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Program Description

2.1 Program Area and Vicinity

Contra Costa Mosquito and Vector Control District (Lead Agency and Program Sponsor) is preparing this PEIR to evaluate the effects of the continued implementation of a suite of control strategies and methods prescribed in its Integrated (Mosquito and) Vector Management Program (IVMP or Program). The District implements its Program primarily within a jurisdiction or Service Area of 802 square miles. The activities described herein are conducted throughout Contra Costa County. Service areas include the cities and towns of Antioch, Brentwood, Clayton, Concord, Danville, El Cerrito, Hercules, Lafayette, Martinez, Moraga, Oakley, Orinda, Pinole, Pittsburg, Pleasant Hill, Richmond, San Pablo, San Ramon, Walnut Creek and all of the unincorporated areas of Contra Costa County.

The environmental impact analysis of the Program will focus on the potential for impacts within the County from the District's proposed Program and identify the potential for control activities within the Service Area to affect any adjacent jurisdictions. Under California law, the District also can take direct but limited action in adjacent areas bordering its Service Area (Alameda, Sacramento, San Joaquin and Solano Counties), if needed to provide control of mosquitoes and other vectors originating in adjacent areas for the health and safety of residents of the immediate Service Area [California Health and Safety Code Section 2270(a)]. This has not historically occurred, nor is it expected to occur in the future. Control activities may also be provided in adjacent areas upon request of the adjacent jurisdictions to protect the health and safety of residents in adjacent jurisdictions. Actions that would be taken outside of the Service Area are the same types of actions undertaken within the Service Area and in similar types of habitats or sites. Such actions would fall under that programs CEQA documentation. In summary, the Program occurs in an area that is somewhat larger than the District's Service Area; this larger area is called the Program Area, the area in which potential impacts could occur. The Program Area and its location within the State of California are shown on Figure 2-1, CCMVCD Program Area.

Mosquito and/or vector control activities are conducted at a wide variety of locations or sites throughout the District's Service Area, including tidal marshes, duck clubs, other diked marshes, lakes and ponds, rivers and streams, vernal pools and other seasonal wetlands, stormwater detention basins, flood control channels, spreading grounds, street drains and gutters, wash drains, irrigated pastures, or agricultural ditches, as well as animal troughs, artificial containers, tire piles, fountains, ornamental fishponds, swimming pools, liquid waste detention ponds, and nonnatural harborage (such as covered wood piles, residential and commercial landscape, trash receptacles). Within the larger Program Area, activities would be conducted at similar sites.

2.2 Program Objectives

2.2.1 Purpose and Need

The District was established in 1927 to reduce the risk of vector-borne disease and discomfort to the residents of its Service Area. In addition to being problematic by disrupting human activities and enjoyment of public and private areas, certain vectors can transmit a number of diseases. A vector is defined by the State of California as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury, including, but not limited to, mosquitoes, flies, other insects, ticks, mites, and rats, but not including any domesticated animal…" [California Health and Safety Code Section 2200(f)]. The diseases of most concern in the Program Area are as follows, by the vector they are associated with:

- **Mosquito-transmitted illnesses:** WNV, WEE, SLE, dog heartworm, and malaria
- **Tick-transmitted illnesses:** Lyme disease, babesiosis, ehrlichiosis, tularemia, Rocky Mountain spotted fever and other spotted fever group rickettsia (e.g., Rickettsia 364D), Anaplasmosis

- **Rodent/rat-transmitted illnesses:** leptospirosis, hantavirus pulmonary syndrome, tularemia, plague
- **Other vector-transmitted illnesses:** rabies transmitted by skunks, plague and murine typhus transmitted by fleas (usually on rats), raccoon roundworm

Depending on the disease, both human and domestic animal health can be at risk of disability, illness, and/or death. Furthermore, potential exists for introduction and transmission of new diseases by current vectors and for new disease vectors to be introduced into the District's Service Area. Examples include the discovery of populations of *Aedes albopictus* (Asian tiger mosquito) and *Aedes aegypti* (yellow fever mosquito) in central and southern California. These mosquito species are effective vectors of the causative agents of diseases such as chickungunya, Dengue fever, and yellow fever.

Yellow jacket wasps and several mosquito species within the Program Area are not known to transmit disease pathogens but are still considered vectors [California Health and Safety Code Section 2200(f)] because they can inflict significant discomfort and injury (e.g., secondary infections and severe reactions including anaphylaxis) to residents, pets, and livestock. For example, employing the District's IMVMP to conduct surveillance and control for mosquito species such as *Aedes dorsalis* (summer salt marsh mosquito), *Aedes sierrensis* (western treehole mosquito), *Aedes squamiger* (California salt marsh mosquito, and *Aedes washino* (Washino's flood water mosquito) is important to minimize populations of these mosquitoes that would otherwise cause discomfort and injury-related issues with citizens, businesses, schools, agricultural operations, etc. The District was formed in 1925 initially to address significant economic and discomfort-related issues involving large populations of mosquitoes, especially the marsh mosquitoes *A. dorsalis*, *A. squamiger*, and *Culiseta inornata*. The District's duties, at citizen request and with election support, have been expanded to include other vectors and vector-borne disease surveillance

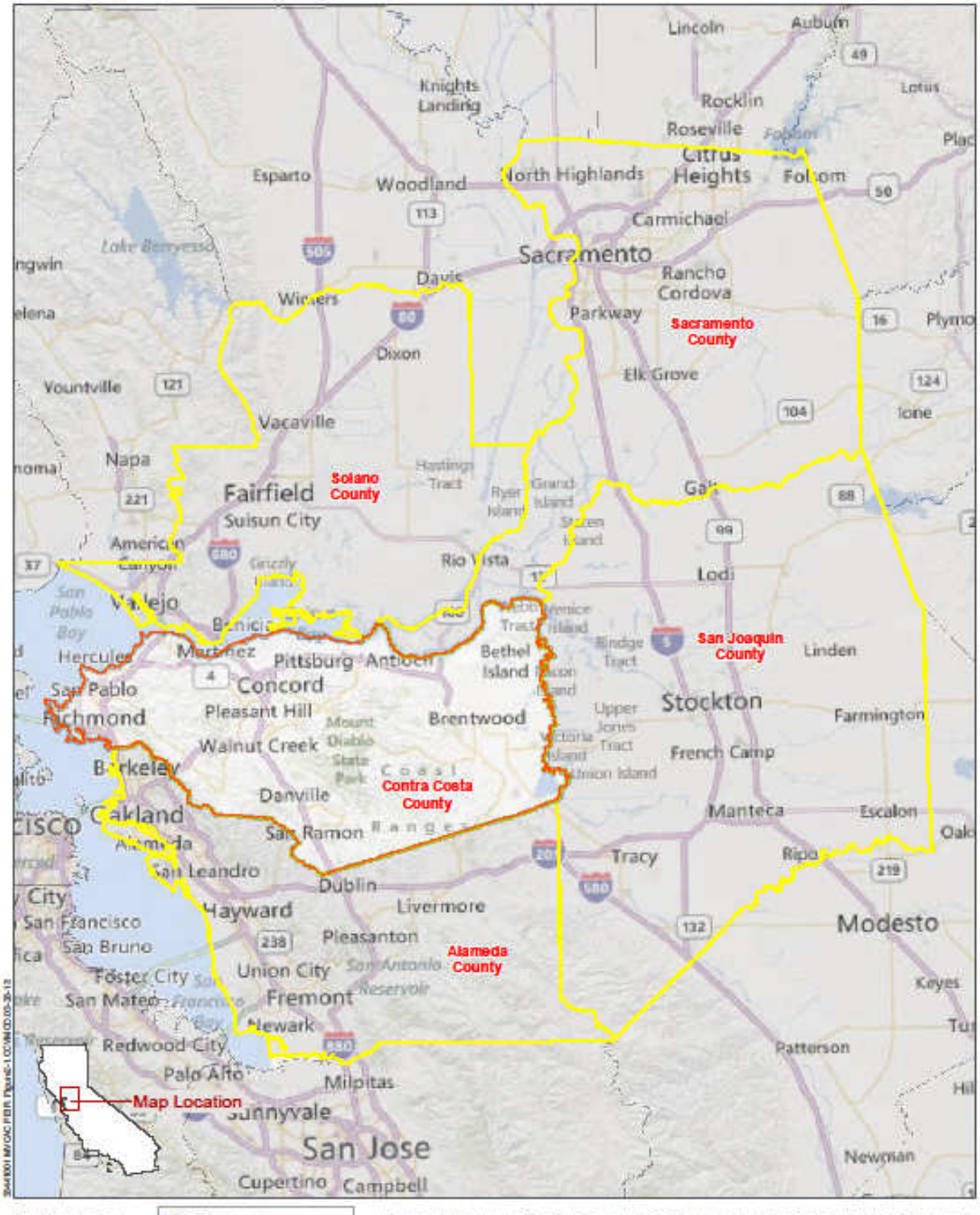
2.2.2 Program Objectives

The District undertakes vector control activities through its Program to control the following vectors of disease and/ or discomfort in the Program Area: mosquitoes, rats, mice, ticks, yellow jackets, Africanized honeybees, and skunks. The District also performs vegetation management (including control of noxious and/or invasive plants) to facilitate access to vector habitat, improve efficiency and effectiveness of vector control operations, and as a source reduction measure..

The Proposed Program's specific objectives are as follows:

- Reduce the potential for human and animal disease caused by vectors
- Reduce the potential for human and animal discomfort or injury from vectors
- Accomplish effective and environmentally sound vector management by means of:
    - Surveying for vector presence, abundance, distribution, human and animal contact or potential for human and animal contact
    - Monitoring and surveying for vector-borne diseases and their antecedent factors that initiate and/or amplify disease
    - Establishing treatment guidelines
    - Appropriately selecting from a wide range of Program tools or components

Most of the relevant vectors are quite mobile and cause the greatest hazard or discomfort at a distance from where they breed. Each potential vector has a unique life cycle, and most of them occupy several types of habitats. To effectively control them an IVMP must be employed. District policy is to identify those species that are currently vectors, to recommend techniques for their prevention and control, and to anticipate and minimize any new interactions between vectors and humans and domestic animals.



INTEGRATED MOSQUITO & VECTOR MANAGEMENT PROGRAM PEIR

Contra Costa Mosquito & Vector Control District

Figure 2-1 - Program Area

Figure 2-1 BACK

2.3 Proposed Program

The District's Program is an ongoing series of related actions for control of mosquitoes and other vectors of human disease and discomfort. The District's activities involve the identification of vector problems; responsive actions to control existing populations of vectors, prevent new sources of vectors from developing, and manage habitat to minimize vector production; education of landowners and others on measures to minimize vector production or interaction with vectors; and provision and administration of funding and institutional support necessary to accomplish District objectives.

The District has, since its inception, taken an integrated systems approach to mosquito and vector control, utilizing a suite of tools that consist of surveillance, vegetation management, and physical, biological, and chemical controls along with public education. These Program "tools" or components are described in the subsequent subsection as "Program alternatives" for the CEQA process (except for public education, which is exempt from CEQA). Program implementation is weighted heavily towards vegetation management and physical and biological control, in part, to reduce the need for chemical control. To realize effective and environmentally sound vector management, vector control must be based on several factors:

- Carefully monitoring or surveying vector abundance and/or potential contact with people
- Carefully monitor and survey for vector diseases and their antecedent factors that initiate and/or amplify disease
- Establishing treatment guidelines
- Selecting appropriate tools from a wide range of control methods

This Program consists of a dynamic combination of surveillance, treatment criteria, and use of multiple control activities in a coordinated program with public education that is generally known as Integrated Pest Management (IPM) or Integrated Vector Management (IVM).

While these Program components or tools together encompass the District's Program, it is important to acknowledge that the specific tools District staff use vary from day to day and from site to site in response to the vector species that are active, their population size or density, their age structure, location, time of year, local climate and weather, potential for vector-borne disease, proximity to human populations, including (a) proximity to sensitive receptors, (b) District staff's access to vector habitat, (c) abundance of natural predators, (d) availability and cost of control methods, (e) effectiveness of previous control efforts at the site, (f) potential for development of resistance in vector populations, (g) landowner policies or concerns, (h) proximity to special-status species, and (i) applicability of Endangered Species Recovery Plans, HCPs, Natural Community Conservation Plans (NCCPs), and local community concerns, among other variables. Therefore, the specific actions taken in response to current or potential vector activity at a specific place and time depend on factors of vector and pathogen biology, physical and biotic environment, human settlement patterns, local standards, available control methods, and institutional and legal constraints. While some consistent vector sources are exposed to repeated control activity, many areas with minor vector activity are not routinely treated, and most of the land within the District's Service Area has never been directly treated for vectors.

The District's IVM Program (or Integrated Mosquito and Vector Management Program, IMVMP), like any IPM program, seeks by definition to use procedures that will minimize potential environmental impacts. The District's IMVMP employs IPM principles by first determining the species and abundance of mosquitoes/vectors through evaluation of public service requests and field surveys of immature and adult mosquito/vector populations and, then, if the populations exceed predetermined criteria, using the most efficient, effective, and environmentally sensitive means of control. For all mosquito species, public education is an important control strategy. In some situations, water management or other physical control activities can be instituted to reduce mosquito-breeding sites. The District also uses biological control such as the planting of mosquitofish. When these approaches are not effective, or are otherwise deemed inappropriate, then pesticides are used to treat specific pest-producing or pest-harboring areas

Three core tenets are essential to the success of a sound IMVMP.

- First, a proactive approach is necessary to minimize impacts and maximize successful vector management. Elements such as thorough surveillance and a strong public education program make all the difference in reducing potential human vector interactions.
- Second, long-term environmentally based solutions (e.g., water management, reduction of harborage and food resources, exclusion, and enhancement of predators and parasites) are optimal as they reduce the potential pesticide load in the environment as well as other potential long- and short-term impacts.
- Lastly, utilizing the full array of options and tools (public education, surveillance, physical control, biological control, and when necessary chemical control) in an informed and coordinated approach supports the overall goal of an environmentally sensitive vector management program.

The District's Program consists of the following alternatives, which are general types of coordinated and component activities, as described below: surveillance, physical control, vegetation management, biological control, chemical control, and nonchemical control/trapping. The Proposed Program is a combination of these alternatives with the potential for all of these alternatives to be used in their entirety along with public education.

Chemical methods to manage vectors and vector habitat (and noxious weeds in some cases), under the Vegetation Management and Chemical Control alternatives described below) are employed independently at specific application sites. The pesticides used as part of the District's Proposed Program are applied at low concentrations (appropriate for the vector involved) to avoid potential impacts to nontarget organisms from acute and/or chronic exposures. Manufacturers carefully establish application amounts mandated by product use requirements for treatment efficacy and low potential risk to nontarget organisms, and these amounts are substantially below the thresholds used for toxicity studies in the laboratory. The pesticides applied by the District degrade rapidly in the environment, thereby reducing the opportunity for environmental persistence. Some of the mosquito larvicide formulations used by the District, when applied according to the manufacturers' label instructions, are designed to provide residual control from approximately 21 up to 150 days. Several of these larvicides are classified as biochemical, biorational, or biological larvicides (e.g., Altosid pellets and XR briquettes, MetaLarv, VectoLex). As different materials are selected for potential rotational use in a given area (i.e., larvicides first, followed by adulticides if needed), District staff take care both in the selection of the materials used and the application process so that co-exposures to nontarget receptors are highly unlikely. This type of practice reduces the probability of additive or synergistic effects that could occur as a result of simultaneous exposures to more than one chemical. Once an area has been treated, the District determines the effectiveness of that treatment by subsequent monitoring of the mosquito population (at all life stages) and would treat again at the same site if the population counts were not reduced sufficiently. Treatment effectiveness is measured by various means including visual observation, larval sampling, and/or trapping of adult mosquitoes. The number and location of incoming service requests is also taken into account.

Synergists, and in some cases adjuvants (used with herbicides to also facilitate mixing and application), are applied to increase the efficacy of some chemical control measures. This application could lead to co-exposures of synergists such as PBO and primary chemical treatments. However, synergists allow for reduced treatment amounts of primary pesticide chemicals, since their performance is improved via conjunctive use. Another example of chemicals sometimes used together is the co-application of methoprene and Bti. This particular treatment is employed to prevent pesticide resistance and to ensure the control of all larval stages of nuisance mosquitoes while minimizing the potential for impacts to nontarget receptors from co-exposures.

