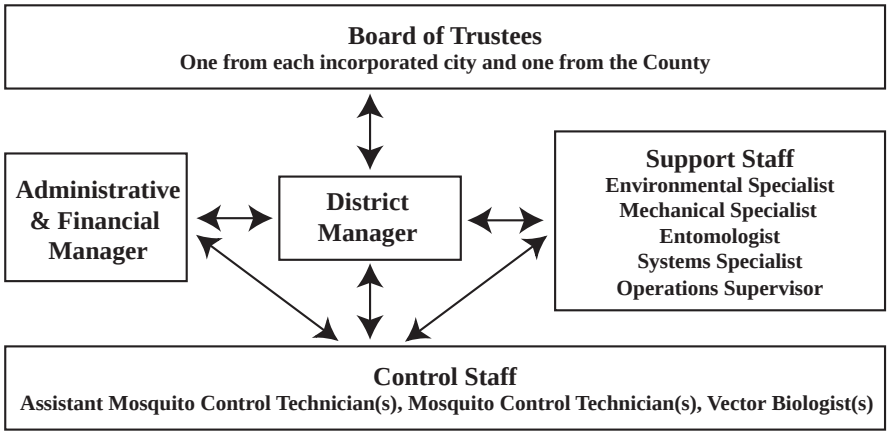
DISTRICT FINANCES

The District has three primary sources of revenue. The first is a share of the *ad valorem* property taxes collected by the County Tax Assessor and placed in a special fund for special districts. The second source of revenue is from a special tax passed by more than two-thirds of the voters in 1982 (Measure K on the ballot). This special tax allows the District to assess a tax on each parcel in the county. The maximum allowable rates are $1.75 per parcel, $3.50 per multiple unit (2-4 units), and $8.75 per multiple unit (5 or more units), or mobile home park. The third is from a benefit assesment passed by more than two-thirds of the voters in 2008. This assessment has a built in cost of living adjustment that can change the assessed fee overtime. The maximum allowable rates of the original assesment were $5 per single family residence, and $1.60 for multiple dwelling units for the first 20 units then $.50 a unit there after. Agricultural properties were assessed at $.01 per 1/4 acre and dry pasture and timberlands were assessed at $.0021 per 1/4 acre. In 2010 single family residences were taxed at a rate of $1.74 for the special tax plus $2.50 for the benefit assesment.

DISTRICT ORGANIZATION

The District operates under the provisions of Sections 2000-2093 of the Health and Safety Code of California. It's governed by a Board of Trustees, consisting of fourteen members. The Board of Supervisors of Alameda County appoints one Trustee representing the County-at-large and one Trustee is appointed by the City Council for each of the thirteen incorporated cities within the District. Each Trustee serves a two-year term.

The Trustees receive an in-lieu of travel expense of $100.00 per month for attending business meetings of the Board. The Board meets on the second Wednesday of each month at the District's office in Hayward at 5:00 p.m. The Board determines the general policies to be followed, employs the District manager, approves the annual budget and controls the expenditures. Each fiscal year, the Board determines the rates of the special tax and benefit assessment that will be levied upon property owners. Funds are held in a trust fund by the County Treasurer, and paid out on warrants approved by the Board and authorized by the County Auditor. Each fiscal year the District accounts are audited by an independent accounting firm.



DISTRICT PERSONNEL ORGANIZATION

The District currently employs a full time staff of fourteen. District personnel are organized into positions with responsibilities for carrying out the District control program.

Manager: Under authority of the Board of Trustees, the District Manager plans, organizes and directs a comprehensive mosquito control program for the Alameda County Mosquito Abatement District; administers the policies of the Board and adheres to legal requirements affecting the District and its operations; represents the District and Board of Trustees in its relations with the community, and other agencies; and performs related work as required. Prepares and administers the annual District budget as directed by the Board of Trustees; maintains accounting system and budgetary controls over expenditures; coordinates salary negotiations with employees, providing the Salary Committee with relevant financial information; interacts with professional consultants and representatives such as attorneys, auditors, and architects; reviews all outside contracts for accuracy, intent and compliance; authorizes payments by District and signs warrants that conform to the budget approved by the Board of Trustees; plans, evaluates and directs a mosquito control program and associated functions of the District in accordance with policies and limitation established by the Board of Trustees, subject to local, State and Federal regulatory statutes; prepares reports as necessary to keep the Board of Trustees apprised of administrative and operational activities; represents the District, often serving on committees with local, regional, and State governmental agencies and the Mosquito and Vector Control Association of California; oversees the District's public relations and communications; attends meetings of the Board of Trustees, providing the Board with operational and budgetary information in a timely manner; oversees risk management, occupational safety, and insurance matters; oversees the Human Resources programs related to employee benefits, hiring practices, employee training and employee evaluation; ensures District compliance with Americans with Disabilities Act requirements.

Administrative & Financial Manager: Under general direction and supervision of the District Manager performs a variety of professional, financial, administrative and human resource related staff work and serves as the Administrative Assistant to the District Manager and handles matters that are confidential in nature. This position is responsible for completion of all clerical, budgeting, bookkeeping, record keeping, and filing. Work includes utilization of accounting software for general ledger, accounts payable, accounts receivable, payroll, and inventory of fixed assets; responsible for the preparation of financial statements and performs related work as required; creates and maintains all financial records and reports, including but not limited to accounts payable, accounts receivable, payroll, and general ledger; insures compliance with all new state and federal laws that may affect payroll; interacts with the District's support staff regarding purchasing and all other financial decisions; prepares monthly financial statements of operation; complies and analyzes data for annual budget preparation, prepares written justification and explanation for expenses and prepares draft of annual budget fo management staff analysis; prepares proposed and final budgets under the direction of the District Manager; maintains inventory records on all fixed assets; works with the District's annual auditor by providing District records; plans and organizes record keeping, reporting, and business office procedures; manages all employee/trustee travel arrangements in compliance with IRS regulations regarding travel expense reimbursements; administers benefit assessment and property tax ledgers; serves as the District's workers' compensation manager, handling all workers' compensation procedures and claims; administers employee and retiree benefit and pension plans; stays current with new state and federal laws and regulations affecting employee benefits; advises management of new state and federal laws and regulations that may warrant changes in District policies; works directly with the District's occupational health provider to make appointments for new hires (pre-employment physicals), all work-related injuries, drug testing, and other matters; manages all employee records, such as but not limited to medical/dental plans, payroll deductions, W-2s, pension plans, performance reports, driving records, workers' compensation injuries, and miscellaneous benefit plans; oversees the District's DMV pull notice program for all driving records of employees; manages special projects assigned by the District Manager.

Support Staff:

Entomologist: The Entomologist is responsible for conducting and executing various aspects of the District's technical program, its goals, expectations, and commitment to mosquito control, applying the knowledge associated with the scientific disciplines of entomology, biology, ecology, microbiology, and biostatistics. The Entomologist comprises an active component of the District's support staff that collaborates to assist the District Manager in planning, organization, directing, and evaluating the District's mosquito control program. Assists in planning field investigative studies; conducts ecological population studies and surveys of mosquito sources and species distribution in the District; collects, processes and identifies specimens, evaluates their health significance and recommends control

measures; performs encephalitis virus surveillance and other vector surveillance protocol as required; performs biological and chemical laboratory work and makes evaluations; performs mosquito related research and presents findings at professional meetings; monitors and evaluates efficacy of field applications of pesticides; investigates resistance of mosquitoes to pesticides used and recommendations regarding their use; determines pesticide use by mosquito species, season, environmental conditions and available equipment; prepares reports including maps, graphs,and analysis for program development and planning; prepares reports, analyses and recommendations on technical and operational projects, problems and sources; oversees the District's mosquitofish program including: holding tank maintenance, purchase, and planting protocol; participates in the training of personnel on the proper use and application of pesticides; maintains certification by attending technical and job-related training sessions, seminars, and continuing education classes; keeps informed and knowledgable about District policies and procedures; attends Coastal Region biologist meetings; keeps a neat and professional appearance; performs occasional other tasks or functions not stated in this description, but within the scope of experience and capability; performs related work as required.

Environmental Specialist: The Environmental Specialist is responsible for the coordination and effective planning of the District's source prevention/reduction program and public relations program. Represents the District at planning, agency and public meetings with the objective of educating agency officials and the public about the ecologically-oriented methodologies used by the District to detect, monitor and control mosquitoes; secures permits, contracts, MOU's or cooperative agreements to prevent or eliminate mosquito sources; coordinates source prevention/ planning projects and public relations activities in an environmentally-sound and informed manner to meet the concerns of the public and other agencies; makes recommendations to planning agencies and landowners to prevent or eliminate mosquito sources; develops, implements and maintains a community education program to inform Alameda County residents, politicians and anyone interested about the District and its programs; participates in and/ or leads training sessions on wetlands laws, policies, agreements and identification; assists or leads team efforts to create or upgrade District brochures and handout materials. As a member of the support team, assists and supports technicians, vector biologists, administrative assistant and manager, and accomplishes field work, facility and equipment maintenance as needed.

Mechanical Specialist: The Mechanical Specialist coordinates and performs mechanical repairs and maintenance of District facilities and equipment. Also responsible for the implementation and documentation of the District Safety program and can operate and maintain District source reduction equipment; plans and follows a preventive maintenance schedule for District facilities, equipment and vehicles; contracts or makes repairs as necessary to facilities, vehicles and equipment; responsible for District Safety Program; insuring employees are properly trained in all safety procedures and programs while working at the facility; provides instruction in the proper use and care of shop equipment, spray equipment and driver safety; provides safety equipment and instruction on its proper use; conducts safety inspections of District facility including shop, office, equipment, vehicles and grounds; maintains all District safety records in compliance with CAL OSHA standards; responsible for budgeting, purchasing, record keeping and preparation of proposals for the purchase of District equipment, tools, spray equipment, vehicles and supplies for equipment and facilities maintenance; contracts with outside agencies for disposal of District equipment; schedules shop projects consisting of routine maintenance and repairs of equipment and vehicles; takes a leadership role in inquiring among District personnel to perform needed District job functions; as a member of the support team, assists and supports technicians, vector biologists, administrative assistant and manager and accomplishes field work, facility and equipment maintenance as needed.

Systems Specialist: The Systems Specialist is responsible for the coordination, maintenance, and development of the District's computer and information systems; manages the computer operating system, installs initial and additional system software, adds and removes user accounts and files, ensures that system resources are efficiently distributed, provides level of security needed in system including passwords and backups; operates as team leader in software and hardware research, purchasing, and development; provides budget information for maintaining the computer system and for the upgrade of software and hardware; initiates disposal of obsolete software and hardware; maintains equipment inventory; oversees the data systems; requests program corrections, modifications, system development and documentation from developers; trains employees in the use of ACMAD data systems and creates user guides; operates as team leader in the development of a Geographic Information System; interfaces with other agencies, Information Technology groups, and the statewide website; assists in public education programs; works with the Environmental Specialist in the development and maintenance of the District's website; as a member of the support team, assists and supports technicians, vector biologists, administrative assistant and manager and accomplishes field work, facility and equipment maintenance as needed.

Field Operations Supervisor: The Field Operations Supervisor is responsible for supervising, directing, and assisting the Mosquito Control Technicians and Vector Biologists in their daily operational work activities. This position comprises an active component of the District's support staff that collaborates to assist the District Manager in planning, organizing, directing, and evaluating the District's mosquito control program. Supervises and evaluates directly, the responsibilities and daily activities of operational field staff; maintains organized files and records on the daily activities and work performance of the operational field control staff; evaluates the daily time records and service requests of operational field staff for timely completion, accuracy, and keeping up with work load; provides manager with weekly update of field control activities; budgets pesticide purchases for the year; purchases pesticides and keeps records of pesticide use, completes a monthly pesticide use report; sets up and maintains sentinel chicken flocks and collects biweekly samples in coordination with District Entomologist; assists in hiring and recruiting prospective regular operational control employees; assists in planning, organizing and implementing elements of the operational control program; assists in training and instructing new and current operational field employees on pesticide safety and application methods including calibration of equipment; helps resolve, individually, when necessary, public complaints arising out of District field activities; collaborates occasionally, with outside agencies to coordinate and facilitate the operational field control work of the District; keeps informed on current developments in mosquito and vector control; maintains certification and supervisor training by attending technical and job-related sessions, seminars, and continuing education classes; attends Coastal Region supervisor meetings; keeps a neat and professional appearance; performs occasionally other tasks or functions not stated in this description, but within the scope of experience and capability; and performs related work as required.

Control Staff:

Assistant Mosquito Control Technician (AMCT): The Assistant Mosquito Control Technician is responsible for accomplishing a wide variety of control work within assigned zones and/or as a team member for a number of zones. Primary responsibility is that of mosquito abatement but may also include other work as required by the District. Responsibilities include the application of comprehensive mosquito control measures with major emphasis on activities designed to inspect and/or proactively reduce the number of breeding places (sources) within an assigned area; conducts surveys of the assigned zone for mosquito breeding sources such as ponds, catch basins, marshy areas, rainwater and pastures; inspects sources for mosquito breeding and collects samples for the identification of species, stage of larval development and notes other environmental factors such as drainage patterns, water related plants and biological control agents; sprays areas for temporary control when there is not another practical means of preventing mosquitoes from developing into the adult stage; re-inspects sprayed areas to evaluate effective kill; keeps records of work done, advises residents regarding mosquito problems and the need for mosquito control; work may include walking long distances through rough and/or wet marshy field conditions, both to inspect and to spray with hand cans (20 lb.) and backpack sprayers (30 - 40 lb.); drives and sprays from automotive equipment and operates hand and power spraying equipment; keeps spraying equipment in working order, performs simple maintenance and repairs; may be involved in lubrication and repair of vehicles and facility maintenance, assist in mechanical maintenance, repairs, fabrications, etc.; prepares and revises operational maps of zones and areas in the district including properties, ponds, topographic characteristics and other features relevant to mosquito control operations, records significant changes on maps and compiles data as required by daily time cards, service requests, mosquito population histories and otherwise assists in collection and compilation of data; utilizes service request data to assist in determination of zone source inspection program; performs source reduction work and support such as brushing creeks and cutting ditches for drainage, levee and tide gate maintenance, etc.; work may include shoveling mud and debris from 2 to 3 foot deep ditches and lifting heavy (30 to 40 lb.) shovel loads onto the side of bank; also, heavy wheelbarrows full of dirt, mud, water and/or debris may be pushed over rough terrain to remove it from the work area; attends training sessions, reads agency manuals and otherwise keeps informed of policies and procedures, keeps support staff informed of progress and problems.

Mosquito Control Technician (MCT): The Mosquito Control Technician is responsible for accomplishing a wide variety of control work within assigned zones and/or as a team member for a number of zones. Primary responsibility is that of mosquito abatement but may also include other work as required by the District. Responsibilities include the application of comprehensive mosquito control measures with major emphasis on activities designed to inspect and/or proactively reduce the number of breeding places (sources) within an assigned area; Conducts surveys of the assigned zone for mosquito breeding sources such as ponds, catch basins, marshy areas, rainwater and pastures; Maintains records of flooding patterns and practices and other factors conducive to mosquito breeding and of significance to timing of operations; inspects sources for mosquito breeding and collects samples for the identification of species, stage of larval development and notes other environmental factors such as drainage patterns, water related plants and

biological control agents; sprays areas for temporary control when there is not another practical means of preventing mosquitoes from developing into the adult stage; re-inspects sprayed areas to evaluate effective kill; keeps records of work done, advises residents regarding mosquito problems and the need for mosquito control, source reduction and the presence of the mosquito abatement personnel; work may include walking long distances through rough and/or wet marshy field conditions, both to inspect and to spray with hand cans (20 lb.) and backpack sprayers (30 - 40 lb.); drives and sprays from automotive equipment and operates hand and power spraying equipment; keeps spraying equipment in working order, performs simple maintenance and repairs; may be involved in lubrication and repair of vehicles and facility maintenance, assist in mechanical maintenance, repairs, fabrications, etc.; prepares and revises operational maps of zones and areas in the district including properties, ponds, topographic characteristics and other features relevant to mosquito control operations, records significant changes on maps and compiles data as required by daily time cards, service requests, mosquito population histories and otherwise assists in collection and compilation of data; utilizes service request data to assist in determination of zone source inspection program; performs source reduction work and support such as brushing creeks and cutting ditches for drainage, levee and tide gate maintenance, etc.; work may include shoveling mud and debris from 2 to 3 foot deep ditches and lifting heavy (30 to 40 lb.) shovel loads onto the side of bank; also, heavy wheelbarrows full of dirt, mud, water and/or debris may be pushed over rough terrain to remove it from the work area; attends training sessions, reads agency manuals and otherwise keeps informed of policies and procedures, keeps support staff informed of progress and problems, and requests consultation with individuals or the group as necessary.