2.3.1 Surveillance Alternative

Vector surveillance, which is an integral part of the District's responsibility to protect public health and welfare, involves monitoring vector populations and habitat, their disease pathogens, and human/vector interactions. Vector surveillance provides the District with valuable information on what vector species are

present or likely to occur, when they occur, where they occur, how many they are, and if they are carrying disease or otherwise affecting humans. Vector surveillance is critical to an IVMP because the information it provides is evaluated against treatment criteria to decide when and where to institute vector control measures. Information gained is used to help form action plans that can also assist in reducing the risk of contracting disease. Equally important is the use of vector surveillance in evaluating the efficacy, cost effectiveness, and environmental impacts of specific vector control actions.

2.3.1.1 Mosquito Surveillance

Mosquitoes in nature are distributed within their environment in a pattern that maximizes their survival to guarantee reproductive success. Immature stages develop in water and later mature to a winged adult that is capable of both long- and short-range dispersal. This duality of their life history presents vector control agencies with unique circumstances that require separate surveillance strategies for the aquatic versus terrestrial life stages.

Surveillance involves monitoring the abundance of mosquito populations, their habitat, mosquito-borne disease pathogens, and the interactions between mosquitoes and people over time and space. The District routinely uses a variety of traps for surveillance of adult mosquitoes, regular field investigation of known mosquito sources for direct sampling for immature stages, public service requests for adult mosquitoes, and low ground pressure ATVs to access these sites when necessary. The District conducts surveillance by way of a variety of activities that include:

- Field counting/sampling and use of trapping, along with the laboratory analysis of mosquitoes, their hosts, and pathogens to evaluate population densities and potential disease threats such as WNV, WEE, and SLE. Sampling of presence and abundance of mosquito populations tends to occur in areas where the citizenry would have a likelihood of exposure to them; field counts take place both at immature and adult stages of mosquito development or life cycle. Kinds of traps use include,host-seeking traps, light traps, gravid/oviposition traps, and emergence traps, and are described below:
    - Host-seeking traps use dry ice (carbon dioxide) to attract female mosquitoes behaviorally cued to seek a host to blood feed. The trap's components include a dry ice container, battery power source, a low ampere motor/fan combination, an LED light source, and a collection container for holding captured adults.
    - Light traps (commonly called New Jersey Light traps) use a source of photo-attraction such as an incandescent lamp (25 watt) or compact fluorescent lamp (7 watt) where mosquitoes are pulled in by the suction provided by an electric (110 v AC) appliance motor/fan combination. Mosquitoes picked up by the suction are directed downward (via screened cone) inside the trap body to a plastic collection jar containing a 1-inch strip of Vapona, Hot Shot® , or No-Pest® strip (dichlorvos).
    - Oviposition traps are used to collect gravid Culex spp. mosquitoes and/or to measure their egg-laying activity. As an example, they may use 5-day-old hay-infused water contained in a small plastic dish pan that has a 6-volt battery-operated fan directly above to draw the gravid female mosquitoes into the small collection net.
    - Emergence traps are used to assess mosquito breeding in habitats that are difficult to access with a larval dipper, to study seasonal adult emergence patterns, and to estimate daily adult emergence or productivity. These types of traps are positioned on or above the water surface to collect mosquito samples and typically consist of some form of floating conical box, suspended cage, or sticky trap. The pyramid shaped, floating trap with a collection jar at the apex is the design most frequently used.

  Mosquito immatures include eggs, four larval stages, and a transitional pupal stage. Mosquito control agencies routinely target the larval and pupal stages to preclude an emergence of adults. Operational evaluation of the presence and abundance of immature mosquitoes is limited to the larval and pupal

stages, although the District may sample eggs for research reasons. The District sometimes uses other lures such as octanol, a commercially manufactured "human-lure" and a solution made by District staff and comprised of brewer's yeast, water, and lactalbumin hydrolysate powder to maximize the catch of some types of traps. Sampling and collection of the immature stages (egg, four larval stages, and a transitional pupal stage) involves the use of a 1-pint dipper (a standardized small plastic pot or cup-like container on the end of a 36-inch handle), which scoops up a small amount of water from the mosquito breeding site. Although used infrequently, aquatic traps can also be used to sample mosquito larvae. Operationally, the abundance of immatures in any identifiable “breeding” source is measured through direct sampling, which provides relative local abundance as the number of immatures per unit volume or area of the source. This method requires access by field personnel to within about 3 feet of larval sites at least every 2 weeks in warm weather. The spatial patchiness of larvae requires access to multiple locations within each source, rather than to single “bell-weather” stations.

- “Arbovirus”[1] surveillance to determine the likelihood and occurrence of mosquito-borne illness is accomplished by two methods commonly used in California: (1) capturing and testing female vector mosquitoes for the presence of mosquito-borne encephalitis viruses as explained above and (2) periodic testing for the presence of encephalitis virus-specific antibodies in the blood serum of either sentinel chickens or wild birds. The first method involves the use of host-seeking traps to capture female vector mosquitoes. Captured females are sorted into groups of up to 50 (called pools) and submitted to UC Davis or a laboratory local to that District to test for the presence of mosquito-borne viruses. The District uses the second method through the placement of caged chickens as “sentinel birds.” Since the viruses of major concern (WNV, WEE, and SLE) are diseases actively transmitted by mosquitoes to both birds and to humans through bites, caged chickens’ routine blood samples will reveal whether one or more of the virus-specific antibodies are present. The chickens are placed generally 10 to a caged area (at least 6 by 12 feet or larger), are humanely handled, and are provided ample shelter with nest boxes, water, and feed. Chickens are used as the early detection system for virus transmission, as they are unaffected by the presence of these viruses in their systems. At the end of the mosquito season, the chickens are adopted out. In addition, dead birds reported by the public to the statewide WNV Hotline are mapped to determine high-risk areas, and those meeting testing criteria are brought to the District or sent to UC Davis to be tested for WNV.

- Field inspection of known or suspected habitats where mosquitoes live and breed. Sites where water can collect, be stored, or remain standing for more than a few days are potential habitats for mosquito breeding that require continuous inspection and surveillance. Water runoff into catch basins and stormwater detention systems from land uses including, but not limited to, residential communities, parks and recreation areas, and industrial sites, as well as ornamental ponds, unmaintained swimming pools, seeps/seepages, seasonal wetlands, tidal and diked marshes, freshwater marshes, wastewater ponds, sewer plants, winery waste/agricultural ponds, managed waterfowl ponds, canals, creeks, streams, tree holes, tires, man-made containers, flooded basements/crawl spaces, and other standing waters are likely sources

- Maintenance of paths and clearings to facilitate sampling and to provide access to vector habitat. It is District policy that staff manages vegetation periodically for accessibility to water bodies and use preexisting roads, trails, walkways, and open areas to conduct routine and essential surveillance activities with the least impact on the environment. Surveillance is conducted using ATVs, but off road access is minimized and used only when roads and trails are not available. Some access for inspection is conducted on foot.

[1] Arthropod-borne viruses. The primary reservoir for the pathogens that cause these diseases is wild birds, and humans only become exposed as a consequence of an accidental exposure to the bite of infective mosquito vectors.

- Analysis of public service requests and surveys and other methods of data collection. The District's mosquito surveillance activities are conducted in compliance with accepted federal and state guidelines, in particular the California Mosquito-borne Virus Surveillance and Response Plan (CDPH et al. 2013) and Best Management Practices for Mosquito Control in California (CDPH and MVCAC 2012). These guidelines recognize that local conditions will necessarily vary and, thus, call for flexibility in selection and specific application of control methods.

2.3.1.2 Tick Surveillance

The District performs surveillance of ticks (e.g., Ixodes pacificus, Dermacentor spp.) to determine incidence of tick-borne pathogens (e.g., Lyme's disease (Borrelia burgdorferi), ehrlichia, bartonella, tularemia, and Spotted fever group rickettsia) by way of the following practices:

> **Collection** of ticks in public contact areas to (a) determine the location of ticks infected with tick-borne pathogens and (b) to determine the seasonal and geographical distribution of the ticks according to species. Ticks are collected by "flagging" vegetation along trails. Stiff fabric is dragged for specified distances along the trails to stimulate ticks to attach to the material. Then they are manually removed and placed in vials for transport back to the laboratory for testing or for submission to other government agencies or diagnostic laboratories.

> **Identification** of ticks brought in by the public, which are usually found biting persons or their domestic animals.

> **Submission** of ticks that have been attached to persons to determine if they are infected with the Lyme disease, tularemia, and/or Rocky Mountain spotted fever organism. The District refers individuals to the appropriate lab for tick testing.

2.3.1.3 Rodent Surveillance

The monitoring and control of rats and mice focuses on domestic rats including Norway rats (Rattus norvegicus), roof rats (Rattus rattus), and on house mice. Norway rats are known to invade homes and businesses from the sanitary sewers. Dissemination of information, public and agency education, and property inspections in response to public service requests involve looking for entry ways, rodent burrows, signs of rodent infestation, and source reduction (e.g., sanitation, harborage, and food sources).

Testing for the presence of hantavirus pulmonary syndrome (HPS) is occasionally conducted by collecting wild rodents. Although performed infrequently, hantavirus surveillance, small traps are placed in suspect areas including peridomestic habitats along the urban fringe or rural areas. The traps are checked the following day to remove any rodents for sampling. Wild rodent collection for disease surveillance requires a Scientific Collecting Permit from CDFW and is conducted in compliance with CDPH and CDC guidelines. Blood samples are submitted to CDPH for testing.

2.3.1.4 Yellow Jacket and Other Wasps/Bees

Venomous biting insect encounters often require District staff's response. It is important to educate the residents that while these insect stings may potentially induce life-threatening allergic reactions and pain, overall, these insects serve beneficial roles as pollinators and biological control agents.

The District responds to public service requests and provides recommendations and control of nonstructural pest populations of yellow jackets and honeybee swarms where these create a risk to public health. In cases where a honeybee swarm does not pose an imminent health threat, the caller is provided with a list of local beekeepers who may be able to remove it nondestructively. Samples from swarms treated by the District are collected and screened in our Laboratory to determine whether they are suspect Africanized bees. The District enters into a service contract with the East Bay Regional Park District [EBRPD] to provide yellow jacket control on EBRPD properties within the County.

2.3.1.5 Other Vector Surveillance

The two primary reservoir vectors of rabies in California are bats and skunks. Both live in close proximity to humans and their pets because of their ability to adapt to the urban/suburban environment. Residential landscapes provide them with an abundance of food and shelter options that have increased their numbers and the potential for direct contact with the human population. This scenario is true for all wildlife and because of it, a potential rabies health threat exists. The District works with home and property owners to discourage wildlife such as skunks and bats from taking up residence on their property. Upon a service request, the District's Vector Control Inspector will survey the property and provide guidance and recommendations on exclusion methods to minimize vector impact on the property.

Positively identify the pest if a sample is provided.

Provide information on biology, prevention and control, and/or refer the caller to an appropriate external information resource such as the University of California Cooperative Extension, the Contra Costa County Bed Bug Task Force, or a local private pest control company.

2.3.2 Physical Control Alternative

Managing vector habitat to reduce vector production or migration, either directly or through public education is often the most cost-effective and environmentally benign element of an IVMP. This approach to the control of vectors and other pests is often called "physical control" to distinguish it from those vector management activities that directly rely on application of chemical pesticides (chemical control) or the introduction or relocation of living agents (biological control). Other terms that have been used for vector habitat management include "source reduction," which emphasizes the significance of reducing the habitat value of an area for vectors, or "permanent control," to contrast with the temporary effectiveness of pesticide applications.[2] Vector habitat management is important because its use can virtually eliminate the need for pesticide use in and adjacent to the affected habitat and, in some situations, can virtually eliminate vector production from specific areas for long periods of time, reducing the potential disturbances associated with frequent biological or chemical control activities. The intent is to reduce the abundance of vectors produced or sheltered by an area while protecting or enhancing the habitat values of the area for desirable species. In many cases, physical control activities involve restoration and enhancement of natural ecological functioning, including production and dispersal of special-status species and/or predators of vectors.

2.3.2.1 Mosquitoes

Physical control for mosquitoes consists of the management of mosquito-producing habitat (including freshwater marshes and lakes, saltwater marshes, temporary standing water for 1 week or more, and wastewater treatment facilities) especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities. Physical control is usually the most effective mosquito control technique because it provides a long-term solution by reducing or eliminating mosquito developmental sites and ultimately reduces and potentially eliminates the need for chemical applications. The physical control practices may be categorized into three groups: maintenance, new construction, and cultural practices.

Maintenance activities are conducted within tidal, managed tidal, and nontidal marshes, seasonal wetlands, diked, historic baylands, and in some creeks adjacent to these wetlands. They include connection of backwaters or isolated pools on floodplains to the main channels of streams and rivers and increased drainage rates and areas in managed wetlands. The following activities are classified as maintenance:

[2] This terminology can be misleading if periodic maintenance is needed for physical control devices or structure.

- Removal of sediments from existing water circulation ditches
- Repair of existing water control structures
- Removal of debris, weeds, and emergent vegetation in natural channels
- Clearance, trimming, and removal of brush for access to streams tributary to wetland areas
- Filling of existing, nonfunctional water circulation ditches to achieve required water circulation dynamics and restore ditched wetlands

New construction typically involves the creation of new ditches to enhance tidal flow preventing stagnant water.

Cultural practices include vegetation and water management, placing culverts or other engineering works, and making other physical changes to the land. They reduce mosquito production directly by improving water circulation and indirectly by improving habitat values for predators of larval mosquitoes (fish and invertebrates), or by otherwise reducing a site's habitat value to mosquito larvae.

The District performs these physical control activities in accordance with all appropriate environmental regulations (e.g., wetland fill and dredge permits, endangered species review, water quality review, streambed alteration permits, see Section 2.7), and in a manner that generally maintains or improves habitat values for desirable species. Major physical control activities or projects (beyond the scope of the District's 5-year regional wetlands permits with the United States Army Corps of Engineers (USACE), San Francisco Bay Regional Water Quality Control Board (SFBRWQCB) and San Francisco Bay Conservation and Development Commission (BCDC) are addressed under this PEIR where known and identified. Minor physical control activities (covered by the regional wetlands permits) are also addressed in this PEIR. They vary substantially from year to year, but typically consist of up to 10,000/21,000 linear feet of ditch maintenance. Under the regional permits, the District's work plans are reviewed annually by trustee and other responsible agencies prior to initiation of the planned work. USACE, USFWS, CDFW, and other responsible agencies can inspect completed work.

The District may request landowners and stewards to maintain and clear debris from drainage channels and waterways; excavate built-up spoil material; remove water from tires and other urban containers; cut, trim, mow, and harvest aquatic and riparian plants (but not including any mature trees, special status plant species[3], or sensitive habitat areas); and perform minor trenching and ditching. The District may provide guidance for mosquito abatement activities to landowners and stewards. However, it will be the responsibility of the landowner to determine and comply with all legal requirements necessary to perform the activity. District policy is that with every recommendation, the District also makes it clear to the landowner the requirement for consultation with resource agencies and acquisition of permits that may be needed prior to commencement of any work.

The remainder of this subsection describes physical control or "source reduction" practices by type of potential mosquito habitat.

2.3.2.1.1 Freshwater Habitats

The District Service Area includes a number of areas, generally man-made, that are permanently ponded with fresh water. Examples 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 mosquito problem because most of the water is deep, and little emergent vegetation may exist.

Source reduction activities to control mosquito populations in freshwater habitats, i.e., marshes and ponds, generally consist of consultation with landowners or land stewards to implement measures including constructing and maintaining channels to reduce mosquito production in floodplains and marshes. The primary principle governing source reduction is to manipulate water levels in low-lying areas to eliminate or

reduce the need for chemical control applications. Physical control of mosquitoes in nontidal habitats typically involves improving the habitat value or dispersal potential of the site for mosquito predators; reducing the habitat value for mosquitoes through vegetation management, increased circulation, steepening banks, or changes in water quality; or by reducing the duration of standing water in areas that produce mosquitoes by filling small areas or improving drainage. Filling or draining artificially ponded areas (low spots in flood-irrigated fields, etc.) can be cost-effective and environmentally acceptable, but is not an appropriate strategy in natural areas (however small), large permanent water bodies, or in areas set aside for stormwater or wastewater retention. In such situations, the other options are more appropriate. At this time, the District is rarely involved in new drainage projects. However, the District does maintain or assist with the maintenance of some existing drainage systems. This maintenance can include upkeep of gates and other water control structures, excavating accumulated spoil materials, and vegetation management such as cutting, mowing, clearing debris, and/or herbiciding overgrown vegetation (see Section 2.3.3 for vegetation management including the use of herbicides).

Ditches are a traditional technique for mosquito control, and they function in a number of ways. In addition to providing drainage if they lead from high to low ground, ditches can serve as a larvivorous fish (i.e., fish that eat mosquito larvae) reservoir. As rainfall 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. Also, sills or weirs constructed in ditches can intentionally decrease water flow, decrease emergent aquatic weeds, prevent depletion of the water table, and allow larvivorous fish year-round refuge. Over the past several decades, urban development has occurred in areas where mosquito control drainage ditches have existed as the primary drainage systems. In many cases, maintenance responsibility for mosquito control projects has been taken over by city and county public works departments and integrated into their comprehensive stormwater management programs.

The District considers two mosquito control strategies when advising on freshwater source reduction for mosquito habitat. One strategy involves reducing the amount of standing water or reducing the length of time that water can stand in low areas following significant rainfall or artificial flooding events. In light of this strategy, District staff will advise or require landowners to construct channels or ditches 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. However, the District does not encourage land managers and/or owners to alter vernal pool and seasonal wetland habitats, especially those managed for waterfowl. The District may also recommend, provide advice on, or manage water control structures to manage mosquito population levels while also meeting the needs of the land manager or landowner. The other strategy relies on vegetation management (see Section 2.3.3). District staff will advise or require landowners to remove or thin vegetation to improve surveillance or reduce mosquito habitats. District policy is that with every recommendation, the District also makes it clear to the landowner the requirement for consultation with resource agencies and acquisition of permits that may be needed prior to commencement of any work.

As environmental laws, including Clean Water Act Section 404, greatly restrict mosquito habitat manipulations in freshwater habitats, the District is generally precluded from undertaking permanent physical control of these areas. Consequently, the District does not usually undertake physical control projects in fresh waterbodies including marshes and ponds.

2.3.2.1.2 Seasonal Wetlands and Vernal Pools

The Service Area's Mediterranean climate results in large numbers of seasonally flooded areas, which may produce large numbers of mosquitoes during part of the year. Vernal pools are a specific type of seasonally flooded wetland, distinguished by a subsurface hardpan and often an assemblage of protected plants and invertebrates. Peripheral areas of tidal and historically tidal marshes can produce mosquitoes in response to seasonal rains, as well as following unusually high tides. Physical control methods include those described above for nontidal habitats.

2.3.2.1.3 Freshwater Marshes and Duck Clubs

Within federal and state property, a number of marshes have been created and operated to provide aquatic habitats for wildlife, especially waterfowl. Some of these marshes are drained and refilled periodically to enhance the primary productivity of the habitat, and under certain circumstances, can result in large populations of mosquitoes. The major waterfowl management areas in the District Service Area include sections of Holland Tract (freshwater diked marshlands), Winter Island (fresh to mildly brackish diked marshlands), and CDFW's Point Edith Wildlife Management Area (brackish partially diked marsh). Physical control methods include those described above for nontidal habitats.

2.3.2.1.4 Saline and Brackish Habitats

Saline and brackish marsh habitats of concern are along the edge of San Francisco and Suisun bays that are subject to tidal action, but they can include reclaimed or other brackish/salt marshes that are not subject to natural tidal action. These brackish areas are usually contained by levees, rotary ditches, or other water control structures. Physical control measures are those used for freshwater marshes (nontidal) and increasing tidal circulation such as:

Circulation ditches to enhance drainage or to allow larvivorous fish access to mosquito breeding locations (with enhancement through the creation of permanent water bodies that act as predatory fish reservoirs

Small ditches formed by a speed scavel that are up to 18 inches wide and 18 inches deep to enhance water circulation

Rotary ditching, which involves the construction of shallow ditches usually 4 feet wide and 2 to 3 feet deep, using high-speed rotary equipment with the spoil material evenly distributed in a very thin layer over the marsh surface, with limitations on its use based on the size of ditch needed, soil types, access, adjacent terrain, and vegetation present

Impoundments that involve keeping a sheet of water across a salt-marsh substrate

Rotational impoundment management (RIM), which is a formal strategy of impoundment management that achieves multipurpose management by allowing the impoundment to (1) control salt-marsh mosquito production from the marsh through means other than insecticides, (2) promote survival and revegetation by maintaining open periods and sufficiently low water levels during the summer flooding period, and (3) allow marine life to use the previously unavailable impounded high marsh

Excavation using a low ground pressure excavator

These ecologically sensitive areas require careful implementation of any physical modifications to avoid damage to the habitat and sensitive species that may be present. Physical control measures can reduce salt-marsh mosquito production through enhancement of the frequency and duration of tidal inundation or through other water management strategies.

2.3.2.1.5 Temporary Standing Water and Artificial Ponds

Temporary standing water can occur from a variety of conditions including irrigation of parks, golf courses, and agricultural fields in addition to ponding from rainfall events in natural areas. As environmental laws generally prevent/restrict permanent draining or filling of small artificial ponds, the District employs other options that are effective in controlling mosquitoes, which include periodic draining, providing deepwater sanctuary for larvivorous fish, minimizing emergent and standing vegetation, and maintaining steep banks. Improved drainage is one effective tool for source reduction in such habitats. The second is the use of irrigation practices for those agricultural areas that require artificial watering. 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 technical assistance to landowners who are interested in reducing mosquitoes by developing effective water management systems on certain lands.

Pond management options that are effective in controlling mosquitoes include periodic draining, providing deepwater sanctuary for larvivorous fish, working with landowners to identify leaky pipes, and advising management to minimize emergent and standing vegetation and maintain steep banks. The District routinely advises landowners on the BMPs for ponds to reduce mosquito development.

2.3.2.1.6 Riparian Areas

Control measures will vary depending on the density of the human population, proximity of sensitive species, the vector potential of the mosquito causing the complaint, and access to the larval breeding or adult resting habitat. Minor physical control activities with insignificant environmental impacts can be accomplished using hand tools to connect small ponded areas to the channel along the edge of streams with highly variable flows. Generally, thick brush and complex microtopography preclude extensive physical control in these areas, or chemical control is generally more effective.

2.3.2.1.7 Tree Holes

Control measures are very limited here due to the large numbers of tree holes in most impacted areas, difficulties in access, concerns for staff safety, and in some cases the age and size of the tree (heritage trees). The control methods used are also dependent on the location and numbers of people and pets affected by the mosquitoes produced from this habitat. Current control measures include public education, filling of some holes with sand or other inert materials (absorbent gel) to displace larval habitat, or chemical control (larvicides, adulticides, or aerosols).

2.3.2.1.8 Wastewater Treatment Facilities/Septic Systems

Wastewater recycling and reuse help to conserve and replenish freshwater supplies. 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 by both municipal and commercial/industrial operations may inadvertently create even more mosquito habitats.

Pond management options that are effective in controlling mosquitoes include periodic draining, providing deepwater sanctuary for larvivorous fish, minimizing emergent and standing vegetation, and maintaining steep banks. The District routinely advises property owners on the BMPs for ponds to reduce mosquito development. In addition, the District provides localized vegetation management on most ponds to discourage mosquito oviposition sites.

Onsite treatment systems, such as septic tanks and associated drain fields, can flow laterally into nearby swales and ditches, especially in rural areas. Physical control requires maintenance and repair of these systems by the property owner and ditch maintenance where lateral flow occurs.

2.3.2.1.9 Artificial Container Habitats

Artificial containers, such as flowerpots, cans, barrels, and tires, provide opportunities for mosquitoes to breed in urban areas. A container-breeding mosquito problem can be solved by properly disposing of such materials, covering them, or tipping them over to ensure that they do not collect water. The District has both house-to-house surveillance and education programs to address urban container-breeding mosquito problems.

2.3.2.2 Other Vectors

Physical control for other vectors such as rats, mice and skunks, is based on site inspections by the District to determine conditions promoting harborage and signs of infestation. Property owners are provided educational materials on control measures that include removal of food sources (such as pet

food, bird/squirrel feeders, and fruit from trees) and blockage of access points into the structure. If the vector shows signs of disease, has been involved in human or pet contact incident, or is otherwise posing an immediate health or safety risk, then Contra Costa County Animal Services Department most often employs removal by trapping or shooting.

Three elements are necessary for a successful vertebrate management program: sanitation, exclusion, and rodent proofing.

Sanitation: Correcting sanitation deficiencies is basic in rodent or skunk control. Eliminating food sources through good sanitation practices will prevent an increase in their populations. Sanitation involves good housekeeping, including proper storage and handling of food materials and pet food. For example, store pet food in metal, rodent-proof containers, clean up bird seed spillage, and pick up tree fruit that is on the ground. For roof rats, thinning dense vegetation will make the habitat less desirable. Algerian or English ivy, star jasmine, and honeysuckle on fences or buildings are very conducive to roof rat infestations and should be thinned or removed if possible.

Exclusion of rodents: Sealing cracks and openings in building foundations, and any openings for water pipes, electric wires, sewer pipes, drain spouts, and vents is recommended. No hole larger than ¼ inch should be left unsealed to exclude both rats and house mice. Doors, windows, and screens should fit tightly. Their edges can be covered with sheet metal if gnawing is a problem. Coarse steel wool, wire screen, and lightweight sheet metal are excellent materials for plugging gaps and holes.

Rodent proofing against roof rats requires more time to find entry points than for Norway rats because of their greater climbing ability. Roof rats often enter buildings at the roofline area so be sure that all access points in the roof are sealed. If roof rats are traveling on overhead utility wires, the District recommends/encourages the property owner to contact a pest control professional or the utility company for information and assistance with measures that can be taken to prevent this access.

While activities designed to reduce vector populations through changes in the physical environment are considered Physical Control, they must be distinguished from activities related to rearing or relocating predators of vectors, which are discussed below as “Biological Control,” as well as those tools that impact vector habitat through manipulation of vegetation, which are described below as “Vegetation Management” practices.

2.3.3 Vegetation Management Alternative

The species composition and density of vegetation are basic elements of the habitat value of any area for mosquitoes and other vectors, for predators of these vectors, and for protected flora and fauna. District staff periodically undertake vegetation management activities, or encourage and teach others how to do so on their property, as a tool to reduce the habitat value of sites for mosquitoes and other vectors or to aid production or dispersal of vector predators, as well as to allow District staff’s access to vector habitat for surveillance and other control activities. District staff’s direct vegetation management generally consists of activities to reduce the mosquito habitat value of sites by improving water circulation or access by fish and other predators, or to allow District staff ‘s access to standing water for inspections and treatment.

For vegetation management, the District uses hand tools or other mechanical means (i.e., heavy equipment) for vegetation removal or thinning and sometimes applies herbicides (chemical pesticides with specific toxicity to plants) to improve surveillance or reduce vector habitats. Vegetation removal or thinning primarily occurs in aquatic habitats to assist with the control of mosquitoes and in terrestrial habitats to help with the control of other vectors. To reduce the potential for mosquito breeding associated with water retention and infiltration structures, District staff may systematically clear weeds and other obstructing vegetation in wetlands and retention basins (or request the structures’ owners to perform this task). In particular, thinning and removal of cattail overgrowth would be done to provide a maximum surface coverage of 30 percent or less. In some sensitive habitats and/or where sensitive species concerns exist, vegetation removal and maintenance actions would be restricted to those months or times

of the year that minimize disturbance/impacts. Vegetation management is also performed to assist other agencies and landowners with the management of invasive/nonnative. These actions are typically performed under the direction of the concerned agency, which also maintains any required permits.

Tools ranging from shovels and pruners to chain saws and “weed-whackers” up to heavy equipment can all be used at times to clear plant matter that either prevent access to mosquito breeding sites or that prevent good water management practices that would minimize mosquito populations. Generally, however, District “brushing” activities rely almost entirely on hand tools. Trimmed vegetation is either removed and disposed of properly from the site or broadcast in such a way as to minimize visual degradation of the habitat. Trimming is also kept to a minimum to reduce the possibility of the invasion of exotic species of plants and animals. Surveys for special-status plants using the California Natural Diversity Database and other online sources of information including relevant HCPs, coordination with the landowner, and acquisition of necessary permits are completed before any work is undertaken. Follow-up surveys are also conducted to verify that the work undertaken was effective and that the physical manipulation of the vegetation did not result in any unintended overall habitat degradation.

In addition, the use of water management to control vegetation is in some ways an extension of physical control, in that water control structures created as part of a physical control project may be used to directly manipulate hydroperiod (flood frequency, duration, and depth) as a tool for vegetation management. Where potential evapotranspiration rates are high, water management can also become a mechanism for salinity management and, indirectly, vegetation management through another path.

Table 2-1 (Herbicides Potentially Used by the District for Weed Control) identifies the herbicides potentially used by the District to manage vegetation for control of mosquito and other vector populations and/or to control invasive plant species (noxious weeds). Both Aquamaster (labeled for aquatic applications) and Roundup (labeled for terrestrial applications) are used for spot control of actively growing vegetation. All herbicides are applied in strict conformance with label requirements. Additional information on herbicides used or proposed for possible future use is contained in Appendix B (Table 3-2, Table 4-1, Section 4.6, and Attachment A, Tables A46 – A50).

Table 2-1 Herbicides Potentially Used for Weed Control

Herbicide Product Name	Common Name / Active Ingredients	EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
> Aquamaster	Glyphosate 53.8%	524-343	Shikimic acid pathway disruptor	Spring-Fall	Vehicle mounted sprayer, backpack sprayer, hand can	Ditches, interior margins of wastewater ponds; marshes; access roads; levees; right-of-ways
> Rodeo®	Glyphosate 53.8%	62719-324	Shikimic acid pathway disruptor	Spring-Fall	Vehicle mounted sprayer, backpack sprayer, hand can	Undesirable floating and emergent aquatic vegetation

Table 2-1 Herbicides Potentially Used for Weed Control

Herbicide Product Name	Common Name / Active Ingredients	EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
> Roundup®	Glyphosate 41%	524-475	Shikimic acid pathway disruptor	Spring-Fall	Vehicle mounted sprayer, backpack sprayer, hand can	Ditches, interior margins of wastewater ponds; marshes; access roads; levees; right-of-ways

EPA Number = Registered with the US Environmental Protection Agency

2.3.4 Biological Control Alternative

Biological control of mosquitoes and other vectors involves the intentional use of vector pathogens (diseases), parasites, and/or predators to reduce the population size of target vectors. It is one of the principal components of a rational and integrated vector control management program. Biological control is used as a method of protecting the public from mosquitoes and the diseases they transmit without the use of pesticides and potential problem of pesticide resistance; however, the use of pathogens involves USEPA-registered materials regulated and labeled as chemical insecticides. The different types of biological controls are described in the following paragraphs.

2.3.4.1 Mosquito Pathogens

Mosquito pathogens include an assortment of viruses and bacteria. Pathogens are highly host-specific and usually infect mosquito larvae when they are ingested. Upon entering the host, these pathogens multiply rapidly, destroying internal organs and consuming nutrients. The pathogen can be spread to other mosquito larvae in some cases when larval tissue disintegrates and the pathogens are released into the water to be ingested by uninfected larvae. Examples of viruses that can infect mosquitoes are mosquito iridoviruses, densonucleosis viruses, nuclear polyhedrosis viruses, cytoplasmic polyhedrosis viruses, and entomopoxviruses. Examples of bacteria pathogenic to mosquitoes are Bs, the several strains of Bti, and *Saacharopolyspora spinosa*. Two bacteria, Bs and Bti, produce proteins that are toxic to most mosquito larvae, while *Saacharopolyspora spinosa* produces compounds known as spinosysns, which effectively control all larval mosquitoes. Bs can reproduce in natural settings for some time following release. Bti materials the District applies do not contain live organisms, but only spores made up of specific protein molecules.

All three bacteria are naturally occurring soil organisms that are commercially produced as mosquito larvicides. Because the potential environmental impacts of Bs or Bti application are generally similar to those of chemical pesticide applications, these materials and Spinosad are evaluated below under the Chemical Control Alternative in Section 2.3.5.

2.3.4.2 Mosquito Parasites

The life cycles of mosquito parasites are biologically more complex than those of mosquito pathogens and involve intermediate hosts, organisms other than mosquitoes. Mosquito parasites are ingested by the feeding larva or actively penetrate the larval cuticle to gain access to the host interior. Once inside the host, parasites consume the internal organs and food reserves until the parasite's developmental process is complete. The host is killed when the parasite reaches maturity and leaves the host (*Romanomermis culicivorax*) or reproduces (*Lagenidium giganteum*). Once free of the host, the parasite can remain dormant in the environment until it can begin its developmental cycle in another host. Examples of

mosquito parasites are the fungi *Coelomomyces* spp., *Lagenidium giganteum, Culicinomyces clavosporus*, and *Metarhizium anisopliae*; the protozoa *Nosema algerae, Hazardia milleh, Vavraia culicis, Helicosporidium* spp*., Amblyospora californica, Lambornella clarki*, and *Tetrahymena* spp.; and the nematode *Romanomermis culicivorax*. These parasites are not generally available commercially for mosquito control at present.