Vector Biologist: The Vector Biologist carries out a thorough inspection and treatment program for mosquito control in an assigned zone(s); identifies both larval and adult stages of the species of mosquitoes found in Alameda County; coordinates the work of team members within assigned zone(s); follows District safety procedures and other regulatory requirements when using pesticides and District equipment; plays a significant role in disease surveillance, entomological research, mapping, public education, public relations (including interviews with TV, radio and print media), training of new employees, equipment and facility maintenance programs; prepares daily work reports and maintains a record of activities using hand held computers (palm pilot) and Vector Control Management System software; possesses basic computer skills; other duties may be required.

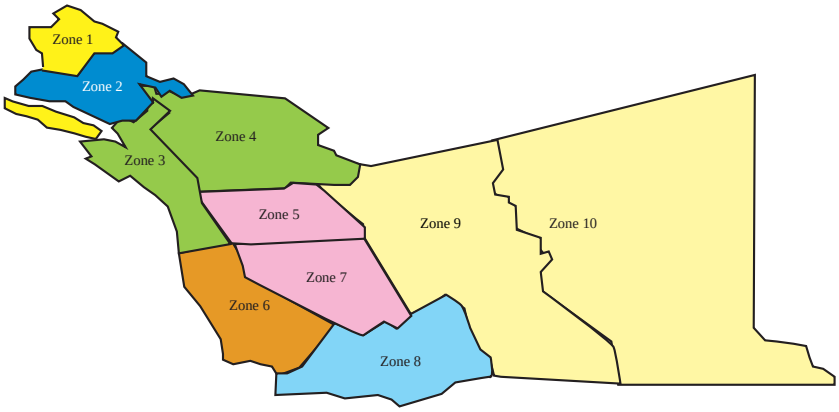
EDUCATION AND TRAINING

District field employees are certified by the California Department of Public Health in mosquito control. To obtain this certification an employee must pass a general examination on pesticide use, and a second examination on the biology and control of mosquitoes. The California Department of Public Health also provides certificates for invertebrate vector control and vertebrate vector control. Most of the District employees have all three certifications. To maintain their certification an employee is required to take a minimum of 40 hours of continuing education every two years.

District personnel also receive training in First Aid, driving safety, CPR, equipment operation and maintenance and operation of District shop equipment. The District also sends employees to special training that is of immediate operational use or long term skill development such as GIS mapping, environmental impact analysis, special equipment maintenance, welding, computer programing, etc. Currently (2011), ten of the District employees have college degrees. Five of our staff have degrees in entomology (1 with a PhD).

FIELD ORGANIZATION

To provide effective and efficient mosquito control, ACMAD is divided into ten zones. These zones tend to be divided along topographic, transportation and political lines. Zones are divided to distribute work load based on population, annual calls and source types. Each zone is assigned to a person who has the primary responsibility for control within the zone. Most control activities can be accomplished by one person. When more than one person is needed or specialized equipment (e.g., helicopter, or all-terrain vehicles) is required, the assigned person coordinates the activity. The assigned person maintains the source records, answers service calls, provides control activities and coordinates team control activities within his/her zone.



Generalized Map of Current Zones

The zone concept used for organization of control activities has proved valuable for many years. This concept provides:

Accountability: One assigned person is accountable for the effective and efficient control of mosquitoes within their zone.
Knowledge: It requires a number of years experience to acquire knowledge of the types of sources, species of mosquitoes, special problem areas and timing to control mosquitoes in a zone.
Continuity: This organization ensures continuity over the years in applying control measures and needed follow-up within each zone.

All of the District's field personnel have assigned zones and also team up to share efforts when needed or to serve as a substitute when the primary assigned person is not available. Thus, the work load on each person is kept more balanced. Zone assignments occasionally change, and many of the District's personnel have worked in different zones, giving them broader knowledge of the whole District.

In addition to zone assignments, many District personnel have specialized skills for serving the whole District. These skills include operation of specialized treatment equipment, making public presentations, repairing equipment, welding, working on data systems, doing needed research, maintaining reference insect collections, maintaining disease monitoring chicken flocks and creating maps or graphical and photographic work.

DISTRICT FACILITIES AND EQUIPMENT

Front exterior view of the remodeled building

In 1984 the District relocated to a centralized facility and disposed of three smaller branch facilities. The new facility had an office, laboratory, shop for maintenance, parking for District vehicles, pesticide storage building, employee and guest parking and fish holding tanks. In 2007 the building was remodeled and 3,700 feet were added. The addition included a new laboratory, technician room, library, wood shop, and additional support staff offices.

District Office:

The District office has a board meeting room, offices for support staff and manager, technician room, library, laboratory, museum curation room, testing room, colony rooms, lunch room, handicap-accessible restrooms and storage for supplies.

District Facilities:

Vehicle Parking: District facilities have ample parking for all District employee's and visitor's vehicles.

Maintenance Shop: The District has a large well equipped maintenance shop which includes a vehicle lift, overhead rolling crane, welding booth, lubricants dispenser, air compressor, tire changer, shop tools (drills, cut off saws, grinders, hand tools, etc.) and storage for general supplies. A wood shop was added on to the building during the remodel.

Storage Buildings: The facilities have specialized storage facilities for pesticides that meet the current requirements for safety. There is general storage for equipment and supplies.

Fish Tanks: The District has two tanks for holding fish stocks.

District Equipment:

General Use Vehicles: The District maintains a fleet of vehicles for general operations and mosquito control consisting of a SUV, a van, 14 pick-up trucks and specialized vehicles. Pick-up trucks used for mosquito control in zones are generally equipped with gas powered 50-100 gallon spray rigs, lock boxes for storage, spill kits, collection equipment, tools, hand cans and/or backpack sprayers and fish transport containers. All are identified with the District logo on the door panels.

Right Hand Drive Pick-Ups/Jeeps: The District has one right hand drive pick-up truck and two jeeps for use in inspecting and treating road side ditches and storm drains. These are equipped with electric spray rigs.

Boats: The District has two boats and an outboard motor for use in deep water sources - 14' aluminum and 12' wood.

ULV Foggers: The District has three ultra low volume (ULV) applicators. Two can be mounted in a truck and their application is computer controlled based on truck speed. The other ULV is a hand held Leco unit for use in small areas.

District all terrain vehicles: The District currently uses two types of all terrain vehicles to obtain access to mosquito producing sources.

Argo: Argos are eight-wheeled, plastic body all terrain vehicles manufactured by Ontario Drive and Gear Limited. These are run with tracks. These vehicles can carry two people and a 50 gallon spray rig. They are used for monitoring and treatment. The District currently owns 4 Argos.

Polaris: The District has one 6x6 Sportsman all terrain vehicle with a tilt bed maunfactured by Polaris. It is a single rider, six-wheeled ATV with a 22 gal electric spray rig. It is used for monitoring and treatments.

REGULATION, COOPERATION AND PARTICIPATION

The District is an Independent Special District created pursuant to state statute (Health and Safety Code division 3, Chaper 1, commencing with section 2000). The District, as authorized by state law, and through its Board of Trustees and staff, governs the control of mosquitoes in the environment within the District's boundaries. This action is subject to and done in accordance with District criteria regarding mosquito control that guide when, where, whether and how to control mosquitoes. District actions are subject to various federal and state laws that regulate mosquito control and environmental protection. The District operates as a regulatory agency but is subject to regulations by:

Federal Agencies:

Army Corps of Engineers (ACE): District physical control projects involving wetlands and water courses are subject to ACE permit review and approval. The District also participates in the interagency review process within ACE, giving the District input during the planning stage of proposed projects to present guidelines on mosquito reduction techniques on wetlands.

Environmental Protection Agency (EPA): The District uses only pesticides registered by the EPA and complies with laws relating to pesticide usage. California EPA administers theses laws and some additional registration requirements put into place by the state to supplement federal laws and regulations.

Occupational Health and Safety Administration (OSHA): The District complies with OSHA regulations and requirements. The District participates in the small employer voluntary compliance program for safety, and voluntarily requests annual safety inspections to help prevent accidents. OSHA laws and regulations are administered by California OSHA.

United States Fish and Wildlife Service (USFWS): The District complies with laws and regulations relating to endangered and theatened wildlife and habitats. The District also coordinates with the Service about refuge lands located within Alameda County. Control on USFWS properties are subject to approval of Pesticide Use Proposals (PUPs) and local restrictions on entry related to nesting seasons.

State of California Agencies:

California Department of Fish and Game: The District complies with laws and regulations relating to transport and use of biological control organisms (fish) and endangered and threatened species protection. The District also coordinates with this Department in relations to refuge wetlands owned by the state.

California Environmental Protection Agency (Cal-EPA): This agency administers federal and state environmental laws and regulations.

California Department of Pesticide Registration (DPR): This agency is part of Cal-EPA and is responsible for all aspects of pesticide sales and use to protect public health and the environment. It is active in registering pesticides for use in California.

San Francisco Regional Water Quality Board: The Board is also part of Cal-EPA and has the mission to protect surface and ground waters of the San Francisco Bay region. They also issue permits for physical control projects.

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

California Department of Public Health (CDPH): The District enters into an annual Cooperative Agreement with CDPH. The agreement determines how the District activities will comply with certain standards concerning mosquito control and pesticide use. It also requires record keeping and monthly reporting of pesticide use to the County Agricultural Commissioner. CDPH ia also responsible for the certification of mosquito control technicians and their continuing education.

Regional Agencies:

East Bay Municipal Utilities District (EBMUD): This District is a major landowner and operates water treatment facilities.

East Bay Regional Park District (EBRPD): The Park District is a major landowner of wetlands. The District coordinates mosquito control activities with EBRPD.

Local Agency Formation Commission (LAFCO): LAFCO regulates and coordinates governmental services, consolidations and creation of new agencies.

San Francisco Bay Conservation and Development Commission (BCDC): Wetland projects along the Bay require a permit from BCDC. BCDC regulates all filling and dredging in San Francisco Bay, regulates new development within the first 100 feet inland from the Bay, maximizes public access to the bay and participates in planning.

Local Agencies:

County of Alameda:

Alameda County Agricultural Commissioner: The District provides the Agricultural Department with monthly reports of pesticide usage and is subject to periodic inspections of equipment, facilities and records.

Alameda County Flood Control District: This District is a major land owner of channels, creeks and flood control infrastructure

Alameda County Vector Control District: This District provides information and assistance for the control of non-mosquito vectors.

Cities: The District complies with specific city requirements relating to pesticide usage within their boundaries.

Hayward Area Shoreline Planning Agency (HASPA): This agency is responsible for protection and planning of development along the Hayward bay shoreline. The District participates in this process.

Hayward Fire Department: The District complies with local fire regulations and materials storage requirements and is subject to periodic facilities inspections.

Special:

Vector Control Joint Powers Agency (VCJPA): This is a special district formed by the participating vector and mosquito control districts in California to provide insurance pooling and administration for Worker's Compensation, vehicle insurance and general liability insurance. The District complies with their requirements and participates in the VCJPA training programs to reduce risks to the District.

Participation:

San Francisco Bay Joint Venture (SFBJV): This is a partnership of 22 public agencies, environmental organizations, business groups and agricultural interests working cooperatively to protect, restore, increase, and enhance wetlands, riparian habitat, and associated uplands throughout the San Francisco Bay Region. The District is an ex-officio member.

South Bay Salt Pond Restoration Project (SBSPRP): The South Bay Salt Pond Restoration Project is the largest tidal wetland restoration project on the West Coast. The goals of the project are to restore and enhance a mix of wetland habitats, provide wildlife-oriented public access and recreation, and provide for flood management in the South Bay. The District is one of 26 Stakeholder Forum members.

Seasonal Wetland Enhancement Committee (SWEC): A partnership of East Bay Reional Parks, Flood Control, Department of Fish and Game, BCDC, U. S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the District to explore alternative mosquito control in salt marshes.

University of California Research: The District independently, and with the MVCAC, participates in supporting research related to mosquito biology and control.

Memberships:

American Mosquito Control Association (AMCA): The District is a member of the Association and generally sends one or more employees and trustees to the annual AMCA conference.

California Special Districts Association (CSDA): The District is an active member of this association.

Entomological Society of America: The District is an active member.

Mosquito and Vector Control Association of California (MVCAC): The District is an active member of the Association and participates in its committees, conferences and training programs. The Association and its member districts participate in the U. S. Environmental Protection Agencies Pesticide Environmental Stewardship Program. District employees have presented numerous papers before these conferences.

Society of Vector Ecologists (SOVE): The District is an active member of this society and participates in the organization's conferences.

DISTRICT PUBLIC INFORMATION PROGRAM

Public Contact

Field Personnel: Direct contact with the public during service calls, routine source inspections and informal contacts are one of the most important forms of public contact. These are person-to-person contacts that are generally problem oriented and information is of immediate interest and use to contacted persons. Each Technician comes into contact with many individuals during the course of their control and inspection activities.

Special Events: In an effort to reach as many people as possible, the District participates in a wide variety of special events. Such events are Home and Garden Shows, the Alameda County Fair, government information events, "Bug Days" at nature centers, watershed and wetland events or presentations to garden clubs etc. These type of events give the District a way to reach large numbers of citizens and provide information about District services.

Special Presentations: Periodic presentations on West Nile Virus, mosquito biology, sources, and prevention and the work done by the District are made to City Councils, government agencies and political representatives. The District occasionally provides speakers to organizations such as Pesticide Applicators Professional Association, Pacific Gas and Electric Company, Lawrence Laboratory and other government agencies. District personnel have also submitted and presented professional papers at the Mosquito and Vector Control Association of California annual conferences on research done by the District.

Miscellaneous Insect Identifications: One of the services provided by the District is the identification of insects submitted by the public. The District staff will examine specimens and provide indentification, biolological information (if available) and recommendations on where to obtain additional information or contact other agencies involved with the identified insect.

Classroom presentations: District personnel will make presentations in school classrooms or on field trips to provide specialized information about the District and mosquito control. These are done on a time available basis at a teacher's request.

Media Contact:

Television and Radio: District personnel are available for interviews and provide special information for media stories. On some occasions the District will notify the media of upcoming projects, special problems or issues for the media to feature. Press releases with updates on West Nile Virus or mosquito control activity in Alameda County are also sent out a few time a year.

Newspapers and Magazines: District personnel are available for interviews and provide special information and photo opportunities for newspaper or magazine stories. On some occasions the District will notify the newspapers of upcoming projects, special problems or issues for the newspapers to feature. Press releases with updates on West Nile Virus or mosquito control activity in Alameda County are also sent out a few time a year.

Newsletters: District personnel are available for interviews and provide special information and photo opportunities for newsletter stories. On some occasions the District will notify groups of upcoming projects, special problems or issues for their newsletters to feature.

Public Information Publications

Biennial Reports: The District produces a biennial report at the end of each odd-numbered year. These are printed and generally available in January or February of even numbered years. The biennial reports are distributed to governmental organizations, newspapers, political representatives and upon request, to members of the public.

Board of Trustees Information: Three special items are produced for the meetings of the Board of Trustees - agenda, meeting minutes and an operations report for each month. Board meeting agendas are posted at the District office. Agendas, minutes and operational reports are mailed to newspapers, governmental agencies and requesting members of the public. Copies of these are also posted on the District web site.

Public Information Brochures: The District produces a number of publications and provides some publications from other related agencies for distribution to the public. The District currently provides the publications below:

District Brochure (16 pages): This is a general publication about District services, miscellaneous mosquito-like insects, mosquito biology, mosquito prevention and a source checklist.

Mosquito Prevention for Fish Ponds (16 pages): General information to fish pond owners for managing their ponds to be free of mosquitoes. This publication discusses proper construction, maintenance, pond removal, mosquito biology, mosquitofish, natural predators and checklist of pond problems.

Mosquitofish Prevention for Water Troughs(4 pages): A brief description of mosquitofish, the danger of chloramines, the type of algae found in troughs, and the District's fish stocking policy.

West Nile Virus: An informational brochure that discusses what West Nile Virus (WNV) is, who is at risk, how it is spread, and how to prevent the spread of WNV. General WNV information in Spanish and Chinese is also included.

Mosquito Abatement, West Nile Virus and You (4 pages): A brief summary of WNV, what the District is doing in response, and steps homeowners can take to protect themselves.

Control de Mosquitos (Zancudos) (4 pages): A bilingual (Spanish with English translation) brochure providing information on mosquito breeding sites, source elimination, and how to protect yourself from mosquito bites.

Tree Hole Mosquitoes (4 pages): A specialized publication about the Western tree hole mosquito (*Aedes sierrensis*) and dog heartworm.

Midges Non-biting Insects (4 pages): A brief description of midges, their identifying characteristics, and the most frequently encountered species.

Miscellaneous Brochures and Handouts: The District also provides brochures from other agencies such as the "Fight the Bite material" (produced in many different languages from the California Department of Public Health), DEET information brochures (in English and Spanish provided by the DEET Education Program), and other handouts that provide information on insect repellent effectiveness and commercially available products for the homeowner.

District Website:

The District maintains a website to provide mosquito control and related information on the internet. The District web address is www. mosquitoes.org. Most of the District's publications are available on the site, such as Board of Trustees' documents (agendas, minutes and operational reports), specialized technical information (mosquito biology, bibliographies, and technical reports), a resource area for classroom teachers to find information about insects and mosquitoes on the internet, and additional general information about District services and links to other related websites. The District website also supports the Mosquito and Vector Control Association of California by providing links and special information

INTRODUCTION TO THE DISTRICT MOSQUITO CONTROL PROGRAM

In order to accomplish long-range, intelligent, and environmentally sound mosquito control, the management and manipulation of mosquitoes must be accomplished using not just one but all available pest control methods. This dynamic combination of methods into one thoughtful, ecologically-sensitive program is referred to as Integrated Pest Management (IPM). Sometimes when referring to vector mosquitoes, this program is referred to as Integrated Vector Management (IVM). The District's mosquito control program employs IPM principles by first determining the species and abundance of mosquitoes through larval and adult surveys and then using the most efficient, effective and environmentally sensitive means of control. In some situations, water management or source reduction programs can be instituted to reduce breeding areas. The District also considers biological control such as the planting of mosquitofish (*Gambusia affinis*). When these approaches are not practical or otherwise appropriate, then a pesticide program is used so that specific breeding areas and/or adult mosquitoes can be treated.

Alameda County contains many sources that act as mosquito and vector breeding areas near populated areas. Without ongoing and effective mosquito control, the human environment would be significantly and adversely affected by substantial mosquito activity. The District's mosquito control program, including biological and chemical control, is essential to abate the vectors in the environment to a tolerable level. The District's program will never alleviate all mosquitoes vectors. Rather, it is a resource maintenance program aimed at striking a balance to allow comfortable and healthful human existence within the natural environment, while protecting and maintaining the environment. History has shown us that the control and abatement of vectors are necessary for our human environment to continue to be habitable.

Program Orientation:

The District mosquito control program is directed primarily at the larval stages of mosquitoes and the sources of mosquitoes. Control activities are contained to a localized area and have a lower impact utilitizing this approach, because the larvicides used by the District specifically target the mosquito's biological systems. Although adult mosquitoes may be targeted for control, this is only in emergency and very localized situations, and it is not the emphasis of the District program. Focusing on breeding larvae requires that control be effected in a number of different types of mosquito sources. Below is a listing of the basic types of sources targeted in the District control program.

Definitions of Source Types:

Sources are any place that hold water and provide a habitat for mosquito larvae to grow. The sources defined below are the types generally used by the Alameda County Mosquito Abatement District for describing the place where mosquito larvae are found or adult mosquitoes have emerged. The decision to control the mosquitoes found in a specific source is dependent upon the mosquito species, flight range of the mosquito species, distance to human or animal hosts, and the ability of the mosquito species to carry human or animal disease.

Canal: Large ditch with flood control gate.
Catchbasin: Basins used to collect and direct runoff water. Found in streets, parking lots, loading docks or private driveways.
Container, Large: 100 gallon or more container.
Container, Small: Container holding less than 100 gallons such as urns, troughs, buckets, flower pots, etc.
Creek: Creeks, streams and potholes. Natural.
Ditch: Roadside, railway, and other long excavations. Manmade.
Gutter: Street gutters where water accumulates.
Leak: Leaking water pipes.
Marsh fresh: Shallow marshy areas, artificial or natural with emergent vegetation.
Marsh reclaimed: Brackish/salt marshes not subject to natural tidal action, usually contained by levees or other water control structures.
Marsh tidal: Marshes subject to natural tidal action.
Mixed Catchbasin/Utility Vault/Sumps: Combination of sumps, catchbasins, vaults, manmade structures.
Natural pond: Lakes and ponds, including stock, duck ponds, and gravel pits.
Ornamental pond: Fish ponds, water garden, fountains, pots, tubs
Overwatering: Water pooled in lawns, gutters, etc. from overwatering
Rainwater: Places collecting storm water- puddles, fields, etc.
Sanitary: Sewer ponds, cesspools, sewer lines, septic tanks.
Seepage: Natural springs, ground water.

Spa: Spas and hot tubs.
Stormdrain: Pipe or culvert carrying storm water.
Swimming: Swimming pools.
Tires: Tire storage and disposal site
Treehole: Cavity in a tree holding water.
Under building: Water under a structure- basement, crawlspace, etc.
Vault: Subterranean room or space.
Well: Drilled or dug wells for water, usually old and no longer used.

MOSQUITOES TARGETED IN DISTRICT PROGRAM

The District targets mosquito species based upon their ability to carry human and animal disease and their ability to cause human discomfort. Some species do not come into contract with humans, cause discomfort or carry disease and are not generally considered targets in the District control program/project. Species not directly targeted in the District program are *Culex apicalis*, *Culex boharti*, *Culex stigmatasoma*, *Culex thriambus*, and *Orthropodomyia signifera*. These species are many times found in association with targeted species.

Below is a list of the mosquito species that have been found within the District:

AEDES
- *Aedes albopictus**
- *Aedes dorsalis*
- *Aedes melanimon*
- *Aedes nigromaculis*
- *Aedes sierrensis*
- *Aedes squamiger*
- *Aedes vexans*
- *Aedes washinoi*

ANOPHELES
- *Anopheles franciscanus*
- *Anopheles freeborni*
- *Anopheles occidentalis*
- *Anopheles punctipennis*

CULEX
- *Culex apicalis*
- *Culex boharti*
- *Culex erythrothorax*
- *Culex pipiens*
- *Culex stigmatosoma*
- *Culex tarsalis*
- *Culex thriambus*

CULISETA
- *Culiseta incidens*
- *Culiseta inornata*
- *Culiseta particeps*

ORTHOPODOMYIA
- *Orthopodomyia signifera**

*Twenty-two species of mosquitoes have been found in or are assumed to be in Alameda County. *Orthopodomyia signifera* has onlybeen found in the adult form. *Aedes albopictus*, the Asian Tiger Mosquito has been found in an imported tire (1986) and "lucky bamboo" plants (2001) from China. No further detections have been made. In addition to the above twenty-three mosquitoes, the District maintains surveillance for other imported or introduced mosquito species that may have the potential to establish themselves in the Bay Area.

Mosquitoes of Alameda County

	Species	Most Common Larval Habitats	Adult Prevalence	Source of Blood Meal	Disease / Pest Significance	Notes
AEDES	**Salt marsh mosquito** *Aedes dorsalis*	Salt marshes	All Year	Animals and Man	High Pest Significance	Most common in the summer after high tides
	Asian tiger mosquito *Aedes albopictus*	Small Containers, Tires	Spring - Summer	Animals and Man	High Pest Significance Vector of Dengue	Found only in an imported tire and lucky bamboo
	Aedes melanimon	Irrigated Fields	Spring - Summer	Animals and Man	High Pest Significance	
	Pasture mosquito *Aedes nigromaculis*	Irrigated Fields	Spring - Summer	Animals and Man	High Pest Significance	uncommon
	Treehole mosquito *Aedes sierrensis*	Treeholes, Tires, Miscellaneous Containers	Spring - Summer	Animals and Man	High Pest Significance Vector of Canine Heartworm	A small mosquito.
	Winter salt marsh mosquito *Aedes squamiger*	Salt Marshes Reclaimed Marshes	Spring	Animals and Man	High Pest Significance	targeted during winter months
	River mosquito *Aedes vexans*	Temporary Pools	Spring	Animals and Man	High Pest Significance Vector of Canine Heartworm	Rarely found
	Woodland pool mosquito *Aedes washinoi*	Temporary Woodland Pools	Spring	Animals and Man	High Pest Significance	
ANOPHELES	*Anopheles franciscanus*	Shallow Pools and Streams in Algae mats	Summer	Large Animals and Occasionally Man	Low to Moderate Pest Significance	
	Western malaria mosquito *Anopheles freeborni*	Seepages, Streams, Lakes, Gravel Pits	Summer	Animals and Man	Low Pest Significance Vector of Malaria	
	Anopheles occidentalis	Streams, Lakes, Pools Occasionally in Brackish Water	Summer	Animals and Occasionally Man	Low Pest Significance	
	Anopheles punctipennis	Temporary Pools, Streams	Summer	Animals and Man	Moderate Pest Significance Vector of Malaria	
CULEX	*Culex apicalis*	Woodland Creeks, Pools	Summer	Amphibians and Reptiles	No Pest Significance	Rarely found
	Culex boharti	Slow Streams, Pools	Summer	Amphibians and Reptiles	No Pest Significance	Rarely found
	Tule mosquito *Culex erythrothorax*	Lakes and Ponds Associated with Tules	Spring - Summer	Birds, Animals, Man	High Pest Significance Vector of Encephalitis	
	House mosquito *Culex pipiens*	Storm Drain Systems, Septic Tanks, Roadside Ditches, Cemetery Urns, Flooded Basements, Utility Vaults	All Year	Birds, Animals, Man	High Pest Significance	Uusally bites indoors at night. common in urban areas.
	Foul water mosquito *Culex stigmatosoma*	Foul Water, Sewage, Temporary Pools	All Year	Birds, Rarely Feeds on Man	Low Pest Significance	Rarely found
	Encephalitis mosquito *Culex tarsalis*	Creeks, Marshes, Temporary Pools, Roadside Ditches, Fresh Water	All Year	Birds, Animals, Occasionally Man	Moderate Pest Significance Vector of Encephalitis	
	Culex thriambus	Rock pools, isolated ponds, Hoofprints along streams and creeks	All Year	Birds	No Pest Significance	Rarely found
CULISETA	**Fish pond mosquito** *Culiseta incidens*	Fish Ponds, Temporary Pools, Catch Basins, Roadside Ditches	All Year	Large Animals and Man	High Pest Significance Possible Vector of Canine Heartworm	Common in urban areas.
	Winter marsh mosquito *Culiseta inornata*	Marshes, Temporary Pools, Roadside Ditches	Fall - Spring	Large Animals and Man	High Pest Significance	
	Culiseta particeps	Shaded Clean Pools, Streams	Fall - Spring	Animals and Occasionally Man	Low Pest Significance	
	Orthopodomyia signifera	Treeholes	Spring - Summer	Animals and Occasionally Man	Low Pest Significance	Adults found in light trap larvae not found

MOSQUITO SPECIES

ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT

✖ **Common**
✿ **Occasional**

Source Type	*Aedes*							*Anopheles*				*Culex*							*Culiseta*			Other
	dorsalis	*melanimon*	*nigromaculus*	*sierrensis*	*squamiger*	*vexans*	*washinoi*	*franciscanus*	*freeborni*	*occidentalis*	*punctipennis*	*apicalis*	*boharti*	*erythrothorax*	*pipiens*	*stigmatasoma*	*tarsalis*	*thriambus*	*incidens*	*inornata*	*particeps*	*Orthopodomyia signifera*
Canal								✿	✿		✿			✿	✖	✿	✖		✿			
Catchbasin															✖	✿			✿			
Containers, small				✖											✿		✿		✖			
Containers, large				✿											✿		✖		✖			
Creek								✖	✖	✿	✖	✿	✿		✿		✿	✿	✿	✿	✖	
Ditch							✿		✿					✿	✿		✖		✿	✿		
Gutter				✿															✿			
Leak															✿				✿			
Marsh fresh					✖		✖			✿				✖			✖		✿	✖		
Marsh reclaimed	✖				✖		✖										✿			✿		
Marsh tidal	✖																✿			✿		
Mixed CB, UV, sump															✖	✿			✿			
Natural pond						✿	✖	✿		✿				✿			✿		✿	✿		
Ornamental pond				✿											✿				✖	✿		
Overwatering															✿		✿		✿			
Rainwater	✿	✿	✿	✖	✖	✿	✖								✿		✖		✿	✖		
Sanitary															✖	✿						
Seepage															✿		✿		✿			
Spa				✿											✿				✖			
Stormdrain															✖	✿			✿			
Swimming															✿		✖		✿			
Tires				✿											✿				✿			
Treeholes				✖															✿			✖
Under building															✖							
Vault															✖							
Well															✖							

ALAMEDA COUNTY MAD'S MOST IMPORTANT MOSQUITOES

(Causing over 99% of all service calls from the public)

Aedes dorsalis **(Salt marsh mosquito)**
This species is found year round in tidal salt marsh areas but is most common after summer high tides. The eggs are laid in the marsh and hatch when the marsh is filled by high tides. Control is by application of biorationals and physical modifications. Most of the sources are in ecologically sensitive areas and require great care to avoid damage. Adults are very aggressive, fly moderate distances, and are capable of producing very high numbers of service requests near marsh areas, especially in large grassy areas such as schools and parks.

Aedes squamiger **(Winter salt marsh mosquito)**
This species is produced in the marshes along the edges of the Bay. The eggs are laid on the marsh in the spring and hatch as soon as the marsh fills with rain water in the fall. Adults emerge the following spring. Most of the control effort occurs during the winter. Control is by physical modifications to the marshes and by spraying with biologically-based larvicides. Many of the marsh sources are ecologically sensitive areas requiring coordination with other agencies. Adults can fly long distances (up to 20 miles). The adult is a very aggressive biter and is very noticeable to the public. This species is capable of reaching very high numbers.

Aedes sierrensis **(Treehole mosquito)**
This species breeds in treeholes (rot cavities or depressions in trees which hold water). Containers such as tires and buckets located near trees and partially filled with organic debris may also produce these mosquitoes. The eggs hatch when the treehole or container fills with water. The adults hatch in March and remain in the area until early summer. This mosquito has a short flight range, is an aggressive biter, and is the primary vector of Canine Heartworm in Alameda County. It is found in any area where there are treeholes. The District is currently using biorational materials for control of this species.

Aedes washinoi **(Woodland pond mosquito)**
This mosquito is produced in woodland depressions that fill with water. Eggs are laid on the mud and organic material along the edges of receding water in these areas. Adults are generally present in the early spring, are very aggressive, and may be found in large numbers. Most of the control effort on this species is by use of biorational materials.