2.3.4.3 Mosquito Predators

Mosquito predators are represented by highly complex organisms, such as insects, fish, birds, and bats that consume larval or adult mosquitoes as prey. Predators are opportunistic in their feeding habits and typically forage on a variety of prey types, which allows them to build and maintain populations at levels sufficient to control mosquitoes, even when mosquitoes are scarce. Examples of mosquito predators include representatives from a wide variety of taxa: coelenterates, *Hydra* spp.; platyhelminths, *Dugesia dorotocephala, Mesostoma lingua, and Planaria* spp.; insects, *Anisoptera, Zygoptera, Belostomidae, Geridae, Notonectidae, Veliidae, Dytiscidae, and Hydrophilidae*; arachnids, *Pardosa* spp.; mosquitofish, *Gambusia affinis*, *Gasterosteus aculeatus*; bats; and birds, *anseriformes, apodiformes, charadriiformes, and passeriformes*. Only mosquitofish are commercially available to use at present, or able to be reproduced/reared, while the District supports the presence of the other species as practical (also see Section 15.2).

The District's rearing and stocking of mosquitofish in mosquito habitat is the most commonly used biological control agent for mosquitoes in the world. 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. Correct use of this fish can provide safe, effective, and persistent suppression of a variety of mosquito species in many types of mosquito sources. As with all safe and effective control agents, the use of mosquitofish requires a good knowledge of operational techniques and ecological implications, careful evaluation of stocking sites, use of appropriate stocking methods, and regular monitoring of stocked fish. Mosquitofish reproduce in natural settings, for at least some time after release. Due to concerns that mosquitofish may potentially impact red-legged frog and tiger salamander populations, District policy is to limit the use of mosquitofish by the public 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.

On average, the District produces and releases about 100,000 mosquitofish annually. The District's rearing and stocking program occurs at District offices, The small-scale fish hatchery produces a discharge that averages 2000 gallons per week, and this hatchery wastewater is now being placed into the sanitary sewer system .

2.3.4.4 Other Vectors

No effective predators exist to control high rodent populations. Cats may provide short-term control when the rodent population is low, but they can impact bird populations. The District would not employ cats for rat control. Raptors cannot provide adequate rodent control in urban environments.

Currently, no commercial biological control agents or products are available for wasp and yellow jacket control.

2.3.5 Chemical Control Alternative

Chemical control is a Program tool that consists of the application of nonpersistent selective insecticides (and herbicides noted in Section 2.3.3 above) to directly reduce populations of larval or adult mosquitoes and other invertebrate threats to public health (e.g., ticks) and the use of rodenticides to control rats and mice. If and when inspections reveal that mosquitoes or other vector populations are present at levels that

trigger the District's criteria for chemical control – based on the vector's abundance, density, species composition, proximity to human settlements, water temperature, presence of predators and other factors – District staff will apply pesticides to the site in strict accordance with the pesticide label instructions . The total number of applications and weight or volumes of specific pesticides the District applied in Summer 2011 through Spring 2012 are presented in Appendix B, Attachment A of this PEIR.

2.3.5.1 Mosquito Abatement

The vast majority of chemical control tools are used for mosquito abatement. The primary pesticides used can be divided between "larvicides," which are specifically toxic to mosquito larvae, and "adulticides," which are used to control adult mosquito populations. These pesticides and their applications are described in the following paragraphs.

2.3.5.1.1 Mosquito Larvicides

Larvicides are applied when the chemical control criteria for mosquito larvae are present and application rates vary according to time of year, water temperature, the level of organic content in the water, the type of mosquito species present, larval density, and other variables. Larvicide applications may be repeated at any site at recurrence intervals ranging from annually to weekly.

Larvicides the District routinely uses include Bti, Bs, Methoprene (Altosid or Metalarv), CoCoBear Oil, BVA-2, Masterline Mosquito Larvicide, *Saacharopolyspora spinosa* (Spinosad) (Natular), and Agnique.

Bti is a biological larvicide. Bti is a bacterium that is ingested by mosquito larvae and that disrupts their gut lining, leading to death before pupation. The District applies Bti as a liquid or bonded to an inert substrate (sand or corncob granules) to assist penetration of vegetation. Persistence is low in the environment, and efficacy depends on careful timing of application 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 Bti. Low water temperature inhibits larval feeding behavior, reducing the effectiveness of Bti during very cold periods. High organic conditions also reduce the effectiveness of Bti. Therefore, use of Bti requires frequent inspections of larval sources during periods of larval production, and may require frequent applications of material. Application can be by hand, from an ATV, from watercraft, or from aircraft (helicopter).

Bs is a biological larvicide. Bs is a bacterium that when ingested by mosquito larvae produces microbial gut toxins that destroy the insect gut wall, leading to paralysis and death. Bs is a biological larvicide the District applies as a liquid or bonded to an inert substrate (corncob granule) to assist penetration of vegetation. The mode of action is similar to that of Bti, but Bs may be used more than Bti in some sites because of its higher effectiveness in water with higher organic content and residual properties that allow longer larvicidal action. Persistence is low in the environment, and efficacy depends on careful timing of application 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 Bs. Low water temperature inhibits larval feeding behavior, reducing the effectiveness of Bs during very cold periods. Bs is also ineffective against certain mosquito species such as those in the genus *Aedes*. Knowing the stage and species present can increase the effectiveness of this material, restricting it to sources containing susceptible species. Therefore, use of Bs requires frequent inspections of larval sources during periods of larval production and may require frequent applications of material. Application can be by hand, from an ATV, from watercraft, or from aircraft (helicopter).

Spinosad is an Omri Listed Dow AgroSciences active ingredient that is a fermentation product of bacteria first discovered in an old rum distillery. Spinosad is a fermentation product of the naturally occurring soil bacterium *Saacharopolyspora spinosa*. 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. 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. The District applies

Spinosad as a liquid or as a sustained-release product that can persist for up to 30 or 180 days. It is applied either in response to high observed populations of mosquito larvae at a site or as a sustained-release product that can persist for up to about 6 months. This product has very low potential for accumulation in soil or groundwater contamination. Application can be performed by hand, from an ATV, from watercraft, or from aircraft.

Methoprene, formerly Altosid, now Metalarv, is a synthetic juvenile hormone that is designed to disrupt the transformation of a juvenile mosquito into an adult. Methoprene products must be applied (or present, if using a slow release formula) to the late instar (e.g., third and fourth) and/or pupal stages of mosquitoes. It is not effective against other life stages. Methoprene can be applied in granular, liquid, pellet, or briquet formulation. Sustained-release products can persist for up to 30 or 150 days. Application can be performed by hand, from an ATV, from watercraft, or from aircraft.

BVA-2 and Masterline Mosquito Larvicide are highly refined petroleum distillates (mineral oil). These new larvicides demonstrate a low level of toxicity to plant growth (phytotoxicity) and rapid environmental breakdown. BVA-2 larvicide oil has a water-white clear color and is also practically odorless. It forms a thin film on water and kills larvae through suffocation and/or direct toxicity. It is typically applied at application rates of 3 to 5 gallons per acre and can be applied by hand, from an ATV, from watercraft, or from a truck.

Agnique is the trade name for a surface film larvicide, comprised of ethoxylated alcohol that kills mosquito larvae and pupae. Agnique forms an invisible monomolecular film that is odorless and visually undetectable. This film interrupts the critical air/water interface (surface tension) in the mosquito's larval and pupal development cycle causing them to drown. Because the layer is thin, larvae can still temporarily penetrate the film to get air allowing for them to survive for up to 5 days. Mortality rate is somewhat dependent on life-cycle stage. Larvae are typically killed within 48 to 72 hours; however, with some species and under certain environmental conditions (such as cool temperatures when development is slow) larval control may take upwards of 120 hours. Water temperature will affect oxygen demands and rate of maturation, thus slowing control. Pupae are typically controlled within 24 to 72 hours, and any pupae that attempt to emerge will be controlled due to the presence of the film. The District may use Agnique as an alternative to BVA-2 although costs, limits of application, and effective duration are issues of concern. Because the application rate of Agnique is much lower than that of BVA-2, 0.35 to 1 gallon per acre, this potential shift would not include an increase in volume of materials applied.

CoCoBear Oil is a high performance larvicidal oil, has a patent pending formulation, that has a reduction of petroleum distillates from 98.7% to 10% when compared to its predecessor, GoldenBear. This new larvicide has similar characteristics and properties to Golden Bear Oil 1111 in that it also demonstrates low-level toxicity to plant growth (phytotoxicity) and rapid environmental breakdown. It forms a thin film on water and kills larvae through suffocation and/or direct toxicity. It is typically applied at application rates of 3 to 5 gallons per acre and can be applied by hand, from an ATV, from watercraft, or from a truck.

Mosquito pathogens and other larvicides most likely to be used are listed in Table 2-2 (Pathogens and Other Larvicides the District Uses for Mosquito Abatement).

Larviciding Techniques

Because of the wide range of mosquito sources in the Service Area, and the variety of pesticide formulations described above, the District uses a variety of techniques and equipment to apply larvicides, including handheld sprayers, backpack sprayers and blowers, truck-or-ATV-mounted spray rigs, watercraft, and helicopters or other aircraft. See Section 2.6 for more detailed information on equipment the District uses.

Ground Larviciding Techniques

The District uses conventional pickup trucks and ARGO ATVs as larvicide vehicles. A chemical container tank, high-pressure, low-volume electric or gas pump, and spray nozzle are mounted in the back of the truck bed, with a switch and extension hose allowing the driver to operate the equipment and apply the larvicide. The ATVs have a chemical container mounted on the vehicle, a 12-volt electric pump supplying high-pressure, low-volume flow, and booms and/or hose and spray tips allowing for application while steering the vehicle. ATVs are ideal for treating areas such as agricultural fields, pastures, and other offroad sites. Additional training in minimizing habitat impacts, recognizing sensitive flora and fauna, and ATV safety and handling is provided to employees before operating these machines.

Additional equipment used in ground applications of liquid formulations includes handheld sprayers (handcans or spray bottles), and backpack sprayers and blowers. Handheld sprayers (handcans) are commercial 1- 3-gallon pump-up sprayers used to treat very small isolated areas. Backpack liquid sprayers are hand pump-up and have a 2- 5-gallon tank or are gas powered with a chemical tank and calibrated proportioning slot. Generally, a pellet or small granular material is applied by hand or with a gas-powered backpack sprayer, blower, ATV-mounted Herd Seeder, or hand crank "belly grinder" machine designed to evenly distribute the pellets or granules.

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Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Pathogens/Biological Control							
Agnique MMF G	Water soluble surface film		EPA 53263-30	Larvicide/pupacide; film spreads over standing water surface and reduces surface tension causing larvae to drown (prevents adult emergence).	Jan.-Dec.	Hand sprayer Power Sprayer	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
FourStar SBG	Bti 2.15%		EPA 85685-1	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
FourStar SR Briquet 180-90-45	Bs 6% Bti 1% 180, 90, 45 day briquets		EPA 83362-3	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoBac 12AS	Bti, 1.2% liquid		EPA 73049-38	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Power Sprayer	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoBac G	Bti, 0.2% granule		EPA 73049-10	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole

Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
VectoLex CG Biologic	Bs 7.5% granule		EPA 73049-20	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoLex WDG	Bs 51.2% granule		EPA 73049-57	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoLex WSP	Bs, 7.5% granule in water soluble packets		EPA 73049-20	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoMax CG	Bs, 2.7% and Bti 4.5% granules		EPA 73049-429	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
VectoMax WSP	Bs, 2.7% and Bti 4.5% granules in water soluble packets		EPA 73049-429	Larvicide; when ingested, produce microbial gut toxins that destroy insect gut wall leading to paralysis and death.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole

Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Other Larvicides							
Agnique MMF	Water soluble surface film		EPA 53263-28	Larvicide/pupacide; film spreads over standing water surface and reduces surface tension causing larvae to drown (prevents adult emergence).	Jan.-Dec.	Hand Spray Bottle	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid Briquets	Methoprene 7.9% 30 day		EPA 2724-375	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid Liquid conc.	Methoprene 20% liquid con.		EPA 2724-392	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Power Sprayer	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid Pellets	Methoprene 4% pellet 30 days		EPA 2724-448	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Backpack Blower Hand Seeder Helicopter Hopper	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid SBG	Methoprene 0.2% granule 5-10 days		EPA 2724-489	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole

Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Altosid WSP (pellets)	Methoprene 4.25% granule in water soluble packs 30 days		EPA 2724-448	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid XR-Briquets	Methoprene 2.1% 150 days		EPA 2724-421	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Altosid XR-G (granules)	Methoprene 1.5% granule 21 days		EPA 2724-421	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
BVA 2	Refined Petroleum distillate		EPA 70589-1	Larvicide/pupacide; film spreads over standing water surface and reduces surface tension causing larvae to drown (prevents adult emergence).	Jan.-Dec.	Power Sprayer Helicopter – Power Spray	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Natular 2EC	Spinosad 20.6% liquid conc.		EPA 8329-82	Larvicide; alters acetylcholine receptors causing involuntary neurological impacts.	Jan.-Dec.	Power Sprayer Hand Spray Bottle	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole

Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Natular G	Spinosad 2.5% granule		EPA 8329-80	Larvicide; alters acetylcholine receptors causing involuntary neurological impacts	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Natular G30	Spinosad 2.5% granules 30 days		EPA 8329-83	Larvicide; alters acetylcholine receptors causing involuntary neurological impacts.	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Natular T30	Spinosad 8.33% tablets 30 days		EPA 8329-85	Larvicide; alters acetylcholine receptors causing involuntary neurological impacts.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
Natular XRT	Spinosad 6.25% tablets 180 days		EPA 8329-84	Larvicide; alters acetylcholine receptors causing involuntary neurological impacts.	Jan.-Dec.	Hand	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole
MetaLarv SP-T	Methoprene 4.25% time released granule		EPA 73049-475	Hormone analogue that interferes with larval development (insect growth regulator).	Jan.-Dec.	Backpack Blower Hand Seeder	Artificial containers, catch basins, channels, intermittent water, marsh, pond, tree hole

Table 2-2 Pathogens and Other Larvicides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	Chemical Type	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
CoCoBear	Refined Petroleum distillate 10%		EPA 8329-93	Larvicide/pupacide; film spreads over standing water surface and reduces surface tension causing larvae to drown (prevents adult emergence).	Jan.-Dec.	Hand Sprayer Power Sprayer Helicopter Sprayer	

CAS Number = Chemical Abstracts Service Registry Number

EPA Number = Registered with the US Environmental Protection Agency

Using ground application equipment, both when on foot and when conveyed by vehicles, has several advantages. Ground larviciding allows applications while in close proximity to the actual treatment area and, consequently, treatments occur to only those microhabitats where larvae are actually present. This method also reduces both the unnecessary pesticide load on the environment and the financial cost of the amount of material used and its application. Both the initial and the maintenance costs of ground equipment are generally less than for aerial equipment. Furthermore, ground larviciding applications are less affected by weather conditions than are aerial applications.

However, ground larviciding is impractical for large or densely wooded/vegetated areas. Also, risk of chemical exposure for the applicators (workers) is greater than during aerial larviciding operations. Damage may occur from the use of a ground vehicle in some natural areas. Ruts and vegetation damage may occur, although both these conditions are reversible and generally short-lived. Technicians are trained to recognize sensitive habitat areas and to use good judgment to avoid impacting these areas.

Aerial Larviciding Techniques

When large areas or areas difficult to reach are simultaneously producing mosquito larvae at densities exceeding District treatment thresholds, then the District may use helicopters or other aircraft to apply any of the larvicides discussed above or listed in Table 2-2. The District contracts with independent flying services to perform aerial applications, with guidance to the target site District staff provides. Aerial application of larvicides is a relatively infrequent activity for the District, typically occurring only a few times each year, with each application covering 100 to 200 acres. However, larval production can vary substantially, and the District is capable of undertaking more frequent or extensive operations if necessary.

The larvicides, excluding granular and pellet formulations, are typically combined with water and applied as a low-volume wet spray mix at 2 gallons per acre. Depending on weather conditions, the volume of final mix can be increased to 5 gallons per acre without changing the actual amount of larvicidal active ingredient that is applied per acre. Adjusting the final mix volume per acre to 5 gallons (or in extreme cases up to 100 gallons per acre) has the advantage of increasing the droplet size to help minimize potential drift and the disadvantage of substantially increasing the flying time, which also increases costs. Aerial application of liquid larvicides typically occurs during daylight hours and at an altitude above the treatment site of less than 40 feet.

Granular and pellet formulations of larvicides are applied using a large mechanical spreader with a bucket (or hopper) that can hold several hundred pounds of granules/material beneath the aircraft. Granular and pellet formulations are generally much more expensive than liquid formulations of larvicides and are used to penetrate dense vegetation. Application rates can range between 3 and 10 pounds per acre for pellets/granules impregnated with methoprene. Applications of methoprene pellets above 5 pounds per acre are highly unlikely due to the high cost. Applications are around 10 pounds per acre for corncob granules impregnated with Bti or Bs. Rates depend on the density of vegetative cover and the organic content of the mosquito breeding water being treated. It is also significant to note that granular applications occur during daylight hours and are at an altitude that is less than 50 feet.