Anopheles freeborni **(Western Malaria mosquito)**
Larvae of these species are found in clear water that contains algae and is well-lit. In the fall, the adult female may travel long distances and enter homes while seeking overwintering sites. On warm days during the winter and in the spring, females emerge from overwintering sites and seek a blood meal. Females are large, aggressive, and active during the day. *Anopheles freeborni* was the primary vector of human malaria in the Sacramento Valley in the early 1900s and the principal reason mosquito control was instituted in California. Although malaria is no longer endemic to this state, this species is capable of vectoring the disease, should the pathogen be re-introduced. This species is best controlled with the use of bacterially-based larvicides.

Culex erythrothorax **(Tule mosquito)**
Larvae usually live in permanent or semi-permanent sources of water which contains large stands of cattails or tules. They are extremely sensitive to vibration and dive quickly so detecting them as immatures is difficult. Adult females feed at night equally on mammals and birds; they will feed on humans in the shade or after sunset. *Culex erythrothorax* can become a major pest to human and other vertebrates that reside near their breeding habitats. This mosquito has been found naturally infected with St. Louis Encephalitis virus, Western Equine Encephalitis virus, and West Nile Virus.

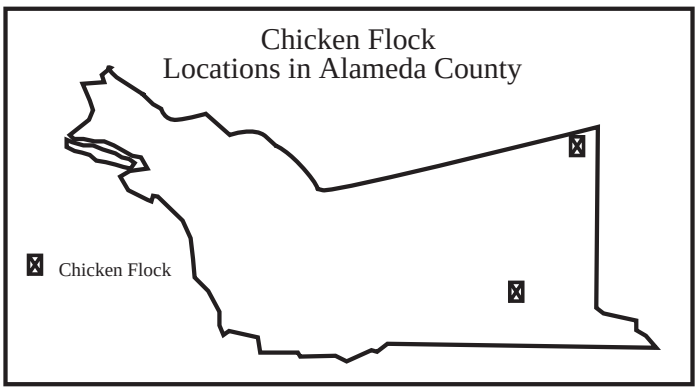
Culex pipiens **(House mosquito)**
This species causes the largest number of service requests in the District. This mosquito is generally an urban problem. The adult can be found all year and breeds in storm drains, catch basins, utility vaults, septic tanks, flooded basements, sumps, and in just about any water container found near human habitations. The adult readily enters homes and bites at night. Because of its preference for cryptic breeding sources, it can take many hours to locate the cause of a problem. Continual treatment and monitoring of sources is required to maintain control. This is the most important vector of West Nile Virus to humans.

Culex tarsalis **(Encephalitis mosquito)**
This mosquito is produced in rain pools, marshes, swimming pools, ponds, and other fresh water sources. Although this species does not produce a large number of the District's service requests, it requires a large control effort to prevent the potential spread of encephalitis in Alameda County. This species feeds primarily on birds and is only moderately aggressive towards man. *Culex tarsalis* is capable of reaching very high numbers. This species is an important vector of mosquito-borne encephalitis viruses and is therefore of special concern to mosquito and vector control districts. Control is by application of biorational materials and physical modifications to sources.

Culiseta inornata **(Winter marsh mosquito)**
This species rests during the summer and becomes active in the fall after the first rains. Eggs are laid on the surface of rain-filled ponds in the fall, and many generations can be produced in a single season. This mosquito bites at dusk in the fall and spring and is moderately aggressive, quite large, and may reach very high numbers. *Culiseta inornata* are very noticeable to the public because of their size and activity. This species is generally found close to temporary fresh water sources. Most of the control is by using biorational materials.

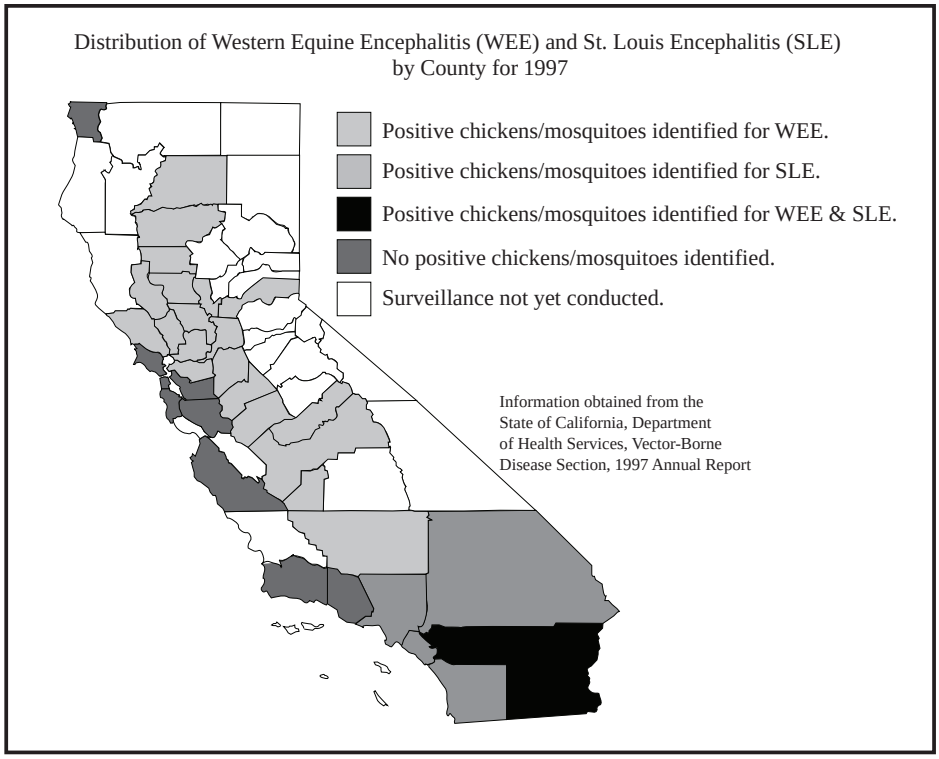
Culiseta incidens **(Fish pond mosquito)**
This mosquito is produced in fish ponds, creeks, and containers. It is the second major cause of service requests for the District. Small sources can produce sufficient numbers to cause discomfort in a neighborhood. This mosquito is moderately aggressive, bites in the evening or shade and is very noticeable because of its large size. It is primarily a problem of urban and suburban areas in summer and autumn. Control is by use of biorationals and mosquitofish.

MOSQUITO-BORNE DISEASES

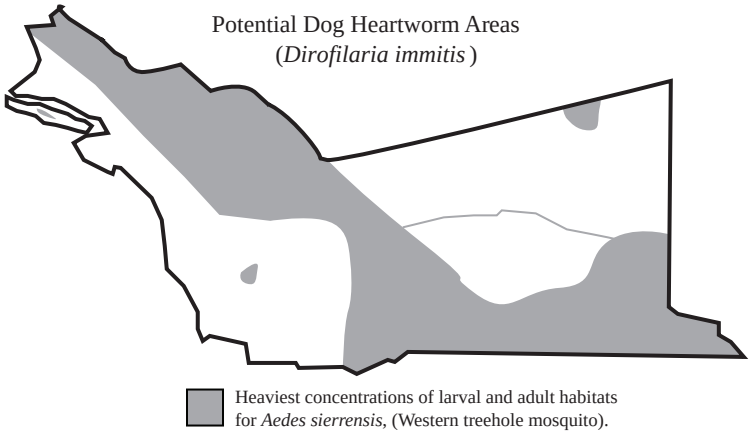


The District is concerned with a number of mosquito transmitted diseases that are endemic to California or could potentially be introduced into this County. The most important diseases are:

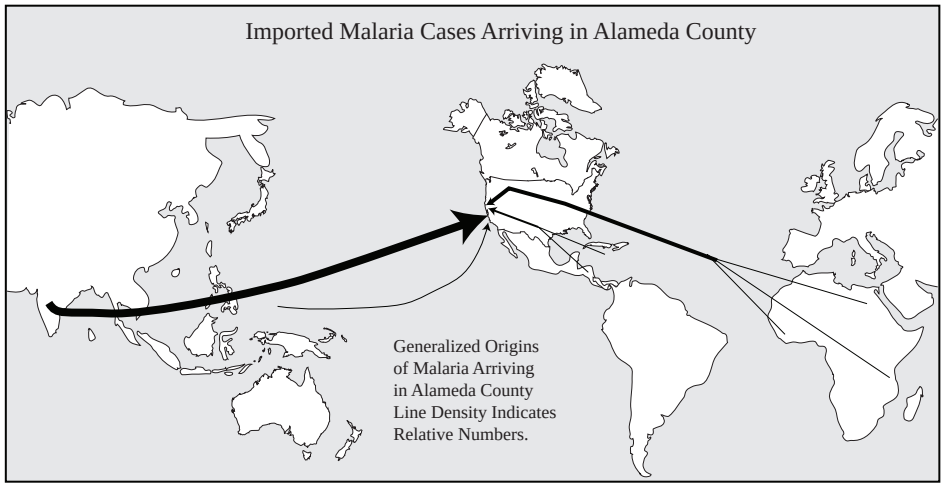
Viral Encephalitis: Encephalitis, an inflammation of the brain, can be caused by several mosquito-transmitted viruses. Typically, these viruses are transmitted by mosquitoes in the genus *Culex*. Historically, California has seen cases of Western Equine Encephalitis (WEE) and St. Louis Encephalitis virus. (See map, Distribution of Western Equine Encephalitis (WEE) and St. Louis Encephalits (SLE) by County for 1997). Much of the original surveillance system established by ACMAD was an effort to detect these viruses. Fortunately, there have never been documented cases of these viruses being transmitted in Alameda County. However, in 1999, a newly-introduced mosquito-borne encephalitis virus, West Nile Virus, was introduced into New York. It quickly moved across the country, arriving in California in 2003. The District was able to increase and enhance its surveillance program to prepare for its appearance in our County. Because of the public health significance of West Nile Virus, the detection and control of *Culex* mosquitoes has become a primary focus of the District.



Dog heartworm: This disease is caused by a parasitic roundworm, *Dirofilaria immitis*. It is transmitted to canines primarily by the Western treehole mosquito, *Aedes sierrensis.* Several other species are currently under study as possible vectors of this disease. It can be transmitted to cats, but in felines it is a dead end disease and does not retransmit to other animals. Information on the distribution and incidence of this disease comes from veterinarians in the county. Prevention is provided by prophylactic drugs and mosquito control. The Western treehole mosquito is commonly found in the rot cavities that form in many local trees. It will also use discarded tires, old fishponds, and most backyard containers as breeding sites. It is most commonly found in hill and riparian areas where there are plenty of trees. The District controls this mosquito by seeking out treeholes near homes and treating them with Altosid®, an insect growth regulator (IGR) in January and February.



Malaria: Although malaria is not presently considered a problem in California, malaria was found in California until the 1940's when it was finally eradicated. California had a high incidence of malaria from the 1850's until about 1920. This disease played an important role in organizing mosquito control in the state. Currently the District monitors cases of malaria that arrive from other countries by immigration and travel. Malaria is a reportable disease via the public health system. The public health departments monitor the patient in order to ensure treatment. All four forms of malaria have arrived in the County - Ovale, Malariae, Falciparum and Vivax. When a malaria case is reported, the District inspects all the sources of malaria vectors *(Anopheles freeborni, Anopleles punctipennis*) within 1 mile of the case. Field personnel determine if mosquitoes are present and what control may be needed.



MOSQUITO SURVEILLANCE

Introduction: The District is dedicated to protecting the public from both the discomfort of mosquito bites and potential mosquito-borne diseases. This responsibility involves monitoring (quantification) the abundance of adult and immature (larvae/ pupae) mosquitoes, and mosquito-borne disease occurrence over time and space. The practice of monitoring both mosquito densities and the diseases they carry is termed surveillance. Applied properly, surveillance provides the District with valuable information on what mosquito species are present, when they occur, where they occur, how many there are, and if they are carrying disease that affect humans. Equally important is the use of surveillance in evaluating the effectiveness of control actions in reducing mosquitoes and mosquito-borne human diseases.

Mosquito Surveillance Methodologies: Mosquitoes in nature are distributed within their environment in a pattern that maximizes their survival to guarantee reproductive success. Simply stated, this means that mosquitoes occur where they are likely to survive, mate, and produce young. One aspect of mosquito biology is the fact that immature stages develop in water and mature into a winged adult that is capable of both long and short range dispersal. This duality of their life history presents mosquito control agencies with unique circumstances that require separate surveillance strategies for the aquatic versus terrestrial life stages.

Mosquito control staff involved with performing surveillance duties are aware of the consequences of their actions in the field. Staff are instructed to be respectful of the environment and associated wildlife and are to proceed with an attitude to limit their impact to only what is necessary to perform their assigned tasks. Disregard for the environment and attendant abuses are not tolerated in the District's mosquito control surveillance operations.

In our mosquito control work, the District uses, whenever possible existing roads, driveways and trails. The District strives to minimize any off-road vehicle travel. When off-road travel is necessary, District staff is instructed to avoid threatened and endangered plants and sensitive habitat areas and to minimize any environmental damage. Off road vehicle operation is avoided in areas where there is dry vegetation to avoid fire danger.

Larval Mosquito Surveillance: District technicians are assigned specific geographical zones within the County. They refer to a list of known mosquito breeding sites and inspect them on a regular basis. Some sites are considered seasonal, and may only breed at specific times of the year. Larval surveillance is conducted by the use of a "dipper." This is a one pint cup attached to the end of a stick. Water is dipped or sampled for the presence of mosquitoes. Samples are examined in the field or laboratory for the abundance, species, and life-stage of mosquitoes present. This information is compared to historical records and used as a basis for treatment decisions (See the chart "Larval Treatment Criteria").

Adult Mosquito Surveillance: Adult mosquito surveillance is done for two primary reasons. First, it allows the technician to locate new, undiscovered sources of larval breeding, or calls attention to the fact that a known larval breeding source needs to receive closer inspection and treatment. Second, the collection of live adult mosquitoes is an integral part of the District's West Nile Virus surveillance program. Adult populations are sampled mostly with the use of two different types of traps. The New Jersey light trap is used in fixed locations where 110v electrical service is available. These traps consist of a 25 watt light bulb (the attractant) and a fan which are connected to a timer. During dusk, evening hours, and dawn, the trap is functioning and collecting night-flying insects into a jar that contains a pesticide strip. Jars are changed weekly. These traps are limited in that trap results are over a one week period, mosquitoes are killed when they enter the jar (rendering them useless for West Nile Virus testing), and different mosquito species show different levels of attraction to light sources, with mosquitoes in the genus *Aedes* showing the least attraction. Most significantly, these traps become less efficacious in areas of greater population density because of competing light sources. The second main trap type used by the District is the CDC trap, or CO_2 trap. This is a portable battery operated trap used to collect adults of nearly all species. The traps use dry ice –frozen CO_2- as the attractant, and adults are captured in a mesh bag. These traps are left out for a single night and picked up the following day, so adult mosquitoes are still alive and useful for virus testing.

Virus Surveillance: The District participates with the California Department of Public Health (CDPH) and The University of California in performing surveillance for mosquito-borne viruses, especially West Nile Virus. The District currently maintains two sentinel chicken flocks that are regularly tested for antibodies to virus. In addition, the District is a part of the CDPH's dead bird surveillance program, which encourages County residents to report dead birds that may be tested for West Nile Virus infection. And as mentioned, the District collects live adult mosquitoes and submits them to UC Davis' Center for Vector-borne Disease for West Nile Virus testing.

TRANSPORTATION AND ACCESS FOR MONITORING AND CONTROL

Access and transportation to potential and known mosquito producing sources is a necessity to accomplish surveillance and control treatments. It is necessary to be able to reach mosquito producing areas reliably, easily, safely and quickly with the minimum of environmental impact.

Normal mosquito surveillance and control necessitates the use of access roads, trails, and clearings to facilitate sampling. Roads allow vehicles to transport needed staff and equipment to specific sites. The ideal access is an all-weather surfaced road that then provides close foot access to all parts of a mosquito source. Vehicle access may necessitate requesting the owner to schedule periodic grading and gravel surfacing of roads or the periodic removal of some marginal vegetation and weed control on the median between the wheel ruts of established dirt/gravel roads. Foot access may require trails (2-3 feet in width) to the margins of wetlands, ponds, streams, and rivers that may require periodic vegetation removal by pruning if necessary.

The District depends on foot, general use vehicles, ATV (all terrain vehicle), boat and aerial travel access to mosquito producing areas for inspections and treatments. Below are descriptions of these and discussion on their uses, limitations, impacts and measures to avoid impacts.

Foot: Travel on foot is the most common access for inspections and treatments of small sources. Limited areas and distances can be covered on foot. There is always risk of injury from tripping and falling especially when carrying treatment equipment (hand cans, backpack sprayer, bulk materials such as granular insecticides) or crossing irregular or heavily vegetated areas. This form of atravel causes the least environmental impacts due to the District's access. Travel on foot is preferred when areas to be inspected or treated are of reasonable size. Foot travel allows careful avoidance of nests, critical micro habitats and endangered or threatened plants. Combined use of vehicles and foot travel can minimize vehicle impacts in sensitive habitats (entering sources on foot from vehicle or ATV access can be used to inspect and treat large areas). Mitigation: Personnel are provided with protective foot wear to minimize personal injury. Use foot access as much as possible from roads when checking or treating sensitive habitats. Remain out of areas when endangered or threatened birds are nesting. Change entry points when possible to avoid creating beaten paths.

General Use Vehicles: The District uses both two wheel and four wheel drive vehicles for field use to get close to mosquito sources. Two wheel drive vehicles are used in control areas that are primarily urban with little need for off road or dirt surfaced road driving (two of these vehicles are set up for right hand drive to facilitate urban storm drain inspection and treatment). Four wheel drive vehicles are provided for areas where dirt road and off road driving will be needed. Most of the District's field use vehicles are also equipped with electric or gas power spray rigs and are also able to pull a trailer with an ATV.

1. **Two wheel drive vehicles:** These are for urban and surfaced road use.
2. **Right hand drive vehicles:** Used in inspecting and treating road side ditches and storm drains.
3. **Four wheel drive vehicles:** These vehicles are used where off road or unsurfaced road travel is necessary.

These vehicles may create impacts on the environment during their normal operation:

Dust: Unsurfaced roads develop a layer of dust that will be disturbed and become airborne when a vehicle passes over them. Depending upon air flow in the area the dust may drift and settle onto surrounding vegetation. Mitigation: Travel speed is set at a level for each situation that minimizes dust and dust drift or travel is done on less dusty accesses if possible.

Rutting: Unsurfaced roads or land, when wet from rain may become too soft to drive without creating ruts. Conditions sometimes occur with the first rains of the season arrive that create a layer on top of the road of wet dust (mud) with dry dust or ground underneath. This will stick to tires or tracks and "peel" off the road creating large clods and ruts (generally this will also stop the vehicle when the wheel wells fill with mud, requiring another vehicle for retrieval). Mitigation: Travel is restricted until area stabilizes after first seasonal rains. Personnel may utilize other access points or substitute foot or ATV travel for vehicle travel.

Vegetation removal: Vegetation on the land or road may be removed by the scraping of the tires during driving or when making turns. Mitigation: Avoid fast or sharp turning and accelerate gently to avoid spinning tires. Personnel may utilize other access points or substitute foot or ATV travel for vehicle travel.

Vegetation crushing: Whenever a vehicle drives over vegetation, pressure from the weight of the vehicle will crush down on any vegetation. The amount of any permanent damage depends on the type of vegetation and the

condition of the vegetation. Most effects of crushing vegetation disappears as the vegetation returns to its normal stand or at worst last until the next growth season occurs. Mitigation: No vehicle travel is done on sensitive habitat areas or where vegetation is tender and subject to visible lasting damage.

Fire: California state law requires vehicles to be equipped with a catalytic converter that operates at high temperatures creating the potential for starting fires when driving in dry vegetation. Mitigation: Travel is not done in areas where dry vegetation is high enough to contact the converter and vehicles are not parked over dry vegetation. All vehicles are equipped with a fire extinquisher, a shovel and are in radio communication with the District office.

Wildlife: The act of traveling in off road or unsurfaced road areas can disturb wildlife or cause injury or death. Most disturbance from vehicle travel is of no lasting impact to wildlife. Animals and birds move to avoid a perceived threat. Injury, death or damage to nests may occur from direct contact with the vehicle. Mitigation: Personnel travel at reduced speeds during off road and unsurfaced road travel to allow birds and animals time to adjust to the vehicle and move out of the way. Potential nesting areas on roads or areas to be traveled are avoided. Access within visibility and disturbance range of Snow plover nesting areas are off limits to travel during nesting season (areas are delineated by wildlife officials and fortunately there are very few mosquito producing habitats in the preferred nesting areas).

All Terrain Vehicles (ATVs): The District relies upon the use of all terrain vehicles to facilitate access into areas that are not otherwise reasonably accessible by foot or general use vehicles. Some situations, where flooding and wetlands preclude access by 4-wheel drive or reasonable walking distance in waders/boots, require the use of an ATV. ATV's allow timely and effective inspection and treatment of large areas (over 5 acres) or areas where vehicle access cannot be used and greater distances need to be covered to reach mosquito sources. During the wet season, ATV's are used more extensively to enable personnel to cover more sources quickly. Overall, ATVs are used as transport of last resort. ATV's are used where:

1) existing passages are available,
2) vegetation does not impede mobility,
3) open water situations present the best course in which to proceed
4) size and distance makes the use of these vehicles necessary for effective and efficient use of time and
5) unacceptable environmental damage may occur if a general use vehicle is used.

District ATV's: The District currently uses two types of all terrain vehicles.

Argo: Argos are eight wheeled, plastic body all terrain vehicles manufactured by Ontario Drive and Gear Limited. These are run with tracks. Ground pressure is 2.1 psi. These vehicles can carry two people and a 50 gallon spray rig. Argos will float and can be equipped with an outboard motor for deep water use. These vehicles are used for monitoring and treatment.

Polaris: The District has one 6x6 Sportsman all terrain vehicle with a tilt bed maunfactured by Polaris. It is a single rider, six wheeled ATV with a 22 gal electric spray rig. It is used for monitoring and treatments.

The potential impacts from ATV use and the District's way of mitigating these impacts are discussed below:

Dust: Dust is generally never a problem as most ATV use is during the wet season.

Rutting: ATV travel is used because of the very low ground pressure from the vehicle on areas too soft for general use vehicle traffic. Even with the low ground pressure ruts can be created. Mitigation: Open mud and very soft areas are avoided during ATV use. Travel is done slowly and carefully on sensitive habitat areas (pickleweed marshes).

Vegetation removal: Vegetation may be removed by the scraping of the tires or tracks during operations or when making turns. Mitigation: Fast or sharp turning is avoided or turns are made on areas outside of the marsh such as levee roads. Personnel may utilize an ATV as a material supply point while inspecting or treating on foot. ATV travel is done slowly and carefully in sensitive habitat areas.

Vegetation crushing: Whenever a vehicle drives over vegetation, pressure from the weight of the vehicle will crush down on some vegetation. The amount of any damage depends on the type of vegetation and the condition

of the vegetation. Most effects of crushing vegetation disappears as the vegetation returns to its normal position or at worst last until the next growth season occurs. A study was done on ATV travel in salt marsh habitats by the University of California (Hannaford and Resh). The study did show impacts on marsh vegetation from travel. The study was done during the active growing season when vegetation was most susceptible to impacts. Most of the travel done by the District is done during the dormant season before active growth occurs so impacts would be expected to be minimal. One of the impacts from ATV use is the visibility of track marks for a short period. The visibility is from wetting the vegetation as the vehicle drives over, the light coating of mud on the vegetation from the wetting and the temporary impression left in the vegetation. This visibility impact has caused occasional complaints to wildlife personnel about possible unauthorized vehicle travel in the marsh. Mitigation: ATV travel is kept to the minimum necessary and done slowly and carefully in marsh habitats. Areas where vegetation is tender and subject to lasting damage are avoided. Points of entry into sources are varied if possible to avoid multiple travel over the same area. ATV travel directions are adjusted to avoid causing visible disruptions.

Fire: Fire danger is not problem in the season ATV travel is necessary.

Wildlife: The act of traveling in many areas can disturb wildlife or cause injury or death. Most disturbance from ATV travel is of no lasting impact to wildlife. Animals and birds move to avoid a perceived threat. Injury, death or damage to nests may occur from direct contact with an ATV. Mitigation: ATV operations are normally done at low speeds allowing birds and animals time to adjust to the vehicle and move out of the way. Potential nesting and burrowing (burrowing owls) areas are avoided or carefully surveyed for nests. Travel in Snow plover nesting areas is not a problem for ATV operations because few mosquito producing habitats are found near the preferred nesting areas and ATV operations do not generally occur during nesting season.

Inspection using an Argo

Inspection using District Boat

Helicopter application

District Boat: District personnel use a 14' aluminum outboard equipped boat to inspect and treat large deep water bodies and islands. The most common areas of boat access are gravel pits, Alameda Creek and Arroyo Del Valle Creek. The boat is the best access to inspect and treat the aquatic plant mats, algae mats and islands for mosquitoes. Boat use minimizes vehicle travel in off road areas of the creek beds and hazardous terrain along shorelines for carrying treatment equipment on foot. Boat operations do not have any lasting environmental impacts.

Aerial: The District uses a contract agricultural application service to provide helicopter treatments to large source areas. Helicopter operations are done at very low altitude in areas away from people. The advantage of using a helicopter is speed of application to large areas without contact with the ground surface (no vegetation disturbances) at a reasonable per acre cost. A helicopter can treat up to 500 acres per hour. Helicopter applications are used when sources needing treatment are very large (200+ acres total) or the time constraints on personnel and equipment require its use. All Applications in the last 20 years have been during the winter months to salt marshes. The impacts from aerial operations are:

Wildlife: The act flying can disturb wildlife or cause injury or death. Most disturbance from helicopter operations is of no lasting impact to wildlife. Animals and birds move to avoid a perceived threat. Injury or death can occur from direct contact with helicopter rotors. Mitigation: The helicopter pilot avoids large concentrations of birds.

Noise: Helicopter operations can cause temporary higher than normal and distracting noise levels. These noise levels are of a very short duration (less than an hour). Mitigation: Plan operations to keep needed time for completion to a minimum.

Recreation and Access: Helicopter operations require the District to close walking trails and restrict access into flight areas for public safety. District personnel will ensure the area is clear before operations begin and prevent any entry during the operations. Personnel are in radio contact at all times during helicopter operations. Mitigation: Plan operations to keep needed time for completion to a minimum. District personnel will prevent entry during operations and explain the operation to the public ("watching the helicopter" is a recreational experience that appears to be enjoyed during these operations).

ACCESS SELECTION CRITERIA
ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT

● ACCEPTABLE
◐ ACCEPTABLE WITH CARE
⊕ NOT ACCEPTABLE
BLANK = NOT APPLICABLE

		Access for Inspection and Treatment								
		Foot	2-wheel	Right Hand	4-wheel	Argo ATV	Polaris ATV	Boat	Aircraft	
Road Condition & Type	Paved Urban Streets	●	●	●	●					
	All Weather Gravel Roads	●	●	●	●	●	●			
	Dry Dirt Roads	●	●	●	●	●	●			
	Wet Dirt Roads	●	◐	⊕	●	●	●			
	Soft Mud on Roads	●	⊕	⊕	◐	◐	◐			
General Source Conditions	Dry Surface Cross County Travel	●	●	●	●	●	●			
	Wet Surface Cross County Travel	●	⊕	⊕	◐	●	●			
	Soft Mud	●	⊕	⊕	⊕				●	
	Shallow Water to 3' Deep	●	⊕	⊕	◐	●		●	●	
	Deep Water Over 3' Deep	⊕	⊕	⊕	⊕	◐		●	●	
	Deep Dry Vegetation	●	⊕	⊕	⊕	⊕	⊕			
Special Sources	Vernal Pool Areas	◐	⊕	⊕	⊕	◐	◐			
	Salt Marshes	●	⊕	⊕	⊕	◐	◐		●	
	Temporary Water	●	⊕	⊕	◐	●	●		●	
	Creeks	●	⊕	⊕	◐	◐	◐	◐		
Wildlife	Active Nesting Areas Endangered Species	◐	⊕	⊕	⊕	⊕	⊕		⊕	

CONTROL OF MOSQUITOES

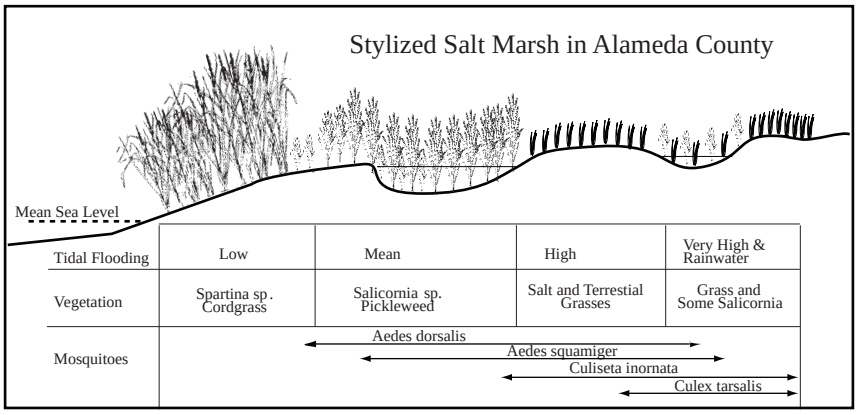
An integrated approach to mosquito control will rely on several strategies. In order of preference, these are physical control, biological control, chemical control using larvicides, and chemical control using adulticides.

Physical Control and Source Reduction

Description of activities: Physical control, also known as source reduction, environmental manipulation, or permanent control, is one part of the District's Integrated Pest Management (IPM) program. Physical control is usually the most effective of the mosquito control techniques available and is accomplished by eliminating mosquito breeding sites or modifying these sites to favor natural predation or to be unfavorable to mosquitoes. This can be as simple as properly discarding old containers such as tires or buckets or as complex as controlling salt marsh mosquitoes (*Aedes squamiger* and *Aedes dorsalis*) utilizing tide control structures and or drainage ditches. Source reduction is important in that its use can virtually eliminate the need for pesticide use in the affected habitat. Source reduction is appropriately touted for its effectiveness and economic benefits.

Mosquito Producing Habitats Considered for Source Reduction:

Freshwater Lakes, Ponds And Retention Areas: Typical sites in California include the margins of reservoirs with shallow water and emergent vegetation, artificial ponds for holding drinking water for livestock and retention ponds created for holding of rainwater. Some retention ponds have been constructed within freeway interchanges and others have been built in cities and towns to provide wildlife habitat and flood protection. Natural lakes are usually not a problem because most of the water is deep, and there may be little emergent vegetation. Seasonal ponds may produce large numbers of mosquitoes during part of the year. Vernal pools may produce mosquitoes and may be important habitats for rare and endangered species. Environmental laws greatly restrict habitat manipulations in these areas. There are a number of species of mosquitoes that exploit this type of habitat. *Culex* species such as *Culex tarsalis* and *Culex erythrothorax* may be found. *Culiseta inornata* and *Culiseta incidens* also will breed in small ponds.



Salt marshes: These are marshes along the Bay edge that are subject to tidal action. In California's not so distant past, extensive coastal salt marshes produced enormous *Aedes* broods, making coastal human habitation virtually impossible. The *Aedes* species produced on salt marshes are very aggressive and have very long flight ranges. Several of the source reduction efforts described below have greatly reduced salt-marsh mosquito production in these marshes. These habitats are environmentally sensitive and are home to a number of endangered and threatened species.

These marshes produce *Aedes squamiger* and *Aedes dorsalis*. *Aedes squamiger* is a winter breeder and has a single generation per year. Eggs hatch with winter rain. *Aedes dorsalis* adults appear mostly in the spring and summer, and may have several generations per year. High tides that leave pools on the marsh trigger hatches of *Aedes dorsalis.* In areas of lower salinity, *Culiseta inornata* and *Culex tarsalis* may also be found.