Using aerial application equipment has are three advantages compared to ground application. First, it can be more economical for large target areas with extensive mosquito production. Second, by covering large areas more quickly, it can free District staff to conduct other needed surveillance or control. Third, it can be more practical for remote or inaccessible areas, such as islands, large marshes, and densely vegetated tule areas, than ground larviciding. However, risk of drift is greater with aerial applications, especially with liquid or ultralow volume (ULV) aerial larviciding and, consequently, more potential risk of nontarget exposure exists. In addition, accuracy in hitting the target area temporarily requires additional manpower for flagging or electronic guidance systems, which can increase costs. Finally, in addition to the timing constraints inherent in most larvicide use, the potential application window can be very narrow for aerial activities due to weather conditions.

2.3.5.1.2 Mosquito Adulticides

In addition to chemical control of mosquito larvae, the District may use pesticides for control of adult mosquitoes when no other tools are available and if specific criteria are met, including species composition, population density (as measured by landing count or other quantitative method), proximity to human populations, and/or human disease risk. As with larvicides, adulticides are applied in strict conformance with label requirements (Appendix B). Adulticides the District potentially uses include Pyrethrins (Pyrocide®, Pyrenone 25-5®); Pyrenone Crop Spray®, and the synthetic pyrethroids Resmethrin (Scourge®) and Permethrin (Kontrol 4-4). Table 2-3 lists the adulticides the District uses for mosquito abatement for 2013 and beyond. Adulticide materials are used infrequently and only when necessary to control adult mosquito populations.

Ground Adulticiding Techniques

The most common form of adulticide application is via insecticide aerosols at very low dosages. This method is commonly referred to as the ULV method. This method employs specially designed ULV equipment mounted on trucks, ATVs, golf carts, and boats or handheld for ground applications. Barrier or residual treatments for adult mosquitoes consist of an application using a material generally applied with a compressed air sprayer to the preferred foliage, buildings, or resting areas of the mosquito species.

Cold aerosol generators, cold foggers, and ULV aerosol machines were developed to eliminate the need for great quantities of petroleum oil diluents necessary for earlier fogging techniques. These units are constructed by mounting a vortex nozzle on the forced air blower of a thermal fogger. Insecticide is applied as technical material or at moderately high concentrations (as is common with the pyrethroids), which translates to very small quantities per acre and is, therefore, referred to as ULV. In agriculture, this rate is assumed less when 36 ounces per acre, but mosquito control ground adulticiding operations rarely exceed 1 ounce per acre. The optimum sized droplet for mosquito control with cold aerosols applied at ground level has been determined to be in the range of 5 to 20 microns.

Adulticiding is the only known effective measure of reducing an adult mosquito population in a timely manner. All mosquito adulticiding activities follow reasonable guidelines to avoid affecting nontarget species including bees. Timing of applications (when mosquitoes are most active), avoiding sensitive habitat areas, working and coordinating efforts with CDFW or USFWS when appropriate, and following label instructions all result in environmentally sound mosquito control practices.

Aerial Adulticiding Techniques

Aerial applications may be the only reliable means of obtaining effective control in areas bordered by extensive mosquito production sites or with a small, narrow, or inaccessible network of roads. Aerial adulticiding is often the only means available to cover a very large area quickly in case of severe mosquito outbreaks or vector-borne disease epidemics.

Two aerial adulticiding techniques are used in California: low-volume spraying and ULV aerosols. Low-volume (<2-gallon-per-acre) sprays are applied with the pesticide diluted in light petroleum oils or water and applied as a rather wet spray. The size of the droplets reduces drift, thus limiting swath widths, and may not be ideal under certain circumstances for impinging on mosquitoes. The technique is compatible with equipment commonly used for aerial liquid larviciding.

A common aerial adulticiding technique applies the insecticide in a technical concentrate or in a very high concentration formulation as a ULV cold aerosol. Lighter aircraft, including helicopters, can be used because the insecticide load is a fraction of the other techniques. If the aircraft are capable of >120 knots, fine droplets can be created by the high-speed air stream impacting the flow from hydraulic nozzles. Slower aircraft and most helicopters typically use some variety of rotary atomizers to create the required droplet spectrum. ULV applications can be difficult to accurately place with any regularity. Without the visual cues, drift and settling characteristics can be difficult to access.

Table 2-3 Adulticides Contra Costa Mosquito and Vector Control District Uses for Mosquito Abatement

Pesticide Product Name	Common Name / Active Ingredients	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Aqua Reslin	20% Permethrine; 20% PBO	EPA 432-796	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all
Pyrenone 25-5	5% Pyrethrins and 25% PBO	EPA 432-1050	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all
Pyrocide 7396	Pyrethrin 5% and PBO 25%	EPA 1021-1569	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all
Pyronyl Crop Spray	Pyrethrin 6% and PBO 60%	EPA 655-489	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all
Scourge 4%	4.14% Resmethrin and 12.42% PBO	EPA 432-716	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all
Zenivex	Etofenprox 20%	EPA 2724-791	Adulticide; interferes with sodium channel function in the nervous system.	Mar.-Nov.	ULV ground	all

CAS Number = Chemical Abstracts Service Registry Number

EPA Number = Registered with the US Environmental Protection Agency

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The flight parameters differ by program and technique. Some operations fly during hours of daylight so their applications begin either at morning's first light or before sunset and work into twilight. At these times, the pilots should be able to see towers and other obstructions as well as keep track of the spray plume. The aircraft can be flown at less than a 200-foot altitude, which may make it easier to hit the target area.

Other operations may be conducted in the dark of the night, typically after twilight or early in the morning before dawn. The aircraft typically are flown between a 200- and 300-foot altitude. Swath widths vary from operation to operation but are normally set somewhere between 400 and 1,200 feet. Most mosquito flight activity is crepuscular, so these flights catch the adults at their peak activity.

Swaths are flown as close to perpendicular with the wind as is possible, working into the wind and commonly forming a long, tight S pattern. A number of factors affect the spray-drift offset and settling such as wind speed, droplet size, aircraft wake turbulence, altitude, and even characteristics of the individual aircraft. Pilots rely somewhat on experience for determining this offset, and some use telltale smoke or paper markers for swath alignment.

Aerial applications may be conducted over, but are not limited to, the following land uses within the Program Area: salt marsh, diked marsh, and seasonal wetlands; evaporation ponds and wastewater ponds; and agricultural, residential, commercial, industrial, and recreational areas.

2.3.5.2 Yellow Jacket and Tick Abatement

Besides using insecticides for mosquito populations, the District selectively applies them to control ground-nesting yellow jackets, as well as to control tick populations that pose an imminent threat to people or to pets. This activity is generally triggered by public requests for District assistance or action rather than as a result of regular surveillance of their populations. The District excludes from its yellow jacket control program populations of this vector that are located in or on a structure. Yellow jacket nests that are off the ground would be treated under special circumstances to protect public health and safety of the District's residents. Whenever a District technician learns that a hive is situated inside or on a structure or is above ground, the resident(s) are encouraged to contact a private pest control company that is licensed to perform this work. When a technician encounters a honeybee swarm or unwanted hive, residents are provided a list of beekeepers that can safely remove the bees. If a beekeeper is not readily available, swarms posing an imminent threat to public safety may be treated with MPede (insecticidal soap). If a District technician deems it appropriate to treat yellow jackets, they will apply the insecticide directly within the nest in accordance with the District's policies to avoid drift of the insecticide or harm to other organisms. Alternatively, they will place tamper-resistant traps or bait stations, selective for the target insect, in the immediate environment of the vector (which is equivalent to "other vertebrate vector control").

Pyrethroid-based chemicals are typically used against ground-nesting yellow jackets and ticks. The potential environmental impacts of these materials is minimal due to two factors: (1) their active ingredients consist largely of Pyrethrin (a photosensitive natural insecticide manufactured from a Chrysanthemum species), or Allethrin and Phenothrin (first generation synthetic pyrethroids with similar photosensitive, nonpersistent characteristics as Pyrethrin), and (2) the mode of their application for yellow jacket population control (i.e., directly into the underground nest) prevents drift and further reduces the potential for inadvertent exposure to these materials. The pesticides the District uses to control yellow jacket and tick populations are shown in Table 2-4 (Pesticides the District Uses for Yellow Jacket Wasp Abatement**)** and Table 2-5 (Pesticides the District Uses for Tick Abatement).

2.3.5.3 Rat Abatement

The District has developed a rat population control program to serve residents in the Service Area. The District's limited use of rodenticides is a result of surveillance or in response to the identification of populations as a result of citizen complaints. Table 2-6 (Pesticides the District Uses for Rat Abatement) lists the pesticides the District uses for control of rats. The District may use two different groups of anticoagulant rodenticides, known as first generation and second generation rodenticides. First

generation rodenticides require consecutive multiple doses or feedings over a number of days to be effective. Concentrations of active ingredient in the bait typically range from 0.005 to 0.1 percent. Second generation rodenticides are lethal after one dose and are effective against rodents that have become resistant to first generation rodenticides. Concentrations of active ingredient in the bait typically range from 0.001 to 0.005 percent, as these anticoagulant baits are far more toxic than first generation baits.

The District may conduct rodent baiting at underground sites such as sewers, storm drains, or catch basins. Secure and tamper-resistant bait stations or other accepted methods of rodent baiting are conducted in areas with severe rodent infestations. In sewer baiting, bait blocks containing bromadiolone (a second generation, single-feeding anticoagulant rodenticide) are often used. The block is suspended by wire above the water line to encourage rodent feeding. For rodent burrows when the rodent population poses a public health risk, chlorophacinone (a first generation, multiple feeding anticoagulant dust) is blown into the burrows.

2.3.6 Other Nonchemical Control/Trapping Alternative

Trapping of rodents can be utilized for population and disease surveillance purposes. Commensal rodents may be trapped to determine species and abundance. Non-commensal (wild) rodents may occasionally be trapped and tested for hantavirus, plague or other rodent borne diseases in cooperation with the California Department of Public Health, under a scientific collecting permit issued by the California Department of Fish and Wildlife. In general, when requests for rodent removal in or on structures occur, citizens are provided with recommendations for trapping, exclusion, and disease prevention or referred to local private pest control companies

Trapping can be utilized for the removal of nuisance wildlife such as skunks when these animals pose a risk to public health and safety. The two primary reservoir vectors of rabies in California are bats and skunks. Both live in close proximity to humans and their pets because of their ability to adapt to the urban/suburban environment. Residential landscapes provide them with an abundance of food and shelter options that have increased their numbers and the potential for direct contact with the human population. This scenario is true for all wildlife and because of it a potential rabies health threat exists. The District works with home and property owners to discourage wildlife such as skunks and bats from taking up residence on their property. Upon a service request, the District's Vector Control Inspector will survey the property and provide guidance and recommendations on exclusion methods to minimize their impact on the property. If all efforts are implemented and the problem remains or a risk to public health and safety exists or economic damage is imminent, the District may leave a trap on property and train the resident on its use and District protocols.

Current protocol is the District may loan live catch skunk traps if specific criteria are met. Residents are requested to check traps every morning and promptly report trapped animals to the District. Failure to comply with this request will result in removal of the trap. Captured skunks are humanely euthanized using carbon dioxide gas in compliance with California Fish and Game Code prohibiting the translocation of trapped animals, which would create a risk of spreading disease.

2.4 Public Education

Public education is a key component that is used to encourage and assist reduction and prevention of vector habitats on private and public property. While this component is a critical element of the District's Program, public education activities are categorically exempt from CEQA review (CEQA Guidelines Section 15322) based on a finding by the State Secretary of Resources that these activities do not have a significant effect on the environment. Therefore, these activities will not be further reviewed in this document.

A solid mosquito/vector prevention program includes good public education. The District's education program teaches the public how to recognize, prevent, and suppress mosquito/vector breeding on their property. This part of the project is accomplished through the distribution of brochures, fact sheets,

newsletters, participation in local events and fairs, presentations to community organizations, newspaper and radio advertising, public service announcements, and contact with District staff in response to service requests. Public education also includes a school program that teaches future adults to be responsible by preventing and/or eliminating vector breeding sources and educates their parents or guardians about District services and how they can reduce vector-human interaction.

Educational activities also include making recommendations on specific property development and land and water management practices or proposals, in response to ongoing or proposed developments or management practices that may create sources of mosquitoes/vectors. To ensure that the District does not indirectly encourage environmental impacts without CEQA review, the District informs landowners and others who might modify the physical environment in response to our educational programs that they have specific environmental obligations, including compliance with CEQA and permit requirements. The District is not a permitting agency and it is not responsible for implementing or approving the recommendations; therefore, property owners or developers are required to prepare and submit their own documents for projects, which may require CEQA review.

2.5 Emergency Activities

In the event of emergency conditions, comprising an actual or imminent disease outbreak declared by the CDPH, the District's Program activities will temporarily vary from its routine operational tools through increases in scope or intensity of methods, and potentially through use of legal pesticides, in strict conformance with label requirements, that the District does not routinely use. Because of their temporary nature and their similarity to routine activities, emergency activities are not evaluated separately in this PEIR. In addition, the state has recognized that emergency conditions may require prompt action of a nature or intensity above typical levels as a means to protect public health, welfare, safety, or property, and has exempted these activities from requirements for further environmental review (CEQA Guidelines Sections 15269, 15359).

2.6 Vehicles and Equipment Used to implement the Program

Equipment listed and described herein is those mechanized items with engines or applicators that have the potential to affect air quality, greenhouse gas emissions, noise, or hazard evaluations for the environmental impact analyses. The specific types of District vehicles and equipment, and aerial equipment used by other pesticide applicators under contract, used in its Program are listed in Table 2-7 (District Vehicle and Equipment List). The list includes vehicles, vehicle-borne pesticide applicators, personnel-borne applicators, and power tools. Nonmechanized equipment, such as trailers and hand rakes, is not included.

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Table 2-4 Pesticides Contra Costa Mosquito and Vector Control District Uses for Yellow Jacket Wasp Abatement

Pesticide Product Name	Common Name / Active Ingredients	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Drione®	Pyrethrin 1%, PBO 10%, Amorphous Silica Gel 40%	CAS 432-992	Adulticide; interferes with sodium channel function in the nervous system.	April-November	Bulb duster	
MPEDE*	Potassium salts of fatty acids 49%	CAS 53219-6	smothering and barrier effects	April-November	Power sprayer	

*Suspected Africanized Honeybees only

CAS Number = Chemical Abstracts Service Registry Number

EPA Number = Registered with the US Environmental Protection Agency

Table 2-5 Pesticides Contra Costa Mosquito and Vector Control District Uses for Rat Abatement*

Pesticide Product Name	Common Name / Active Ingredients	CAS or EPA Number	Mode of Action	Timing of Application	Method of Application	Sites
Bell Contrac Small Blox	Bromadiolone	12455-79	Second-generation anticoagulant.	Jan.-Dec.	Bait Station	All nonaquatic
Bell Contrac Super-Size Blox	Bromadiolone	12455-82	Second-generation anticoagulant.	Jan.-Dec.	Bait Station	All nonaquatic
Bell Terad 3 Blox	Cholecalciferol	12455-106	Hypocalcaemia, CNS depression	Jan.-Dec.	Bait Station	All nonaquatic
First Strike	Difethialone	7173-258	Second-generation anticoagulant.	Jan.-Dec.	Bait Station	All nonaquatic
Ditrac Blox	Diphacinone	12455-80	First-generation anticoagulant	Jan.-Dec.	Bait Blocks	All nonaquatic

*Always check the label for the active ingredient. The same or similar trade names may be used for products with different active ingredients.