Temporary standing water: While it can be possible to fill small artificial ponds that produce mosquitoes, it is usually impossible to do so in natural areas (however small), large permanent water bodies, or in areas set aside for stormwater or wastewater retention. In such situations, other options that are effective in controlling mosquitoes include periodic drainage,

minimizing emergent and standing vegetation, and maintaining steep banks. *Aedes, Culex* and *Anopheles* mosquitoes are frequently produced in these habitats.

Proper water management, land preparation, and adequate drainage are the most effective means of physically controlling mosquitoes in these types of sources. The District provides educational assistance to landowners that are interested in reducing mosquitoes breeding on their property. Several state and federal programs provide both financial and technical assistance in developing efficient irrigation and drainage facilities for private land. These programs not only improve the value of the property, but assist in controlling mosquito development.

Wastewater treatment facilities: In many parts of Alameda County, clean freshwater for domestic, agricultural, or industrial uses is becoming a critical resource. Wastewater recycling and reuse help to conserve and replenish freshwater supplies. Citizens daily produce approximately 100 gallons of wastewater per capita from domestic sources alone. Concern for water quality conditions in lakes, rivers, and marine areas has resulted in the enactment of new state laws that will greatly limit future disposal of wastewater into these aquatic systems. To adjust to these changing conditions, many communities must implement wastewater reuse and recycling programs. Mosquito problems are frequently associated with some of the conventional wastewater treatment operations, and the expanded use of wastewater recycling and reuse may inadvertently create even more mosquito habitats.

Pond management options which are effective in controlling mosquitoes include periodic draining, minimizing emergent and standing vegetation, and maintaining steep banks. The District routinely advises property owners on the best management practices for ponds to reduce mosquito development.

Septic Systems: Many households in California, especially in rural areas, use on-site treatment systems, such as septic tanks and associated drain fields. With proper soil porosity, sufficient lateral fields, and low human congestion, these systems are safe and efficient. The waste water in a properly located and maintained septic tank system will percolate into the subsoil without causing surface water accumulation that may induce mosquito production. Yet, when these systems are placed in locations with inappropriate soil conditions, wastewater will flow laterally, often into nearby swales and ditches. Septic systems that have been opened and not properly resealed may produce large populations of mosquitoes (*Culex pipiens*). Physical control measures include repair and rebuilding of systems.

Municipal Treatment Facilities: In California, municipal treatment facilities may be associated with mosquito problems. These can stem from operation of both small (package plants) and large facilities. Package plants may result in mosquito production in holding ponds because they are poorly maintained or operated beyond their capacity (*Culex pipiens, Culex stigmatasoma, Culex tarsalis, Culiseta incidens*). Larger plants may use various methods to improve water quality conditions beyond the levels obtained in secondary treatment process. These methods include spray irrigation, rapid-dry ponds, aquatic plant waste water systems, and the use of natural or modified wetlands. Physical control methods include vegetation management, pond maintenance, structure repair, and improvement of pond substrates.

Spray-Irrigation Systems: Secondarily treated wastewater is used to irrigate golf courses, road medians, pastures, sod fields and crops. During the rainy season, these spray fields may become waterlogged, particularly those in low-lying areas with high water tables or in poorly drained soils. Under these conditions, the continued application of spray irrigation will result in the accumulation of surface water, thus providing aquatic habitats for a variety of mosquito species (*Culex pipiens, Culex stigmatasoma, Culex tarsalis, Culiseta incidens*). Physical control methods are employed by landowners, and include proper grading of irrigated lands, and better water management.

Stormwater and wastewater management: The management of stormwater and wastewater is very important, and when done without proper engineering, construction or maintenance, can result in considerable mosquito problems (*Culex pipiens, Culex stigmatasoma, Culex tarsalis, Culiseta incidens, Culiseta inornata, Anopheles* spp.). Because of recent restrictions on the flow of stormwaters into natural waterways, the question of design of stormwater retention facilities has become a critical issue. Physical control measures may be required, but proper design of facilities will be the most important factor. Mosquito production can be engineered out of stormwater and wastewater facilities but not always easily. Permanent water ponds can be kept clean of weeds with a water quality sufficient to support mosquito-eating fish. Dry facilities can be designed to dry down in three days to prevent floodwater mosquito production, but some standing water beyond the three-day period may occur due to intermittent rainfall common during the rainy season.

Container habitats: Containers such as flowerpots, barrels, water tanks, pickle vat tanks, tires, wheel barrows, children's toys, wading pools, depressions in tarps or covers, boats, roof gutters, bird baths, pet dishes, water troughs, cans, treeholes, fountains, tires and almost anything that will hold water are excellent habitats for several *Aedes*, *Culex* and *Culiseta* species. Abandoned or poorly maintained swimming pools also fall into this category. Typically problems with container breeders occurs during the wetter parts of the year. Container-inhabiting mosquitoes of particular concern in the District are *Aedes sierrensis* and *Culiseta incidens*. Other mosquito species found in containers include *Culex pipiens*, *Culex stigmatosoma*, and *Culex tarsalis.*

Source Reduction in Freshwater Habitats: Source reduction for mosquito control in freshwater habitats typically involves constructing and maintaining channels (ditches) to reduce mosquito production in areas such as flood plains, swamps, and marshes. A number of different mosquito control strategies or approaches are considered when performing freshwater source reduction.

Planning Review: The District reviews plans for developments, marsh restorations, modifications to water systems and proposed water features to evaluate potential mosquito problems. Recommenations for ways to minimize or prevent mosquito problems and District needs for inspection and treatment access are made for proposed wetland projects.

Dumping/Draining: Draining or emptying is a very effective way to prevent any mosquitoes. This is used for small sources such as containers, fish ponds, tanks, above ground swimming pools or other urban sources.

Ditching: This technique reduces the amount of standing water or reduces the length of time that water can stand in low areas following significant rainfall events. This strategy involves constructing channels, ditches or water control structures with control elevations low enough to allow for a certain amount of water to leave an area before immature mosquitoes can complete their life cycle. At this time, the District is rarely involved in construction of new drainage or water control structure projects. When the District is involved in new construction, these projects are covered by CEQA processes and in many cases involve extensive projects with full Environmental Impact Statements produced by other lead agencies. In these cases the District is working as a "sub-contractor" to provide equipment and personnel to accomplish the goals of these projects and further the District's goals by insuring that mosquito control concerns are incorporated into the projects.

Fish Reservoir: This technique involves constructing a main central ditch or ponding area with smaller lateral ditches at the lowest elevations of intermittent wet areas to serve as a larvivorous fish reservoir. As the rainfall water level increases, larvivorous fish move outward to adjacent areas to prey on immature mosquitoes, and as water levels decrease, larvivorous fish retreat to water in the ditches or pond. Weirs may be constructed in main ditches to decrease water flow, decrease emergent aquatic weeds, prevent depletion of the water table, and allow larvivorous fish year-round refuge.

Pumping: The use of direct pumping to remove water will eliminate mosquito breeding areas. This technique is currently only used by landowners on the advice of the District to remove water from small residential or commercial sources such as swimming pools, flooded basements, water under buildings, water tanks, and other small localized non-natural impoundments. The District does not do the pumping.

Vegetation Control: Excess vegettion protects mosqutio larvae and pupae from natural predators. It can also decrease the effectiveness of a larvicide treatment. Vegetation control is effected by mowing, pruning, hand removal, water level variation or herbicide applications. These activities of vegetation control are performed by the property owner and the District is not usually directly involved. Over the past several decades, urban development has occurred in areas where mosquito control drainage existed as the primary drainage systems. In many cases, maintenance responsibility for these control systems has been taken over by cities, flood control agencies, park districts, or county public works departments and integrated into their comprehensive stormwater management programs. Responsibility for vegetation control and maintenance rests with these controlling agencies. The District may make recommendations for such maintenance when mosquito problems develop.

Filling: Filling of depressions that hold water prevent mosquito production. Filling is subject to a CEQA process, except in small back yard applications.

Salt marsh Source Reduction Techniques

Environmental Considerations: Prior to the 1970s when the majority of mosquito control ditching, filling, and impoundment construction were completed, mosquito control was usually the primary consideration when manipulating salt marshes. Little concern was given to environmental issues. Today, minimizing adverse salt marsh ecological impacts must be considered when designing a source reduction project and has equal weight in the process of achieving regulatory approval. Minor hand ditching and maintenance of existing ditches by the District is subject to permitting and a reporting process through the Army Corps of Engineers, in coordination with the land owner (usually a local, state or federal agency) and other federal, local and regional approvals. Environmental regulatory agencies generally will consider ditching of impoundments because it usually will reduce pesticide use and will allow the maintenance of an impoundment in a free tidally exchanging condition for a longer period of the year. In some cases, it allows the impoundment to be opened permanently.

Ditching: Ditching can be used in both salt marsh or freshwater locations to control mosquitoes by:

1) enhancing drainage thus eliminating mosquito-producing sites, or,
2) allowing access of larvivorous fish to mosquito breeding locations (this can be enhanced through the creation of permanent water bodies which act as predatory fish reservoirs).

Hand ditch cleaning

Ditching Used by the District: The District currently uses only hand ditching techniques for maintenance projects.

Hand Ditching: Hand ditching is used to maintain existing ditches and do very minor ditch creation. Most of this type of ditching is to trim vegetation and keep small ditches open to tidal flow and keep access open for fish to move within the marsh. This type of ditching is done by hand using shovels, rakes, pitch forks, hoes, machetes and power weed cutters.

Benefits of Hand Ditching: This is a low impact type of ditching. Personnel walk to the site, spoils are spread by hand and removed vegetation is spread away from the ditch. Such work is only done on the parts of the existing ditch system that need maintenance.

Environmental Risks of Hand Ditching: Minor localized vegetation disruption along ditches from foot traffic during the maintenance, short term turbidity in ditches and possible disruption of wildlife.

Hand Ditching Applications: This is the technique used most often by the District. It is used to maintain existing small ditches covered by an Army Corp of Engineer's permit. The District may apply for up to 30,000 feet of maintenance on a permit. Actual maintenance depends upon the condition of the ditches, vegetation growth, mosquito production history of the area and localized blockages that occur from debris in ditches (old boats, lumber, stumps, mattresses, or other slimy items). In a typical year the District may maintain 2-5,000 feet of ditches. When maintenance is done the change in capacity of cleaned ditch is only negligible or insignificant, the surface area is restored, the spoil is deposited as authorized by the permit, and the work does not impact any mature trees, threatened or endangered plant species, or sensitive habitat areas.

Mitgation: To avoid adverse effects on the habitat, hand maintenance of ditches is done only when needed. The work is done when the tide is out and the water in the ditches is stationary or slow moving to prevent spread of the localized turbidity. Spoils and removed silt are spread evenly or as requested in the permit to avoid changes in the character of the marsh and to keep undesirable plant species from becoming established. The time of entry for maintenance is planned to avoid nesting seasons or critical times when wildlife would be disturbed from nesting. The entry is coordinated with land owners.

BIOLOGICAL CONTROL

Biological control agents of mosquito larvae include predatory fish, predatory aquatic invertebrates, and mosquito pathogens. Of these, only mosquitofish are available in sufficient quantity for use in mosquito control programs. Natural predators may sometimes be available in sufficient quantity for use in mosquito control programs. Biological control is sometimes used in conjunction with selective bacterial or chemical insecticides.

Mosquitofish (*Gambusia affinis*) are the only true biological control agent currently used by mosquito abatement districts in this country. These fish are ideal control agents for several reasons. They feed primarily at the water's surface, where larvae can be found. They can tolerate a significant range in water temperature and water quality. They are also easy to handle, transport, stock, and monitor. Unfortunately, there have been concerns that mosquitofish have had a negative impact on local threatened and endangered species, and may displace native fishes. Therefore, in an effort to reduce any impact on these species, the District's policy is to limit the use of mosquitofish to ornamental fish ponds, water troughs, water gardens, fountains, and unused swimming pools. Limiting the introduction of the mosquitofish to these sources should prevent their migration into habitats used by threatened, endangered, or rare species.

CHEMICAL CONTROL

Chemical control loosely refers to the use of specific compounds to either control immature mosquitoes (larvicides) or mature mosquitoes (adulticides). Only those pesticides registered by the United States Environmental Protection Agency and California Environmental Protection Agency are used by the District for mosquito control. Over 99% of all treatments performed by the District are larviciding operations. Adulticiding is only considered a treatment of last resort.

All pesticide labels contain signal words that specify the toxicity level of the product. These signal words are:

> **CAUTION.** This word signals that the product is slightly toxic. An ounce to more than a pint taken by mouth could kill the average adult. Any product which is slightly toxic orally, dermally, or through inhalation or causes slight eye and skin irritation will be labeled CAUTION.
> **WARNING.** This word signals that the product is moderately toxic. As little as a teaspoonful to a tablespoonful by mouth could kill the average sized adult. Any product which is moderately toxic orally, dermally, or through inhalation or causes moderate eye and skin irritation will be labeled WARNING.
> **DANGER.** This word signals that the pesticide is highly toxic. A taste to a teaspoonful taken by mouth could kill an average sized adult. Any product which is highly toxic orally, dermally, or through inhalation or causes severe eye and skin burning will be labeled DANGER.
>
> All materials used by the District for mosquito control have a CAUTION label.

Larviciding

Introduction: Larviciding is a general term for the process of killing mosquitoes by applying natural agents or commercial products designed to control larvae and pupae (collectively called larvicides) to aquatic habitats. Larvicide treatments can be made from either the ground or air. A wide variety of aquatic habitats and communities, ranging from small domestic containers to larger agricultural and marshland areas, are treated with larvicides. Natural fauna inhabiting these sites may include amphibians, fish, vertebrates and invertebrates, particularly insects and crustaceans. Frequently, the aquatic habitats targeted for larviciding are temporary or semipermanent. Permanent aquatic sources usually contain natural mosquito predators such as fish and do not require further treatment, unless vegetation is so dense that it prevents natural predation (e.g., algae mats providing shelter for *Anopheles* spp.). Temporary sites such as marshes and flooded agricultural areas or woodland depressions produce prolific numbers of floodwater mosquitoes. These sites are generally very low in species diversity due to the time needed for most species to locate and colonize them. While flood water mosquitoes develop during the first week post-inundation, it may take two to three weeks for the first macro invertebrate predators to become established. Many non-target species exploiting temporary aquatic habitats are capable of recovering from localized population declines via re-colonization from proximal areas. Many of these are mobile (can fly from location to location) and may leave the source temporarily when a surface film treatment is made.

Four types of larvicides are available for use by the District: biorational, growth regulators, surface films, and chemical compounds, encompassing seven active ingredients registered for use in California. Larvicides may be applied by hand, from hand-held or vehicle-mounted engine-driven blowers, or by aircraft, depending on the project, the formulation, and the target habitat.

Applicators of any of these Products must be certified by the California Department of Public Health or an appropriate regulatory agency.

1. **Biorational products.** Biorational products exploit insecticidal toxins found in certain naturally occurring bacteria. These bacteria are cultured in mass and packaged in various formulations. Products based on the bacteria in the genus *Bacillus* must be ingested by mosquito larvae so the toxin is released. This means that these biorational products are only effective against larvae since pupae do not feed. Another biorational product available for mosquito control is derived from the soil bacterium *Sacchaopolyspora spinosa*, which produces natural metabolites called spinosyns during fermentation. These metabolites are lethal to mosquito larvae when ingested or by contact. Any of the bacteria used to control mosquito larvae have no significant effects on non-target organisms when applied for mosquito control in accordance with product labels.