CAS Number = Chemical Abstracts Service Registry Number

EPA Number = Registered with the US Environmental Protection Agency

Table 2-6 Contra Costa Mosquito and Vector Control District Vehicles and Equipment

Type of Vehicle/Equipment	Engine	Fuel Type
Ground Surveillance and Applications/Management		
Chevy Pickup Truck	V-8 ; 4.8, 5.3, 5.7, 6.0, 7.4 L	Gas
GMC Pickup Truck	V-8 ; 4.8, 5.3, 5.7, 6.0, 7.4 L	Gas
Toyota SUV	2.4 L	Gas
Chevy Cargo Van	4.3 L	Gas
Hand Sprayer – LECO ULV Model 800	Briggs and Stratton	Gas
Hand Sprayer – Mozzie ULV Model 250	Electric	Electric
Transfer Tank Rears 200SS	Honda GX160	Gas
A-1 Mist Blower	Honda GX160	Gas
Storm Mister	Honda GX390	Gas
Clarke-Cougar ULV	Briggs and Stratton	Gas
MicroGen ED2-20	Briggs and Stratton	Gas
Maruyama Mist Duster MD150DX	Kawasaki	Gas/Oil Mix
Maruyama Mist Duster MD155DX	Kawasaki	Gas/Oil Mix
Stihl SR420	Stihl	Gas/Oil Mix
Colt-T ULV	Tecumseh TCII	Gas/Oil Mix
LECO P-1 ULV	Robin Eco2	Gas/Oil Mix
LECO P-1 ULV	Robin Eco25	Gas
Water Surveillance and Applications/Management		
Gregor Boat	Johnson 15 hp 4 stroke	Gas
Kvichak Conquest Boat	Johnson 115 hp 2 stroke	Gas/Oil Mix
Argo ATV	Kawasaki 26 hp	Gasoline
Honda ATV	Honda 475cc 4 stroke	Gasoline
Polaris ATV	Polaris 300cc 4 stroke	Gasoline
Aerial Applications		
1968 Bell 206 Jet Ranger helicopter	Allison 250-C20J turboshaft 420 shp	Jet Fuel
1989 Bell 206 Jet Ranger helicopter	Allison 250-C20J turboshaft 420 shp	Jet Fuel
1960 Hiller Soloy helicopter	Allison 250-C20J turboshaft 420 shp	Jet Fuel
1992 Air Tractor AT-502 Turbine	507 kW (680shp) Pratt & Whitney Canada PT6A series turboprop	Jet Fuel
1987 Air Tractor AT-501	Pratt & Whitney 600 shp	Jet Fuel

2.6.1 Vehicles and Equipment for Ground Surveillance and Chemical Application

The District uses open bed 4-wheel drive pickup trucks that have been modified for the particular Program activity. Generally, 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 larvicides. When treatment sites cannot be accessed by roads, access is by way of ATVs or by foot (if vehicle access is prohibited), and treatments are made using handheld sprayers or belly grinders (for granular or pellet formulations). Some situations where flooding and wetlands preclude access by 4-wheel drive vehicles or reasonable walking distance in waders/boots do require the use of an approved ATV. District staff do not use ATVs where environmental conditions (e.g., impenetrable vegetation/terrain, endangered/threatened plants, sensitive habitat) can result in causing an accident, personal injury, or significant environmental damage. When used, ATVs are fitted with 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 like agricultural fields, pastures, salt marshes, and other offroad sites.

Additional equipment used in ground applications includes handheld sprayers, seeders, and backpack sprayers/blowers. Handheld sprayers (handcans) are standard 1- or 2- or 2- or 3-gallon garden style pump-up sprayers used to treat small isolated areas with precision. Backpack sprayers are either gas or hand powered and are fitted with chemical tanks that can hold granular or pellet formulations in addition to liquid. Generally, for smaller areas, pellet or small granular material is applied with a mechanical hand-crank spreader, seeder, or backpack blower.

The manual removal of vegetation is the primary method used for vegetation management within and around a waterbody and would be performed using hand pruners, trimmers, handsaws, chainsaws, and weed eaters. The use of heavy equipment for vegetation management in waterways supporting native or special status fish species would only be used with the following BMPs: consultation with resource agencies, not operating such equipment in the water; providing appropriate containment and cleanup systems to avoid, contain, and clean up any leakage of toxic chemicals into the aquatic environment; controlling turbidity; and minimizing the area that is affected by the vegetation management activity. In Section 2.9, see Table 2-9 for a complete listing of BMPs used by the District at present and in the future.

2.6.2 Boats for Water Surveillance and Application

District personnel use a 13 foot aluminum outboard-equipped boat or a 24 foot aluminum outboard-equipped boat to inspect and treat large deepwater bodies and islands. In the future, the district may also utilize an airboat. They are commonly used to access sloughs without usable levee roads, lakes, ponds, sewage treatment facilities, islands, and marsh areas within the project area. 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 offroad areas of the creek beds and hazardous terrain along shorelines for carrying treatment equipment on foot. Airboats can be used specifically in areas with shallow water and vegetation that can preclude the use of an outboard boat or ATV, and provide increased efficiency and efficacy for surveillance and treatment in large aquatic areas. Further, boat operations do not have lasting environmental impacts.

2.6.3 Aerial Application

The District uses a contract agricultural application service to provide helicopter and potentially fixed wing aircraft[3] treatments to large or problematic/difficult access source areas (around 100 acres, up to 1,200 acres). Helicopter and fixed-wing operations are done at very low altitude in areas away from people. An advantage of using a helicopter is the high rate of application to large areas without contact with the ground surface (no disturbance of vegetation) at a reasonable per acre cost. A helicopter can treat up to 200 acres per hour. Helicopter treatments occur during daylight hours, typically before noontime when little or no wind occurs, and at an altitude that is less than 40 feet above the surface of the site being treated. A 120-gallon tank is used with a typical application rate of 2 gallons of final mix per acre. Although very cost prohibitive, the application rate can exceed 5 gallons per acre in "special" circumstances when a larger droplet size is desired to further minimize potential drift issues or penetrate vegetation. Typically, aerial larvicide treatments are done using granular Bs and Bti formulations at a target rate of 10 to 20 pounds per acre depending on the density of vegetation. If dense vegetation is present, application rates may increase to up to 20 pounds per acre.

2.7 Program Alternatives

The District has developed a range of project alternatives partially as result of input from the scoping process, and these alternatives and others are briefly described and evaluated in a technical report to the PEIR (Appendix E). This technical report is also summarized in Chapter 15 of this PEIR.

2.7.1 No Program Alternative

CEQA Guidelines require an analysis of the "No Project" Alternative, which is defined as what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services [Section 15126.6, Subdivision (e)(2)]. For Program purposes, the No Project Alternative would be equivalent to "no action" or to discontinue the Program described above. In the absence of continuing the current Program, the District would not exist solely to engage in public education control activities. See Section 15.2.2 for more information on the No Program Alternative.

2.7.2 Alternatives Eliminated from Further Consideration

These alternatives are identified and evaluated in the District's Alternatives Report (Appendix E) and summarized in Section 15.2 of this PEIR. In summary, the District determined that of the 19 potential tools, the following 8 methods were not immediately available or viable for use in its IMVMP: biological control pathogens (viruses), biological control (parasites), biological control plants, mass trapping, attract and kill, inundative releases, regulatory control, and repellents.

- Biological Control Pathogens (viruses) is deemed infeasible for mosquito, yellow jacket wasp, tick, and rodent control at present. This method is not commercially available in California, and there are currently many efficacy related issues.

- Biological Control (parasites) is deemed infeasible, as this method is not commercially available in California. Research on the use of parasites for mosquito control has also shown several limitations related to efficacy. Although the use of parasites as a means for managing vector populations shows promise, much work concerning their biology, cultivation, mass production, transport, and release remains to be done.

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[3] The District does not currently use any fixed-wing aircraft for aerial treatments but could do so in the future if the need arose.

- Biological Control Plants, or carnivorous plants, whether terrestrial or aquatic, use a wide range of invertebrate prey and are not specific predators of mosquitoes. What little data exist indicates that carnivorous plants, especially terrestrial species, are inefficient for the control of mosquitoes and other invertebrate vectors.
- Mass Trapping is not considered by the District to be a practical, effective, reliable method of controlling vector populations. Operational difficulties exist in placing out and retrieving large numbers of traps for most vectors, the least of which are the volume of traps required, numbers of staff, amount of staff time, access, and travel necessary for this tool to be effective. Mass trapping of mosquitoes has proven to be both costly and in most instances ineffective. Mass trapping of yellow jackets also has a limited effect on the abatement of yellow jackets, with the traps sometimes becoming an attractive nuisance.
- Attract and Kill is not considered by the District to be a practical, effective, reliable, method of controlling vector populations. The technology for both mosquitoes and yellow jackets is limited, and effectiveness is either not obtained or is inconsistent. Nontarget insects can be impacted. The District is aware of one commercially available ATSB product, Terminix® AllClear. The District still needs to operationally test this material, as well as other potential ATSBs, to determine those circumstances where their use may be effective while also having little or no nontarget species impacts.
- Inundative Releases, of either sterilized or genetically altered, is not considered by the District to be a practical or a currently feasible method of controlling vector populations. Genetically modified vectors are still experimental. They are also not commercially available at this time. The use of any genetically altered organisms, even mosquitoes, may also not be acceptable to the public
- Regulatory Control is not considered feasible because adoption of regulations is lengthy, time intensive, expensive and uncertain as to the regulatory outcome. This approach is not focused sufficiently on control of existing populations. Moreover, regulatory controls are dependent upon state and federal agencies to initiate and implement, and thus this approach cannot assure that any project objectives would be achieved. Additionally, regulatory actions have the potential to create as well as eliminate additional vector habitats.
- > Repellants, although effective for small-scale use by humans and animals, are not part of the overall Program control strategy because they merely displace the problem and do not reduce the vector population in an area. Repellents also require proper application, timely use, and discipline concerning their use to achieve optimal effectiveness. Unfortunately, the use of repellents does not guarantee the elimination of human vector interactions and potential vector-borne disease transmission.

2.7.3 Other Alternatives

While no other alternatives are considered feasible or appropriate to achieve the District's Program objectives, and all of the Program alternatives would be combined into the District's Proposed Program, potential options or alternative methods within some of the Program alternatives could be used to modify those alternatives, thus minimizing impacts to the environment or replacing chemical treatments previously used. A Reduced Chemical Control Program was evaluated to reduce the impact to air quality from possible objectionable odors.

2.7.4 **Environmentally Superior Alternative**

Table S-1 presents a summary of all the impacts associated with each Program alternative and. therefore, the overall Program of all of the alternatives combined. It is based on Table 15-1 which presents a summary of all the statements of impact with significance determinations. For Surveillance, Physical Control, Vegetation Management, Chemical Control, and Nonchemical Control/Trapping Alternatives, the impacts are either “less than significant” (LS) or “no impact” (N). There is only one potentially significant impact: The Chemical Control Alternative could subject people to objectionable odors. Impacts even with BMPs implemented could be potentially significant but mitigable. Certain VOCs, sulfur compounds, and chlorine compounds found in some pesticides emit characteristic odors when they evaporate (volatilize) into air, even at very low concentrations well within safety limits. Pesticides currently used or proposed for future emit phenols (e.g., deltamethrin, etofenprox, permethrin, or resmethrin). Materials such as Bti and the adulticides pyrethrin and permethrin have an odor. Due to limited applicability, small quantities of these types of substances are typically used. The human sense of smell (olfactory system) is sensitive to these types of compounds as a warning mechanism, and some individuals are more sensitive than others. The Chemical Control Alternative would apply certain types of odorous treatments using hydraulic spraying and atomizing (fogging), which could result in drift of small droplets and gaseous vapors. Depending on atmospheric conditions (i.e., wind direction, wind speed, stability class), this drift could subject people to objectionable odors near a treatment area. The materials have been used in the current Program, and people have not complained about odors. However, it is possible that complaints could occur in the future despite public notification procedures about large-scale treatments. Section 15.4 describes two "Reduced Program Alternatives:" Reduced Chemical Control and No Chemical Control. > Reduced Chemical Control: To the extent the District can modify elements of the Chemical Control Alternative to mitigate identified impacts by avoiding completely the potentially significant impacts associated with some pesticide products by using other, less odorous products, then the environmentally superior alternative would be a Program incorporating these modifications to this alternative as components of the overall IMVMP. Excluding air quality and the odor issue, the impacts to all of the other resources would be the same as for the proposed Program. > No Chemical Control: This alternative would completely remove the chemical treatment options under the Vegetation Management and Chemical Control Alternatives. It would not have any of the less-than-significant impacts associated with herbicide and pesticide use. However, it was determined to be inconsistent with Program objectives and IVM principles, and it could lead to substantial impacts to human health due to the reduced effectiveness of the Program in controlling mosquito and other vector populations. The No Program Alternative is not the environmentally superior alternative due to its potentially significant impacts to the following resources and concerns identified in Section 15.3: urban and rural land uses, aquatic and terrestrial biological resources, ecological health, human health, and public services and hazard response.

2.8 Other Required Permits and Agency Coordination

2.8.1 Required Permits

2.8.1.1 California Department of Public Health

The District’s Program as a whole, including the registration and continuing education of state-certified field personnel, is reviewed and approved by the CDPH, through a formal Cooperative Agreement that is renewed annually. The CDPH also performs onsite annual inspection of the District’s equipment, operations, safety training, and records.

2.8.1.2 Statewide General NPDES Permit for Vector Control

The application of pesticides at, near, or over waters of the US that results in discharges of pollutants requires coverage under a NPDES permit. In response to the Sixth Circuit Court's decisions and previous decisions by other courts on pesticide regulation, the State Water Resources Control Board (SWRCB) has adopted four Pesticide Permits. Water Quality Order No. 2011-0002-DWQ (General Permit No. CAG 990004) is the Permit for Biological and Residual Pesticide Discharges to waters of the US from vector control applications. The District completed application requirements, including preparation of a Pesticide Application Plan (PAP) and public notice requirements, and received permit approval on October 31, 2011

This General Permit covers the point source discharge of biological and residual pesticides resulting from direct and spray applications for vector control using: 1) larvicides containing monomolecular films, methoprene, Bacillus thuringiensis subspecies israelensis (or Bti), Bacillus sphaericus (or B. Sphaericus), temephos, petroleum distillates, or spinosad; and 2) adulticides containing malathion, naled, pyrethrin, deltamethrin, etofenprox, lambda-cyhalothrin, permethrin, prallethrin, resmethrin, sumithrin, piperonyl butoxide (PBO), or N-octyl bicycloheptene dicarboximide (or MGK-264). Users of products containing these active ingredients are required to obtain coverage under this General Permit prior to application to waters of the US. This General Permit only covers the discharge of larvicides and adulticides that are currently registered in California..

Pursuant to California Water Code Section 13389, SWRCB and Regional Water Resources Control Boards (RWQCBs) are exempt from the requirement to comply with Public Resources Code, Chapter 3, Division 13 when adopting NPDES permits (SWRCB 2011a).

2.8.1.3 Statewide General NPDES Permit for Algae and Aquatic Weed Control

This General Permit regulates the discharge of aquatic pesticides (algaecides and aquatic herbicides) used for algae and aquatic weed control to waters of the United States. These are algaecides and aquatic herbicides with registration labels that explicitly allow direct application to water bodies. This General Permit becomes effective on December 1, 2013.

Except for discharges on tribal lands that are regulated by a federal permit, this General Permit covers the point source discharge to waters of the United States of residues resulting from pesticide applications using products containing 2,4-D, acrolein, copper, diquat, endothall, fluridone, glyphosate, imazamox, imazapyr, penoxsulam, sodium carbonate peroxyhydrate, and triclopyr-based algaecides and aquatic herbicides, and adjuvants containing ingredients represented by the surrogate nonylphenol. This General Permit covers only discharges of algaecides, and aquatic herbicides that are currently registered for use in California, or that become registered for use and contain the above-listed active ingredients and ingredients represented by the surrogate of nonylphenol.

A Discharger under this General Permit includes any entity involved in the application of algaecides and aquatic herbicides that results in a discharge of algaecides and aquatic herbicides and their residues and degradation byproducts to waters of the United States, and meets either or both of the following two criteria:

The entity has control over the financing for or the decision to perform algaecide and aquatic herbicide applications that result in discharges, including the ability to modify those decisions; or

The entity has day-to-day control of algaecide and aquatic herbicide applications or performs activities that are necessary to ensure compliance with this General Permit. For example, the entity is authorized to direct workers to carry out activities required by this General Permit or perform such activities themselves.

2.8.1.4 United States Army Corps of Engineers

For minor physical control activities, the District obtains 5-year regional permits from the USACE, SWRCB, and BCDC (with review by the USFWS, CDFW, National Marine Fisheries Service (NMFS), and other agencies as needed). The current USACE permit for the maintenance of existing water circulation ditches and channels for the purpose of mosquito abatement in tidal marshes runs through July 1, 2013 (USACE 2007), and the BCDC permit runs through April 1, 2014. The District is working collaboratively with the CDPH and other Coastal Region Districts toward renewing the USACE source reduction permit.

2.8.1.5 United States Fish and Wildlife Service

Should USFWS aquire land within Contra Costa County, the District would be required to submit an annual Pesticide Use Proposal (PUP) and apply for a Supplemental Use Permit (SUP) whenever performing vector control activities on USFWS lands. Depending on the location and nature of the work, the District may also be required to consult with the USFWS under Section 7 of the federal Endangered Species Act to address potential impacts to sensitive species and habitats. In addition to SUPs and PUPs, the USFWS reviews and may also comment on the District's proposed annual minor physical control projects (see Section 2.8.1.4 above on the USACE permit).

2.8.1.6 County Agricultural Commissioner

County Agricultural Commissioners also regulate sale and use of pesticides in California. In addition, County Agricultural Commissioners issue Use Permits for applications of pesticides that are deemed as restricted materials by CDPR. For chemical control activities, the District reports to and is periodically reviewed by the Contra Costa County Agricultural Commissioner.

2.8.2 Agency Coordination

For work on State of California lands and riparian zones, wetlands, or other sensitive habitats, the District coordinates, reviews activities, and often collaborates with several agencies including the USDA, CDFW, EBRPD, EBMUD, Contra Costa County agencies, municipalities, and property owners of Contra Costa County. The District routinely works with land managers and resource agency staff to minimize the impacts of its activities on the environment as explained in Section 2.9.2 below.

Additionally, any physical control activity conducted inside the Contra Costa Flood Control District's (FC District) right-of-way will be coordinated with the FC District. Likewise, any grading activities in unincorporated Contra Costa County, will be coordinated with the FC District and the Contra Costa County Maintenance Division.

2.9 Best Management Practices

The District has implemented a number of procedures and practices under current Program activities that would continue into the future for the Proposed Program. These BMPs represent measures to avoid, minimize, eliminate, rectify, or compensate for potential adverse effects on the human, biological, and physical environments and District Staff. While similar to mitigation measures under CEQA, these BMPs are already in use and would continue to be used as part of the Proposed Program. Subsequent environmental impact assessments in this PEIR reflect the continued use of these measures, which are organized under the following categories and listed in Table 2-7:

> General BMPs

> Tidal Marsh-Specific BMPs

> Salt Marsh Harvest Mouse (SMHM)

> Ridgway's Rail (RR) (Maley 2014)

> California Least Tern (CLT)

> Western Snowy Plover (WSnPl)

> California Tiger Salamander (CTS)

> Vernal Pool Tadpole Shrimp (VPTS)

> Contra Costa Goldfields (CCG)

> Soft Bird's Beak (SBB)

> Vegetation Management

> Maintenance/Construction and Repair of Tide Gates and Water Structures in Waters of the U.S.

> Applications of Pesticides, Surfactants, and/or Herbicides

> Hazardous Materials Spill Management

> Worker Illness and Injury Prevention Program and Emergency Response

The District will observe all state and federal regulations. The District will follow all appropriate laws and regulations pertaining to the use of pesticides and herbicides and safety standards for employees and the public, as governed by the USEPA, CDPR, and local jurisdictions (with some exceptions). Although the products the District uses are all tested, registered, and approved for use by the USEPA and/or CDPR, the District provides additional margins of safety with the adherence to additional internal guidance based on BMPs and the principles embodied in District IMMP policies, where applicable:

> Ensure all District and contracted applicators are appropriately licensed by the state.

> District staff or contractors will coordinate with the Contra Costa County Agricultural Commissioner, and obtain and verify all required licenses and permits as current prior to pesticide/herbicide application. All applicators and handlers will use proper personal protective equipment.

> All applicators and handlers will use proper personal protective equipment.

2.9.1 Pesticide Applications to Product Label Requirements

2.9.1.1 California Pesticide Regulatory Program

CDPR regulates the sale and use of pesticides in California. CDPR is responsible for reviewing the toxic effects of pesticide formulations and determining whether a pesticide is suitable for use in California through a registration process. Although CDPR cannot require manufacturers to make changes in labels, it can refuse to register products in California unless manufacturers address unmitigated hazards by amending the pesticide label. Consequently, many pesticide labels that are already approved by USEPA also contain California-specific requirements. Pesticide labels defining the registered applications and uses of a chemical are mandated by USEPA as a condition of registration. The label includes instructions telling users how to make sure the product is applied only to intended target pests and includes precautions the applicator should take to protect human health and the environment. For example, product labels may contain such measures as restrictions for applications in certain land uses and weather (i.e., wind speed) parameters.

2.9.2 Other BMPs for Mosquito and/or Vector Control

Many BMPs the District directly practices can be found in the Best Management Practices for Mosquito Control in California (CDPH and MVCAC 2012). These BMPS are incorporated by reference into this PEIR and are reproduced in their entirety in Appendix F, Supplemental Program Information.

Table 2-7 Contra Costa Mosquito and Vector Control District BMPs to Avoid/Minimize Environmental Impacts by Alternative

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
A. General BMPs						
1. **District staff has had long standing and continues to have cooperative, collaborative relationships with federal, state, and local agencies. The District regularly communicates with agencies regarding the District's operations and/or the necessity and opportunity for increased access for surveillance, source reduction, habitat enhancement, and the presence of special status species and wildlife. The District often participates in and contributes to interagency projects. The District will continue to foster these relationships, communication, and collaboration.**	√	√	√	√	√	√
2. **In particular, District staff will regularly communicate with resource agency staff regarding vector management operations, habitat, and flora and fauna in sensitive habitats. Such communications will include wildlife studies and occurrences of sensitive species in areas that may be subject to vector management activities.**	√	√	√	√	√	√
3. **When walking or using small equipment in marshes, riparian corridors, or other sensitive habitats, existing trails, levees and access roads will be used whenever possible to minimize or avoid impacts to species of concern and sensitive habitats. Specific care will be taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in the vicinity of tidal marsh habitat.**	√	√	√	*	√	√
4. **District staff has received training from USFWS and CDFW biologists regarding endangered species, endangered species habitat, and wildlife/wildlife habitat recognition and avoidance measures. District supervisory staff frequently engages staff on these subjects. For example, District staff has become familiar with California Ridgway's rail call recordings to invoke avoidance measures if these calls are heard in the field. District staff is trained to be observant, proceed carefully, and practice avoidance measures if needed when accessing areas that may serve as bird nesting habitat (e.g., watch for flushing birds that may indicate a nest is nearby). Emphasis will be placed on species and habitats of concern where vector management activities might occur (e.g., SMHM, RIRA, special status plants, vernal pools, tidal marsh, etc.). These training sessions will be included as a part of the required safety training records that are kept by**	√	√	√		√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
vector control agencies.						
5. **Conduct worker environmental awareness training for all treatment field crews and contractors for special status species and sensitive natural communities that a qualified person (e.g., District biologist) determines to have the potential to occur on the treatment site. Conduct the education training prior to starting work at the treatment site and upon the arrival of any new worker onto sites with the potential for special status species or sensitive natural communities.**	√	√	√	√	√	√
6. **District staff will work with care and caution to minimize potential disturbance to wildlife while performing surveillance and vector treatment/population management activities (see 1 through 5 above).**	√	√	√	*	√	√
7. **Identify probable (based on historical experience) treatment sites that may contain habitat for special status species every year prior to work to determine the potential presence of special status flora and fauna using the CNDDB, relevant Habitat Conservation Plans (HCPs), NOAA Fisheries and USFWS websites, Calfish.org, and other biological information developed for other permits. Establish a buffer of reasonable distance, when feasible, from known special status species locations and do not allow application of pesticides/herbicides within this buffer without further agency consultations. Nonchemical methods are acceptable within the buffer zone when designed to avoid damage to any identified and documented rare flora and fauna.**	√	√	√	*	√	
8. **Vehicles driving on levees to travel through tidal marsh or to access sloughs or channels for surveillance or treatment activities will travel at speeds no greater than 10 miles per hour to minimize noise and dust disturbance.**	√	√	√		√	√
9. **District staff will implement site access selection guidelines to minimize equipment use in sensitive habitats including active nesting areas and to use the proper vehicles for onroad and offroad conditions.**	√	√	√	√	√	√
10. **Properly train all staff, contractors, and volunteer help to prevent spreading weeds and pests to other sites. The District headquarters contains wash rack facilities (including high-pressure washers) to regularly (in many cases daily) and thoroughly clean equipment to prevent the spread of weeds.**	√	√	√	√	√	√
11. **Operation of noise-generating equipment (e.g., chainsaws, wood chippers, brush-cutters, pickup trucks) will abide by the time-of-day restrictions**	√	√	√	√	√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
established by the applicable local jurisdiction (i.e., City and/or County) if such noise activities would be audible to receptors (e.g., residential land uses, schools, hospitals, places of worship) located in the applicable local jurisdiction. Shut down all motorized equipment when not in use.						
12. **For operations that generate noise expected to be of concern to the public, the following measures will be implemented:** – **Measure 1: Provide Advance Notices: A variety of measures are implemented depending on the magnitude/nature of the activities undertaken by the District, and may include but are not limited to press releases, hand delivered flyers, and posted signs. Public agencies and elected officials also may be notified of the nature and duration of the activities, including the Board of Supervisors or City Council, environmental health and agricultural agencies, emergency service providers, and airports.** – **Measure 2: Provide Mechanism to Address Complaints: District staff is available during regular business hours to respond to service calls and address concerns about nighttime operations.**	√	√	√	√	√	√
13. **The District will perform public education and outreach activities.**	√	√	√	√	√	√
14. **Engine idling times will be minimized either by shutting equipment and vehicles off when not in use or reducing the maximum idling time to 5 minutes. Correct tire inflation will be maintained in accordance with manufacturer‘s specifications on wheeled equipment and vehicles to prevent excessive rolling resistance. All equipment and vehicles will be maintained and properly tuned in accordance with manufacturer‘s specifications. All equipment will be checked by a certified visible emissions evaluator if visible emissions are apparent to onsite staff.**	√	√	√	√	√	√
B. Tidal Marsh-Specific BMPs						
1. **District staff will continue to implement the measures in the USFWS's "Walking in the Marsh: Methods to Increase Safety and Reduce Impacts to Wildlife/Plants”. District staff will receive annual training and review of this document to remain up to date and current on this document and its methodologies for protecting sensitive species and the marsh habitat.**	√	√	√	*	√	
2. **District will minimize the use of equipment (e.g., ARGOs) in tidal marshes and wetlands. When feasible and appropriate, surveillance and control work will**	√	√	√	*	√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
be performed on-foot with handheld equipment. Aerial treatment (helicopter and fixed wing) treatments will be utilized when feasible and appropriate to minimize the disturbance of the marsh during pesticide applications. When ATVs (e.g., ARGOs) are utilized techniques will be employed that limit impacts to the marsh including: slow speeds; slow, several point turns; using existing levees or upland to travel through sites when possible; use existing pathways or limit the number of travel pathways used.						
3. **District will minimize travel along tidal channels and sloughs in order to reduce impacts to vegetation used as habitat (e.g., Ridgway's rail nesting and escape habitat).**	√	√	√		√	
4. **District staff will minimize the potential for the introduction and spread of spartina, perennial pepperweed and other invasive plant species by cleaning all equipment, vehicles, personal gear, clothing, and boots of soil, seeds, and plant material prior to entering the marsh, and avoiding walking and driving through patches of perennial pepperweed to the maximum extent feasible.**	√	√	√	*	√	√
5. **When feasible, boats will be used to access marsh areas for surveillance and treatment of vectors to further reduce the risk of potential impacts that may occur when using ATVs to conduct vector management activities.**	√	√	√	*	√	
6. **The District currently references and provides staff training relevant to the USFWS "Walking in the Marsh: Methods to Increase Safety and Reduce Impacts to Wildlife/Plants" guidelines (USFWS undated).** – **District staff is trained to walk carefully in the marsh and to continuously look ahead of themselves to avoid potential wildlife disturbance (e.g., carefully make observations in their surroundings to detect flushing birds and nests). Specific care is taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in vicinity of cord grass habitat (e.g., rack line).** – **When walking in marshes District staff utilizes existing trails when possible (i.e., deer trails and other preexisting trails).**	√	√	√	√	√	√
C. Salt Marsh Harvest Mouse (SMHM)						
1. **Activities (surveillance, treatment, source reduction) within or adjacent to harvest mouse habitat will not occur within two hours before or after extreme**	√	√	√	*	√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
high tides of 6.5 feet National Geodetic Vertical Datum (NGVD) or above as measured at the Golden Gate Bridge (corrected for time and tide height for the site) or when the marsh plain is completely inundated because suitable upland refugia cover is limited and potentially disturbance-creating activities could prevent mice from reaching available cover.						
2. **Vegetation removal is limited to the minimum amount necessary to allow for surveillance, treatment, and vector habitat reduction (vegetation management) to minimize or avoid loss of SMHM. Similarly, excavation, fill, or construction activities will also be limited to the minimum amount necessary to minimize/avoid loss of SMHM.**	√	√	√		√	
3. **Vegetation clearing will be conducted systematically within the project area to ensure that SMHM are encouraged to move toward remaining vegetation and are not trapped in islands of vegetation subject to removal and far from suitable cover.**		√	√			
4. **Each day, 30 minutes before commencement of vector habitat management (physical control, vegetation management), observations will be conducted for the presence of SMHM in the work area by staff trained by USFWS personnel in the safe and effective methods for observing SMHM.**		√	√	*	√	
5. **To the extent feasible, physical control, vegetation management and other vector habitat reduction activities will be conducted between December 1 and February 28 (outside of the SMHM breeding season). Surveillance, chemical control, biological control, and public education activities occur year-round and are therefore carefully coordinated with resource agencies to minimize potential impacts to SMHMs and their habitats.**		√	√		√	
6. **When walking in the marsh, existing trails will be used whenever possible. Specific care will be taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in the vicinity of tidal marsh habitat to avoid potential disturbance of SMHM.**	√	√	√	*	√	√
7. **District staff will receive training on measures to avoid impacts to SMHM.**	√	√	√	*	√	√
8. **If SMHM nests or adults are encountered during vector management activities, avoidance measures will be immediately implemented and findings will be reported to the appropriate resource agency.**	√	√	√	*	√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
D. **Ridgway's Rail (RIRA)**						
1. **Activities (surveillance, treatment, source reduction) within or adjacent to RIRA's Rail habitat will not occur within two hours before or after extreme high tides of 6.5 feet National Geodetic Vertical Datum (NGVD) or above as measured at the Golden Gate Bridge (corrected for time and tide height for the site) or when the marsh plain is completely inundated because suitable upland refugia cover is limited and potentially disturbance-creating activities could prevent RIRAs from reaching available cover.**	√	√	√	*	√	√
2. **Vegetation removal is limited to the minimum amount necessary to allow for surveillance, treatment, and vector habitat reduction (vegetation management) to minimize or avoid loss of RIRA. Similarly, excavation, fill, or construction activities will also be limited to the minimum amount necessary to minimize/avoid loss of RIRA.**	√	√	√		√	
3. **To the extent feasible, physical control, vegetation management and other vector habitat reduction activities will be conducted between September 1 and January 31 (outside of the RIRA breeding season). Surveillance, chemical control, biological control, and public education activities occur year-round and are therefore carefully coordinated with resource agencies to minimize potential impacts to RIRAs and their habitats.**		√	√		√	
4. **District staff will notify the appropriate resource agency prior to entering potential RIRA habitats and will regularly coordinate with the resource agency(ies) on the locations of breeding RIRAs and avoid breeding RIRAs to the extent feasible. Any observations of adverse effects to RIRAs will be reported by District staff.**	√	√	√	√	√	
5. **When walking in the marsh District staff will use existing trails whenever possible. Specific care will be taken when walking and performing surveillance in the vicinity of natural and manmade ditches or sloughs or in the vicinity of tidal marsh habitat to avoid potential disturbance of RIRAs.**	√	√	√	*	√	√
6. **Entry into suitable breeding habitat for RIRAs will be minimized. When entry is required, the preferred method will be by foot. Other entry methods will be based on consultation with the appropriate resource agency.**	√	√	√	*	√	√
7. **District staff will receive training on measures to avoid impacts to RIRAs.**	√	√	√	*	√	√