   ***Bacillus thuringiensis var. israelensis* (B.t.i.)**
   Product names: Acrobe, Bactimos pellets, Teknar HP-D, Vectobac 12AS, Vectobac G, Vectobac TP.
   Advantages: B.t.i. is highly target-specific and has been found to have significant effects only on mosquito larvae and closely related insects (e.g., black flies and midges). It is available in a variety of liquid, granular, and pelleted formulations, which provide some flexibility in application methods and equipment. B.t.i. has no measureable toxicity to vertebrates and is classified by the EPA as "Practically Non-Toxic" (i.e., Caution). B.t.i. formulations contain a combination of five different proteins with a larger crystal. These proteins have varying modes of action and synergistically act to reduce the likelihood of resistance developing in larval mosquito populations.
   Barriers to Use: To be effective, *Bacillus* insecticides must be ingested b y the mosquito larvae during feeding. Therefore, applications must be carefully timed to coincide with periods in the life cycle when larvae are actively feeding. Pupae and late 4th stage larvae do not feed and therefore will not be controlled by B.t.i. Low water temperature inhibits larval feeding behavior, reducing the effectiveness of B.t.i. during very cold periods. High organic conditions also reduce the effectiveness of B.t.i. Therefore it is not feasible to use this material in sources with a high concentration of decaying organic material. The cost per acre treated is generally higher for B.t.i. than for surface films. B.t.i. is used extensively by the District when appropriate, but other products may be used when later stages of mosquito are present.
   Impact on water quality: B.t.i. contains naturally produced bacterila proteins generally regarded as environmentally safe. It leaves no residue and is quickly biodegraded. At the application rates used in mosquito control programs, B.t.i. is unlikely to have any measureable effect on water quality. There are no establishes standards, tolerances, or EPA approved tests. Other naturally occurring strains of this bacterium are commonly found in aquatic habitats.

   ***Bacillus sphaericus* (B.s.)**
   Product name: Vectolex CG, Vectolox G Granules, Vectoloex WDG, Vectolex WSP
   Advantages: B.s. is another bacterial pesticide with attributes similar to those of B.t.i. The efficacy of this bacterium is not affected by the degree of organic pollution in larval development sites and it may actually cycle in habitats containing high densitites of mosquitoes, reducing the need for repeated applications.
   Barriers to use: Like B.t.i., B.s. must be consumed by mosquito larvae and is therefore not effective against non-feeding stages such as late instar larvae or pupae. B.s. is also ineffective against certain mosquito species such as those developing in salt marshes, seasonal forest pools, or treeholes. Toxicity of B.s. to mosquitoes is due to a single toxin rather than a complex of several molecules as is the case with B.t.i. Development of resistance has been reported in other countries, where the material has been applied for extended periods of time. Knowing the stage and species present can increase the effectiveness of this material, restricting it to sources containing susceptible species. Development of resistance can be overcome by rotating B.s. with other mosquitocidal agents. In some cases, other materials should be used instead of B.s. District applicators use a variety of different materials and choose the appropriate one based on conditions present at the time of the application.
   Impact on water quality: B.s. is a naturally occurring bacterium and is environmentally safe. It leaves no residues and is quickly biodegraded. At the application rates used in mosquito control programs, B.s. is unlikely to have any measureable effect on water quality. There are no established standards, tolerances, or EPA approved tests. Other naturally occurring strains of this bacterium are commonly found in aquatic habitats.

   ***Saccharopolyspora spinosa* (Spinosad)**
   Product names: Natular XRT, Natular G30

Advantages: Spinosad is a fermentation product of the naturally occurring soil bacterium *Saccharopolyspora spinosa*. It has very low vertebrate non-target toxicity and is classified by the EPA as a reduced risk larvicide with a category III CAUTION label. It causes excitation of the mosquito's nervous system, ultimately leading to paralysis and death. This mode of action makes this pesticide a good option for rotational use in the prevention of resistance. This product does not persist in the environment and has very low potential for accumulation in soil or groundwater contamination.

Barriers to use: Spinosad is affected by exposure to sunlight which can cause it to break down more rapidly. Its action on the target organism is either by contact or by ingestion, and as with other bacterial larvicides, activity can be reduced in highly organic water.

Impact on water quality: Spinosad is a fermentation product of a naturally occurring bacterium and is generally regarded as environmentally safe. It leaves no residues and is quickly biodegraded. At the application rates used in mosquito control programs, spinosad in unlikely to have any measureable effect on water quality.

2. **Insect Growth Regulators**

Insect growth regulators (IGRs) disrupt the physiological development of larvae thus preventing adults from emerging. The two products currently used for controlling mosquito larvae are methoprene and diflubenzuron. The effective life of these products varies with the formulation. Methoprene can be applied in granular, liquid, pellet, or briquette formulation. Methoprene has minimal non-target effects and no use restrictions. Diflubenzuron is rarely used in California because it may affect growth of non-target invertebrates. IGRs for mosquito control can be used in sources of water that are consumed by humans.

Product names: Altosid briquettes, altosid liquid larvicide, Altosid pellets, Altosid SBG, Altosid XR briquettes, Altosid XRG

Advantages: Methoprene is a larvicide that mimics the natural growth regulator used by insects. Methoprene can be applied as liquid or solid formulation or combined witih B.t.i or B.s. to form a "duplex" application. Methoprene is a desirable IPM control strategy since affected larvae remain available as prey items for predators and the rest of the food chain. This material breaks down quickly in sunlight and when applied as a liquid formulation it is effective for only 3-5 days. In the briquette form, methoprene can persist in a source for either 30 or 150 days, depending upon the product. The availability of different formulations provides options for treatment under a wide range of environmental conditions. Studies on non-target organisms have found methoprene to be nontoxic to vertebrates and most invertebrates at concentrations used by mosquito control.

Barriers to Use: Methoprene products must be applied (or present, if using a slow release formula) to the late fourth instar and/or pupal stages of mosquitoes. It is not effective against other life stages. Monitoring for effectiveness is more challenging since mortality is delayed. Bring samples of larvae in treated source water into the lab to observe normal or abnormal development is the best way to gauge if the treatment was effective.

3. **Surface agents**

Mosquito larvae and pupae breathe through tubes called siphons that extend above the water surface. Surface agents such as refined mineral oils or monomolecular films (alcohol derivatives) can spread across the surface of the water to prevent mosquitoes from breathing. Depending on the product, the film may remain on the water's surface from a few hours to a few days. Surface films are the only available products that are effective against late stage larvae and pupae.

Product Names: Golden Bear Oil (GB1111), BVA 2 Oil, Agnique MMF

Advantages: These materials are efficacious in eliminating pupae, since no other larvicide is effective to this stage of development. Agnique forms an invisible monomolecular film that is visually undetectable. Treatments are simplified due to the spreading action of the surfactant across the water surfaceand into inaccessible areas. These surfactants are considered "practically nontoxic" by the EPA. Agnique is labeled "safe for use" in drinking water.

Barriers to Use: The drawback of using oils in habitats where natural enemies are established is that surface-breathing insects, particularly mosquito predators, are similarly affected. GB1111 forms a visible film on the water surface. BVA does not produce a visible sheen and is currently the surface oil of choice in District applications.

As a general rule, surfactants are used only after alternative control strategies have been considered and ruled ineffective. Ideally, surfactants should not be used in a rich macro-invertebrate habitat. Surface oils are sometimes the only feasible choice in cases where the material must have the ability to spread on water found in an underground drain.

4. **Chemical larvicides**

Chemical larvicides for mosquito control are typically organophosphates. The District no longer uses these products because of their potential non-target effects and label restrictions.

Adulticiding

Our District considers adulticiding a treatment of " last resort." Adulticiding is the application of insecticides for control of adult mosquitoes. The most common form of adulticiding is the application of insecticide aerosols at very low dosages and using little or no diluent. This method is commonly called the ultra-low-volume (ULV) method. Ground adulticiding is almost exclusively conducted with specially designed ULV equipment. The amount of material applied during ground adulticiding operations for control of adult mosquitoes rarely exceeds 1 oz. per acre (this is in contrast to agricultural fogging applications where materials may be applied at up to 36 oz. per acre). Adulticiding techniques are used only when necessary to obtain control.

The efficiency of adulticiding is dependent upon a number of integrated factors. First, the mosquito species to be treated must be susceptible to the insecticide applied. Second, insecticide applications must be made during periods of adult mosquito activity. This factor is variable with species. Some species of mosquitoes are diurnal (daytime biting), while others are crepuscular (dawn and dusk). Adulticiding should be timed when the mosquitoes are flying and/or exposed to the aerosol mist. Third, the application must be at a dosage rate that is lethal to the target insect and applied with the correct droplet size. Typically with ground applications, vegetated habitats may require up to three times the dosage rates that open areas require. This is purely a function of wind movement and its ability to sufficiently carry droplets to penetrate foliage. It has been shown that droplets within the 10-25 micron range are most effective in controlling adult mosquitoes. Fourth, environmental conditions may affect the results of adulticiding. Wind determines how the ULV droplets will move from the spray equipment into the treatment area. Conditions of no wind will result in the material not moving from the application point. High wind, a condition that inhibits mosquito activity, will disperse the insecticide too widely to be effective. Light wind conditions (<10mph) are the most desirable because they move the material through the treatment area and are less inhibiting to mosquito activity. Application is also avoided during hot daylight hours because thermal conditions will cause the small droplets to quickly rise and become completely ineffective on the adult mosquitoes. Generally, applications are made at night, when a thermal inversion is present, keeping material near to the ground.

Materials Used to Control Adult Mosquitoes

Pyrethrins and Pyrethroids - General Description: Natural pyrethrins (pyrethrum) are extracted from chrysanthemum flower heads grown commercially in parts of South America, Africa and Asia. Synthetic analogues of the natural pyrethrins reached commercial success in the 1950s. Like the natural pyrethrins, first generation synthetic pyrethroids such as phenothrin and tetramethrin, are relatively unstable to light. During the 1960s-1970s, great progress was made in synthetic light-stable pyrethroids. These photostable pyrethroids represent the second generation of these compounds.

Pyrethroids exhibit rapid knockdown and kill of adult mosquitoes, characteristics that are considered a major benefit of their use. The mode of action of these compounds relates to their ability to affect sodium channel function in the neuronal membranes. Most pyrethroids use piperonyl butoxide as a synergist to increase effectiveness.

Synthetic pyrethroids are not cholinesterase inhibitors, are non-corrosive and will not damage painted surfaces. They are less irritating than other mosquito adulticides and have a less offensive odor. In comparison to other adulticides, pyrethroids may be effectively applied at much lower rates of active ingredient per acre. The synthetic pyrethroids are mimics of natural pyrethrum, a botanical insecticide. Natural pyrethrum is used in agricultural areas and has a significantly higher cost. Natural pyrethrins are compounds that are not photostable.

Natural Pyrethrins: Pyrenone 25-5 is a California-registered natural pyrethrin formulation, with a a label containing a CAUTION statement. Pyrenone 25-5 contains 5% pyrethrin and 25% piperonyl butoxide. Pyrenone 25-5 is applied as a ULV spray with a dosage per acre of typically 0.87 oz/acre (equivalent to 0.0027lbs of pyrethrins and 0.0135 pounds of piperonyl butoxide per acre).

Resmethrin: Resmethrin, a first generation synthetic pyrethroid, is the active ingredient in Scourge. Resmethrin provides rapid knockdown and quick kill of all species of adult mosquitoes, and is also effective against many other flying or crawling insects, although it is slower acting than natural pyrethrins. Resmethrin exhibits very low mammalian toxicity, degrades very rapidly in sunlight and provides little or no residual activity. Scourge (the commercial product used for mosquito control) contains 4.14% resemthrin, 12.54% piperonyl butoxide, 5% aromatic petroleum solvent (a mixture of hydrocarbons) and other inert ingredients. Scourge is labeled with the signal word CAUTION. The maximum rate of application is 0.007 lbs per acre of active ingredient. Laboratory studies indicate that resmethrin is potentially toxic to fish. However, with rapid photo degradation in water and low-use rates for mosquito control, the risk to fish is minimal. The high cost of resmethrin is also a disadvantage of this adulticide.

Equipment: Ground adulticiding equipment is normally mounted on some type of vehicle, but smaller units are available that can be carried by hand or on a persons back. The District currently uses the Leco Model 1600 (truck mounted), Mozzie (truck mounted) and Leco Model P1 (hand held) manufactured by Clarke Engineering Technologies. The insecticide metering equipment on the truck mounted ULV foggers is computer controlled, speed correlated, event recording and a programmable flow management system.

DISCUSSION OF GENERAL CONSIDERATIONS FOR USING PESTICIDES

Handcan Application

Handheld ULV

Helicopter Larvicide Application

There are a number of general considerations when pesticides are used for mosquito control. These involve the type of application (ground or aerial), target (larval or adult), resistance development, weather considerations, non-target organisms and avoidance of chemically sensitive people. A variety of larviciding equipment is used for both aerial and ground applications, necessitated by the wide range of breeding habitats, target species, and budgetary constraints. There are advantages and disadvantages to each application system and to the aerial and ground treatments themselves.

Ground Application:

Application Equipment: The District uses open bed pickup trucks that have been modified for the particular task. A chemical container tank, high pressure, low volume electric or gas pump, and spray nozzle are mounted in the back of the bed, with a switch and extension hose allowing the driver to operate the equipment and apply the larvicide from the truck's cab. Specialized equipment, such as All Terrain Vehicles (ATVs) have a chemical container mounted on the vehicle, a 12 volt electric or gasoline engine powered pump supplying high pressure low volume flow, and a hose and spray tip allowing for application while steering the vehicle. ATVs are ideal for treating areas such as agricultural fields, pastures, salt marshes and other off-road sites. ATV application can generally treat about 5 acres per hour. Additional training in ATV safety and handling is provided to employees before operating these machines. Additional equipment used in ground applications include hand held sprayers, seeders and backpack sprayers. Hand held sprayers (hand cans) are standard one or two gallon garden style pump-up sprayers used to treat small isolated areas. Backpack sprayers are gas or hand powered sprayers with a chemical tank. Generally a pellet or small granular material is applied with a seeder designed to distribute pellets or granules. Hand applications can generally cover 2-4 acres per hour.

Advantages of ground application: There are several advantages to using ground application equipment, both when on foot and when conveyed by vehicles. Ground larviciding allows applications while in close proximity to the actual treatment area, and consequently treatments to only those micro habitats where larvae are actually present. This also reduces both the unnecessary pesticide load on the environment and the financial cost of it. Ground larviciding applications are less affected by weather conditions than aerial applications.

Disadvantages of ground application: Ground larviciding is impractical for large or densely wooded areas. There is also a greater risk of chemical exposure to applicators than there is during aerial larviciding operations. Damage may occur from the use of a ground vehicle in some areas. Ruts and vegetation damage may occur, although both these conditions are reversible and generally short-lived. Technicians are trained to recognize sensitive areas and to use good judgement to avoid significant impacts.

Aerial Application:

Application Equipment: The District contracts with a commercial aerial applicator to provide needed aerial treatments. The equipment used is a helicopter equipped to apply liquid formulations or granular materials. Helicopter applications can effectively treat up to 500 acres per hour.

Advantages of aerial application: There are several advantages to using both fixed and rotary wing aerial larvicide application equipment. It is more economical for large application areas provided the entire site needs to be treated. It is easier to calibrate equipment and operators because the target area is generally mapped and the material is weighed or measured when loading. It is more practical for remote or inaccessible areas such as islands and marshes than ground larviciding. Equipment does not have to contact the marsh surface, so no track marks or surface disturbance occurs.
Disadvantages of aerial application: There is a greater risk of non-target impacts, especially with liquid aerial larviciding. It is generally more expensive than a ground application. To ensure accuracy in hitting the target, either additional manpower for flagging or expensive electronic guidance systems are needed. Application windows can be narrow due to weather conditions. Aerial applications are more prone to drift problems. Aerial applications require special FAA licenses, training of staff, and additional liability insurance.

Resistance:

Managing larvicide resistance: Selecting the proper class of larvicide and the formulation are both important in pesticide resistance management. One way to encourage resistance is to use sublethal dosages. Insects with inherent tolerances for weakly applied pesticides may survive to produce tolerant offspring. Soon, an entire population of tolerant mosquitoes may arise.

Another way to potentially produce resistance is to depend on slow-release formulations beyond their recommended use period. Release rate studies have shown that the active ingredients are not available linearly, and that beyond the recommended time limits, they may be sublethal. The District acknowledges these issues, and takes measures to rotate pesticides used on larval sites to avoid this situation.

Choosing when to larvicide:

The District program is larvicide oriented when treatment is required. Larviciding is done whenever 1st through 4th instar larvae are present. Late 4th instar larvae do not feed so a pupicide will be needed to obtain control. Larviciding is typically not as effective or as economical as permanent source reduction or water management, but is more effective than adulticiding.

Choosing When to Adulticide:

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 mosquitoes (often *Aedes* species, but on rare occasions, *Culex* pipiens) 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.

Weather Considerations:

Applications of any type are not made during high winds. Weather is closely linked with mosquito development, so District personnel focus on seasonal variations. Typically, a heavy rainfall season will produce larger flooded areas and a greater abundance of most species of mosquitoes, especially *Aedes* species, *Culex tarsalis*, *Culiseta inornata*, and *Culiseta incidens*. The timing of rainfall patterns is important. Early season rains give technicians more time for inspection and treatment compared with late season rains. Temperature is also critical, because higher temperatures accelerate larval development, and shorten the window of necessary treatment time before mosquitoes mature to adults. In addition, warmer weather is clearly linked with an increase in West Nile Virus transmission. Low rainfall years tend to favor the house mosquito, *Culex pipiens*. This species breeds in the underground storm drain systems in urban/suburban areas. When heavy winter rains fail to flush out these lines, this species can begin its breeding cycle very early in the season.

Non-target Considerations:

The presence of non-target organisms will have an effect on the type of treatment option used by the District. Non-targets can serve as a food source in an ecosystem. Some non-targets may prey on mosquitoes, and therefore serve an important ecological role. Materials are selected to have the least impact on non-targets as possible and still obtain control of the mosquito population.

Avoidance of Sensitives:

Applications are not made when known chemically sensitive individuals may be in contact with the area or chemicals. When adulticide applications are made, residents are notified and contacted prior to the application.

TREATMENT DECISION MAKING

The District uses a phased approach to pesticide treatments. In the choice of material to use District personnel will use the material with the least impact to control larvae and as a last resort, localized adulticiding may be chosen. In general this progression of choices would be:

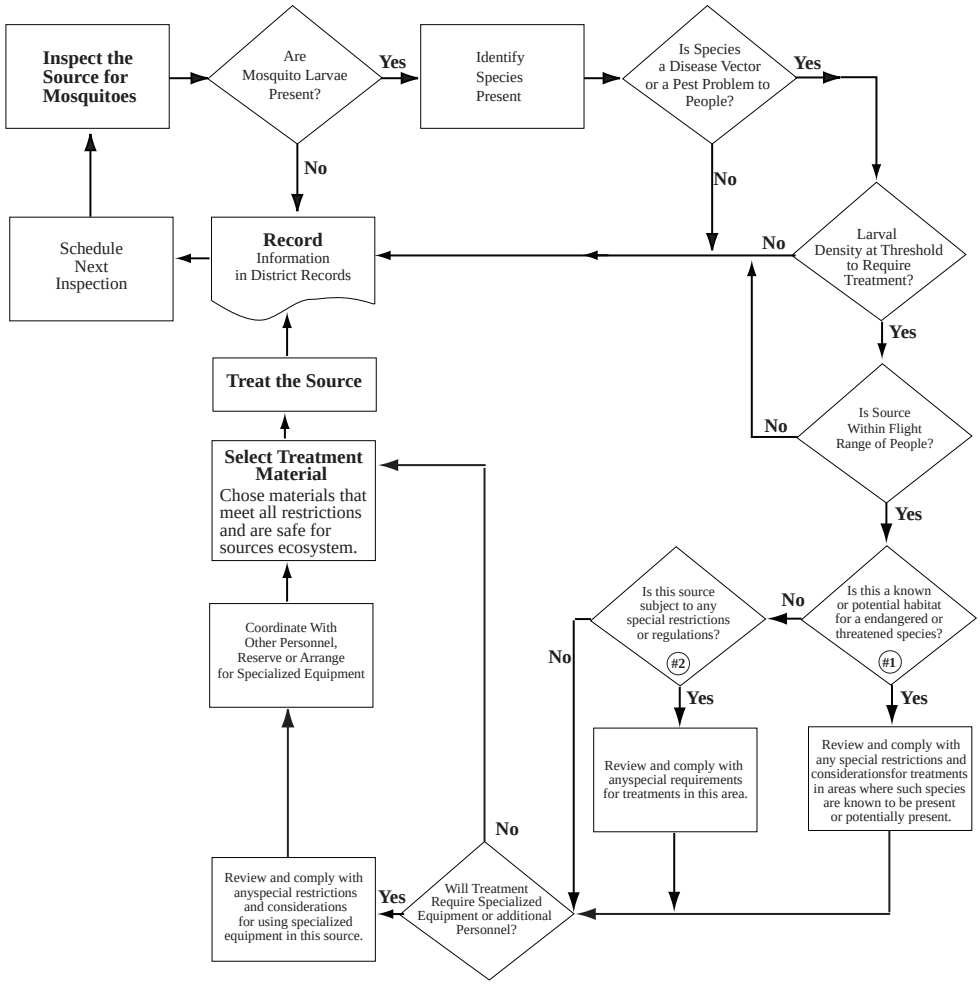
Bio-rationals → Insect Growth Regulators → Surface Agents → Adulticides

Decisions on where and when to treat are based on thresholds (see Larval Treatment Criteria chart). These thresholds are meant to be guidelines since each site is different and other factors play a role in the levels of mosquitoes that can be tolerated. Some of these factors are as listed:

The proximity of homes or heavy human use areas to the source.
The age and distribution of the immature mosquitoes in a source.
The number of mosquito service calls attributed to the source from previous seasons.
The expected weather conditions and the season of the year.
The accessibility to the source (including special restrictions).
The pest or disease significance of the mosquito to be controlled in the source.
The size of the source (staff and equipment needs increase with size).
The sampling method used to check the source.
The number of active sources and available personnel and equipment.

On the next page there is a general treatment decision chart showing the way decisions are made for treatment. This is followed by two additional charts providing information on where the District uses the generalized treatment criteria for larval sources and various materials for mosquito control and the decision process for treatments.

Treatment Decision Model for Mosquito Sources



#1

Fairy shrimp
Tadpole shrimp
California Red-legged frog
Tiger salamader
Salt marsh harvest mouse
Bird's beak
Contra costa goldfields
California clapper rail

#2

Entry restrictions
(nesting season closures)
Pesticide use permits
Memorandums of understanding
District policies
Agricultural restrictions
(food crops, organic grower)
City ordinances (Berkeley)

Larval Treatment Criteria

	Species	Most Common Larval Habitats	Distance to Populated Area	Larval Treatment Threshold	Notes
AEDES	**Salt marsh mosquito** *Aedes dorsalis*	Salt marshes	0 meters - 2 miles	≥1 per 10 dips	High Pest Significance
	Asian tiger mosquito *Aedes albopictus*	Small Containers, Tires	**ANY DISTANCE**	**IMMEDIATE TREATMENT IF ANY DETECTED**	Found only once in an imported tire
	Aedes melanimon	Irrigated Fields	0 meters - 2 miles	≥1 per 10 dips	High Pest Significance
	Pasture mosquito *Aedes nigromaculis*	Irrigated Fields	0 meters - 2 miles	≥1 per 10 dips	High Pest Significance
	Treehole mosquito *Aedes sierrensis*	Treeholes, Tires, Miscellaneous Containers	0 - 300 meters	≥1 per dip or baster sample	High Pest Significance Vector of Canine Heartworm
	Winter salt marsh mosquito *Aedes squamiger*	Salt Marshes Reclaimed Marshes	0 meters - 10 miles	≥1 per 10 dips	High Pest Significance
	River mosquito *Aedes vexans*	Temporary Pools	0 meters - 1 mile	≥1 per 10 dips	Has not Been Found Since the 1950's
	Woodland pool mosquito *Aedes washinoi*	Temporary Woodland Pools	0 meters - 1 mile	≥1 per 10 dips	High Pest Significance
ANOPHELES	*Anopheles franciscanus*	Shallow Pools and Streams in Algae mats	0 - 500 meters	≥1 >3rd instar larva per dip	Low Pest Significance
	Western malaria mosquito *Anopheles freeborni*	Seepages, Streams, Lakes, Gravel Pits	0 meters - 1 mile	≥1 >3rd instar larva per dip	Low Pest Significance Vector of Malaria
	Anopheles occidentalis	Streams, Lakes, Pools Occasionally in Brackish Water	0 - 500 meters	≥1 >3rd instar larva per dip	Low Pest Significance
	Anopheles punctipennis	Temporary Pools, Streams	0 meters - 1 mile	≥1 >3rd instar larva per dip	Moderate Pest Significance Vector of Malaria
CULEX	*Culex apicalis*	Woodland Creeks, Pools	NO TREATMENT	NO TREATMENT	No Pest Significance
	Culex boharti	Slow Streams, Pools	NO TREATMENT	NO TREATMENT	No Pest Significance
	Tule mosquito *Culex erythrothorax*	Lakes and Ponds Associated with Tules	0 - 500 meters	≥1 per dip	High Pest Significance Vector of Encephalitis
	House mosquito *Culex pipiens*	Storm Drain Systems, Septic Tanks, Roadside Ditches, Cemetery Urns, Flooded Basements, Utility Vaults	0 meters - 1 mile	≥1 per 10 dips	High Pest Significance
	Foul water mosquito *Culex stigmatosoma*	Foul Water, Sewage, Temporary Pools	0 - 300 meters	≥1 per dip	Low Pest Significance
	Encephalitis mosquito *Culex tarsalis*	Creeks, Marshes, Temporary Pools, Roadside Ditches, Fresh Water	0 meters - 2 miles	≥1 per 10 dips	Moderate Pest Significance Vector of Encephalitis
	Culex thriambus	Rock pools, isolated ponds, hoofprints, alond streams and creeks	NO TREATMENT	NO TREATMENT	No Pest Significance
CULISETA	**Fish pond mosquito** *Culiseta incidens*	Fish Ponds, Temporary Pools, Catch Basins, Roadside Ditches	0 meters - 1 mile	≥1 per dip	High Pest Significance Possible Vector of Canine Heartworm
	Winter salt marsh mosquito *Culiseta inornata*	Marshes, Temporary Pools, Roadside Ditches	0 meters - 1 mile	≥1 per dip	High Pest Significance
	Culiseta particeps	Shaded Clean Pools, Streams	0 - 300 meters	≥1 per dip	Low Pest Significance
	Orthopodomyia signifera	Treeholes	NO TREATMENT	NO TREATMENT	Adults Found in Light Trap Larvae not Found

Pesticides Used by Alameda County Mosquito Abatement District

Product Name	Active Ingredient	EPA #
Agnique	Ethoxylated alcohol	2302-14
Altosid Liquid Conc	s-methoprene	2724-446-64833
Altosid Pellets 4.25	s-methoprene	2724-448-50809
Altosid 2.1 XR briquettes	s-methoprene	2724-421-64833
Altosid 8.6 briquettes	s-methoprene	2724-375-64833
Altosid XR-G	s-methoprene	2724-451
Altosid WSP	s-methoprene	2724-448
BVA 2 Oil	Aliphatic petroleum hydrocarbons	70589-1
FourStar Bti briquettes 45	*Bacillus thuringiensis var. israelensis*	69504-2
FourStar Bti briquettes 150	*Bacillus thuringiensis var. israelensis*	69504-2
Golden Bear Oil	Aliphatic petroleum hydrocarbons	8898-16
Natular XRT	Spinosad	8329-82
Natular G30	Spinosad	8329-82
Pyrenone 25-5	pyrethrins	432-1050
Scourge 4%	resmithrin	432-716
Scourge 18%	resmithrin	432-667
Skeeter Abate	temephos	8329-70
Vectobac 12AS	*Bacillus thuringiensis var. israelensis*	275-66
Vectolex CG	*Bacillus sphaericus*	275-77
Vectolex WDG	*Bacillus sphaericus*	73049-57
Vectolex WSP	*Bacillus sphaericus*	73049-20

CONTROL SELECTION CRITERIA
ALAMEDA COUNTY MOSQUITO ABATEMENT DISTRICT

● DO NOT USE

⊕ USE ONLY AFTER BIOLOGICAL CONSULTATIONS AND ASSESSMENTS

	Chemical Control Materials												
	Biorationals					I.G.R.s		Surface Agents			Adulticides		FISH
	B.t.i. Liquid	B.t.i. Solids	B.s. Liquid	B.s. Solids	Spinosad Solids	Methoprene Liquid	Methoprene Solids	Agnique	BVA	GB1111	Scourge	Pyrenone 25-5	
Water Temperature <65° F	●	●							●	●			
Water Temperature >65° F													
Larval Instar 1st - 3rd						●							
Larval Instar 4th - pupae	●	●			●								
Fresh Water													
Brackish Water													⊕
Low Organic Load													
High Organic Load													⊕
Emergent Vegetation <50%													
Emergent Vegetation >50%	●		●			●		●	●	●			
Predators Not Abundant													
Predators Abundant								●	●	●	●	●	⊕
Endangered Aquatic or Terrestrial Species Absent													
Endangered Aquatic Species Present						●	●		●	●	●	●	●
Endangered Aquatic Species Possible						⊕	⊕		⊕	⊕	⊕	⊕	⊕
Endangered Terrestrial or Avian Species Present									●	●			
Endangered Terrestrial or Avian Species Possible									⊕	⊕			

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

Hazardous and Toxic Materials:

In the normal operations of the District potentially hazardous or toxic materials are generated that must be disposed of or handled in special ways. The District has a California Environmental Protection Agency site number (#00055002) for disposal of wastes generated. Below is a listing and discussion of these:

Pesticides:

Storage: The District has a pesticide storage building conforming to current codes and laws for storage of bulk materials for future use. Larvicide oil is stored in a locked double walled above ground tank.
Transport: District vehicles are equipped with required secure storage for transport. Field operations vehicles are equipped with "spill kits" to deal with small spills should they occur. Personnel are in radio communications with the District and should a large spillage occur they can obtain rapid assistance. Personnel receive training in proper procedures for transport and spills.
Empty Pesticide Containers: The District stores empty pesticide containers until a reasonable quantity is on hand then they are taken for disposal in a State specified site. Several of the pesticide companies are currently working on a return plan to recycle the empty containers.
Unneeded Pesticide Materials: These are disposed of at a State specified site as required by law.

Hazardous Materials:

Used Oil: The District stores used motor oil in a double walled 55 gallon drum. When the drum is near full, a licensed disposal company is called to pick up the oil.
Used Oil Filters: The District drains the filters into the above mentioned drum and stores the filters in a special container for pick up by a licensed disposal company.
Miscellaneous Solvents: Paint thinner and other used solvents are stored in marked containers then taken to the County operated Household Hazardous Waste Station.
Miscellaneous Materials: Used cleaning supplies and other potentially toxic or hazardous waste are turned into the County operated Household Hazardous Waste Station. Empty paint, solvent and cleaning supplies containers are disposed of as required by law.

Runoff:

Vehicle Wash Water: Water from washing District vehicles is channeled into a drain leading to the municipal sewer. Vehicles are not washed where the runoff goes to storm drains. The heavy materials from vehicle cleaning (mud, sand, grit, etc.) is trapped in a basin and is pumped as needed by a licensed disposal company. Any spills of oil, pesticides or other materials are cleaned up to prevent their entering the storm drain.

Storage Tanks:

The District has completed removal of all underground storage tanks. When the District facility was constructed there were underground tanks installed for a hydraulic lift reservoir, gasoline, diesel, larvicide oil, waste oil and emergency drainage for the pesticide storage building.

Recycling:

The District recycles materials that can be recovered for reuse. Materials set aside for recycling are plastics, paper, miscellaneous metals, aluminum, glass and toner cartridges. Materials are put into the recycling stream at local receiving stations. Toner cartridges from the copier and laser printer are shipped to a company that accepts these.

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VectoLexe CG (biological larvicide granules) Pesticide Label and Material Safety Data Sheet

VectoLex' Biological Larvicide "Naturally the Best for Your Worst Conditions Abbott Laboratories, 1996

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