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
8. **If RIRA nests or adults are encountered during vector management activities, avoidance measures, as provided during training from the resource agencies, will be immediately implemented and findings will be reported to the appropriate resource agency.**	√	√	√	*	√	√
E. **California Least Turn (CLT)**						
1. District staff will notify the appropriate resource agency prior to entering potential CLT habitats between April 15 and August 31 (breeding season) and will regularly coordinate with the resource agency(ies) on the locations of breeding CLTs and avoid breeding CLTs to the extent feasible. Any observations of adverse effects to CLTs will be reported by District staff.	√			*	√	
2. Entry into suitable breeding habitat for CLT will be minimized. When entry is required, vehicle speed will be reduced to 5mph and peripheral paths will be utilized to the extent feasible. Other entry methods will be based on consultation with the appropriate resource agency.	√			*	√	
3. District staff will receive training on measures to avoid impacts to CLTs	√			*	√	
4. If CLT nests or adults are encountered during mosquito management activities, avoidance measures, as provided during training from the resource agencies, will be immediately implemented and findings will be reported to the appropriate resource agency.	√			*	√	
F. **Western Snowy Plover (WSnPl)**						
1. District staff will notify the appropriate resource agency prior to entering potential WSnPl habitats between March 1 and September 15 (breeding season) and will regularly coordinate with the resource agency(ies) on the locations of breeding WSnPls and avoid breeding WSnPls to the extent feasible. Any observations of adverse effects to WSPs will be reported by District staff.	√			*	√	
2. Entry into suitable breeding habitat for WSnPl will be minimized. When entry is required, vehicle speed will be reduced to 5mph and peripheral paths will be utilized to the extent feasible. Other entry methods will be based on consultation with the appropriate resource agency.	√			*	√	
3. District staff will receive training on measures to avoid impacts to WSnPls	√			*	√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
4. If WSnPl nests or adults are encountered during mosquito management activities, avoidance measures, as provided during training from the resource agencies, will be immediately implemented and findings will be reported to the appropriate resource agency.	√			*	√	
G. **California Tiger Salamander (CTS)**						
1. Trucks and ARGOs will be restricted to established roads and berms in vernal pool areas. Only small ATVs (e.g. Polaris) will be utilized near vernal pools.	√			*	√	
2. Methoprene, monomolecular films, and adulticides will not be used in vernal pool areas.				*	√	
3. District staff will receive training on measures to avoid impacts to CTS	√			*	√	
H. **Vernal Pool Tadpole Shrimp (VPTS)**						
1. Trucks and ARGOs will be restricted to established roads and berms in vernal pool areas. Only small ATVs (e.g. Polaris) will be utilized near vernal pools.	√			*	√	
2. Methoprene, monomolecular films, and adulticides will not be used in vernal pool areas.				*	√	
3. District staff will receive training on measures to avoid impacts to VPTS	√			*	√	
I. **Contra Costa Goldfields (CCG)**						
1. District staff will receive training on the identification, biology and preferred habitat of Contra Costa goldfields.	√			*	√	
2. When possible, project actions to be conducted in areas containing suitable habitat for this species will occur during the time period when CCG is in bloom and identifiable (March-June), so that any CCG plants observed can be avoided and documented.	√			*	√	
3. District staff will coordinate with CDFW and USFWS regarding the locations of known CCG populations, so that these populations can be avoided. Flagging may be used to identify the boundaries of known CCG populations.	√			*	√	
4. Trucks and ARGOs will be restricted to established roads and berms in vernal pool areas. Only small ATVs (e.g. Polaris) will be utilized near vernal pools. When feasible, mosquito management activities will be conducted on foot	√			*	√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
using hand equipment.						
J. **Soft Bird's Beak (SBB)**						
1. **District staff will receive training on the identification, biology and preferred habitat of soft bird's beak.**	√	√	√	*	√	√
2. **When possible, project actions to be conducted in areas containing suitable habitat for this species will occur during the time period when soft bird's beak is in bloom and identifiable (July-November), so that any soft bird's beaks plants observed can be avoided and documented.**	√	√	√	*	√	√
3. **District staff will coordinate with CDFW regarding the locations of known soft bird's beak populations, so that these populations can be avoided. Flagging will be used to identify the boundaries of known soft bird's beak populations.**	√	√	√	*	√	√
4. **When possible, vector management activities will be conducted on foot using hand equipment.**	√	√	√	*	√	√
K. **Vegetation Management**						
1. **Consultations will be made with the appropriate resource agency to discuss proposed vegetation management work, determine potential presence of sensitive species and areas of concern, and any required permits.**		√	√			
2. **Vegetation management work performed will typically be by hand, using handheld tools, to provide access to vector habitat for surveillance, and when needed control activities. Tools used include: machetes, small garden variety chain saw, hedge trimmers and "weed-eaters".**		√	√			
3. **District will consult and coordinate with resource agencies as well as have all necessary permits prior to the commencement of work using heavy equipment (e.g., larger than handheld/garden variety tools such as small excavators with rotary mowers) in riparian areas.**		√	√			
4. **Minor trimming of vegetation (e.g., willow branches approximately three inches in diameter or less, blackberry bushes, and poison oak) to the minimum extent necessary will occur to maintain existing paths or create access points through dense riparian vegetation into vector habitat. This may include minor trimming of overhanging limbs, brush and blackberry thickets that obstruct the ability to**		√	√			

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
walk within creek channels. Paths to be maintained will not be a cut, defined corridor but rather a path maintained by selective trimming of overhanging or intrusive vegetation. Paths to be maintained will range in width from three to 6 feet across.						
5. **Downed trees and large limbs that have fallen due to storm events or disease will be cut only to the extent necessary to maintain existing access points or to allow access to vector habitats.**		√	√			
6. **Vegetation management work will be confined to September 1 to January 31 to minimize potential impacts to sensitive species, especially breeding birds. When work is expected to occur between February 1 and August 31 (nesting season), additional consultations will occur with appropriate resource agencies to help identify locations of active nests of raptors or migratory birds as well as any additional protection measures that will need to be implemented prior to commencement of work.**		√	√			
7. **Every effort will be made to complete vegetation management in riparian corridors prior to the onset of heavy rains. Maintenance work to be done in early spring will be limited to trimming of access routes to new tree shoots, poison oak, blackberries, and downed trees that block these paths.**		√	√			
8. **District staff will work with care and caution to minimize potential disturbance to wildlife, while performing vegetation management activities within or near riparian corridors.**		√	√			
9. **Within suitable habitat for California Freshwater Shrimp (Syncaris pacifica), no in-channel vegetation will be removed, trimmed, or otherwise disturbed. District staff will work with resource agencies to determine locations of suitable habitat for California Freshwater Shrimp and receive written authorization to proceed prior to commencement of vegetation management activities.**		√	√			
10. **If suitable habitat necessary for special status species is found, including vernal pools, and if nonchemical physical and vegetation management control methods have the potential for affecting special- status species, then the District will coordinate with the CDFW, USFWS, and/or NMFS before conducting control activities within this boundary or cancel activities in this area. If the District determines no suitable habitat is present, control activities may occur without further agency consultations.**		√	√			

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
11. **When using heavy equipment for vegetation management, District staff (and contractors) will minimize the area that is affected by the activity and employ all appropriate measures to minimize and contain turbidity. Heavy equipment will not be operated in the water and appropriate containment and cleanup systems will be in place on site to avoid, contain, and clean up any leakage of toxic chemicals.**		√	√			
L. **Maintenance / Construction and Repair of Tide Gates and Water Structures in Waters of the U.S.**						
1. **District staff will consult with appropriate resource agencies (USACE, USFWS, CDFW, NMFS, BCDC, Regional Water Quality Control Board) and obtain all required permits prior to the commencement of ditch maintenance or construction within tidal marshes.**		√				
2. **Work plans for the upcoming season' proposed work as well as a summary of the last season' completed work will be submitted for review and comment to USACE, USFWS, NMFS, CDFW, BCDC and the Regional Water Quality Control Board no later than July 1 of each year for which work is being proposed. The work plan will include a delineation of all proposed ditching overlain on topographic maps at a minimum of 1" = 1000' scale, with accompanying vicinity maps. The plan will also indicate the dominant vegetation of the site, based on subjective estimates, the length and width of the ditches to be maintained, cleared or filled, and the estimated date the work will be carried out.**		√				
3. **All maintenance work will be done at times that minimize adverse impacts to nesting birds, anadromous fish, and other species of concern, in consultation with USFWS, NMFS, and CDFW. Work conducted will, whenever possible, be conducted during approved in water work periods for that habitat, considering the species likely to be present. For example, tidal marsh work will be conducted between September 1 and January 31, where possible and not contraindicated by the presence of other sensitive species. Similarly, in water work in waterbodies that support anadromous fish, work will be conducted between July 1 and September 30.**		√				
4. **Care will be taken to minimize the risk of potential disruption to the indigenous aquatic life of a waterbody in which ditch maintenance is to take place, including those aquatic organisms that migrate through the area.**		√				

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
5. **Staging of equipment will occur on upland sites.**		√				
6. **Mats or other measures will be taken to minimize soil disturbance (e.g., use of low ground pressure equipment) when heavy equipment is used.**		√				
7. **All projects will be evaluated prior to bringing mechanical equipment on site, in order to identify and flag sensitive sites, select the best access route to the work site consistent with protection of sensitive areas, and clearly demarcate work areas.**		√				
8. **Measures will be taken to minimize impacts from mechanical equipment, such as hand ditching as much as possible; reducing turns by track-type vehicles, taking a minimum number of passes with equipment, varying points of entry, driving vehicles at low speed, and not driving on open mud and other soft areas.**		√				
9. **Discharges of dredged or fill material into tidal waters will be minimized or avoided to the maximum extent possible at the project site and will be consistent with all permit requirements for such activity. No discharge of unsuitable material (e.g., trash) will be made into waters of the United States, and material that is discharged will be free of toxic pollutants in toxic amounts (see section 307 of the Clean Water Act). Measures will be taken to avoid disruption of the natural drainage patterns in wetland areas.**		√				
10. **Discovery of historic or archeological remains will be reported to USACE and all work stopped until authorized to proceed by the appropriate regulatory authorities/resource agencies.**		√				
11. **Ditching that drains high marsh ponds will be minimized to the extent possible in order to protect the habitat of native salt pan species.**		√				
12. **No spoils sidecast adjacent to circulation ditches will exceed 8 inches above the marsh plain to minimize risk of colonization of spoils by invasive, nonnative plants and/or the spoils lines from becoming access corridors for unwanted predators (e.g., dogs, cats, red fox). Sidecast spoil lines exceeding 4 inches in height above the marsh plain will extend no more than 6 feet from the nearest ditch margin. Any spoils in excess of these dimensions will be hydraulically redispersed on site (e.g., by rotary ditcher), or removed to designated upland sites (per conditions of resource agency issued permits). Sidecast spoil lines will be breached at appropriate intervals to prevent local impediments to water**		√				

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
circulation.						
13. **If review of the proposed work plan by USACE, USFWS, or CDFW determines the proposed maintenance is likely to destroy or damage substantial amounts of shrubby or sub-shrubby vegetation (e.g., coyote brush, gumplant) on old sidecast spoils, the District will provide a quantitative estimate of the extent and quality of the vegetation, and provide a revegetation plan for the impacted species prepared by a biologist/botanist with expertise in marsh vegetation. The Corps approved revegetation plan will be implemented prior to April 1 of the year following the impacts.**		√				
14. **Small ditch maintenance work will be performed by hand, whenever possible, using handheld shovels, pitch forks, etc., and small trimmers such as "weed-eaters". (Note: the majority of small ditch work performed by the District is by hand.)**		√				
15. **Work will be done at low tide (for tidal areas) and times of entry will be planned to minimize disruption to wildlife.**		√				
16. **In marshes which contain populations of invasive nonnative vegetation such as pepperweed or introduced spartina, sidecast spoils will be surveyed for the frequency of establishment of these species during the first growing season following deposition of the spoils. The results of the surveys will be reported to the USACE, USFWS and CDFW. If it is determined the sidecasting of spoils resulted in a substantial increase in the distribution or abundance of the nonnative vegetation which is detrimental to the marsh, the District will implement appropriate abatement measures after consultation with the USACE, USFWS and CDFW.**		√				
17. **When possible (i.e., with existing labor and vehicles), refuse such as tires, plastic, and man-made containers found at the work site will be removed and properly discarded.**		√	√			
M. **Applications of Pesticides, Surfactants, and/or Herbicides**						
District staff will conduct applications with strict adherence to product label directions that include approved application rates and methods, storage, transportation, mixing, and container disposal.			√	*	√	
2. **District will avoid use of surfactants when possible in sites with aquatic**			√		√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
nontargets or natural enemies of mosquitoes present such as nymphal damselflies and dragonflies, dytiscids, hydrophilids, corixids, notonectids, ephydrids, etc. Surfactants are a least preferred method and are the only tool that can be used with pupae to prevent adult mosquito emergence. The District will use a microbial larvicide (Bti, Bs) or IGR (e.g., methoprene) instead or another alternative when possible.						
3. **Materials will be applied at the lowest effective concentration for a specific set of vectors and environmental conditions. Application rates will never exceed the maximum label application rate.**			√	*	√	
4. **To minimize application of pesticides, application of pesticides will be informed by surveillance and monitoring of vector populations.**			√		√	
5. **District staff will follow label requirements for storage, loading, and mixing of pesticides and herbicides. Handle all mixing and transferring of pesticides and herbicides within a contained area.**			√		√	
6. **Postpone or cease application when predetermined weather parameters exceed product label specifications, when wind speeds exceed the velocity as stated on the product label, or when a high chance of rain is predicted and rain is determining factor on the label of the material to be applied.**			√	*	√	
7. **Applicators will remain aware of wind conditions prior to and during application events to minimize any possible unwanted drift to waterbodies, and other areas adjacent to the application areas.**			√	*	√	
8. **Spray nozzles will be adjusted to produce larger droplet size rather than smaller droplet size. Use low nozzle pressures where possible (e.g., 30 to 70 pounds per square inch). Keep spray nozzles within a predetermined maximum distance of target weeds or pests (e.g., within 24 inches of vegetation during spraying). Adjusting droplet size would only apply to larvicides, herbicides and non-ULV applications. Use ULV sprays that are calibrated to be effective and environmentally compatible at the proper droplet size (about 10-30 microns).**			√	*	√	
9. **Clean containers at an approved site and dispose of at a legal dumpsite or recycle in accordance with manufacturer's instructions if available.**			√	*	√	
10. **Special status Aquatic Wildlife Species:** – **A CNDDB search was conducted in 2012, updated in 2014, and the results**			√	*	√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
incorporated into this PEIR. District staff communicates with state, federal, and county agencies regarding sites that have potential to support special status species. Many sites where the District performs surveillance and control work have been visited by staff for many years and staff is highly knowledgeable about the sites and habitat present. If new sites or site features are discovered that have potential to be habitat for special status species, the appropriate agency and/or landowner is contacted and communication initiated. – **Use only pesticides, herbicides, and adjuvants approved for aquatic areas or manual treatments within a predetermined distance from aquatic features (e.g., within 15 feet of aquatic features). Aquatic features are defined as any natural or man-made lake, pond, river, creek, drainage way, ditch, spring, saturated soils, or similar feature that holds water at the time of treatment or typically becomes inundated during winter rains.** – **If suitable habitat for special status species is found, including vernal pools, and if aquatic-approved pesticide, herbicide, and adjuvant treatment methods have the potential for affecting the potential species, then the District will coordinate with the CDFW, USFWS, and/or National Marine Fisheries Service (NMFS) before conducting treatment activities within this boundary or cancel activities in this area. If the District determines no suitable habitat is present, treatment activities may occur without further agency consultation.**						
11. **District staff will monitor sites post-treatment to determine if the target vector or weeds were effectively controlled with minimum effect to the environment and nontarget organisms. This information will be used to help design future treatment methods in the same season or future years to respond to changes in site conditions.**			√	*	√	
12. **Do not apply pesticides that could affect insect pollinators in liquid or spray/fog forms over large areas (more than 0.25 acres) during the day when honeybees are present and active or when other pollinators are active. Preferred applications of these specific pesticides are to occur in areas with little or no honeybee or pollinator activity or after dark. These treatments may be applied over smaller areas (with hand held equipment), but the technician will first inspect the area for the presence of bees and other pollinators. If pollinators are present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent.**			√		√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
13. **The District will provide notification to the public (24 – 48 hours in advance if possible) and/or appropriate agency(ies) when applying pesticides or herbicides for large-scale treatments (e.g., fixed-wing aircraft or helicopters) that will occur in close proximity to homes, heavily populated, high traffic, and sensitive areas. The District infrequently applies or participates in the application of herbicides in areas other than District facilities.**			√	*	√	
N. **Use of Mosquitofish**						
1. Not planting mosquitofish without surveys by a biologist qualified to perform such surveys, and/or consultation with CDFW biologists.				√		
2. Limiting such plantings to areas where the District's historic and ongoing Surveillance Program indicates that mosquito breeding is likely to occur.				√		
3. Consulting appropriate federal and state fish and wildlife department websites, including the USFWS website, CDFW website, and CalFish.org to determine if the area under consideration for treatment, including a 1 mile radius around the site, is a known habitat for threatened and/or endangered species.				√		
4. Not planting in streams until flows have become discontinuous, and stream habitat consists of isolated pools to minimize the potential for the movement of mosquitofish to areas where treatment was not intended.				√		
5. The public is instructed on State regulations and directed to only stock mosquitofish in ornamental ponds, horse troughs and non-maintained swimming pools.				√		
O. **Hazardous Materials and Spill Management**						
Exercise adequate caution to prevent spillage of pesticides during storage, transportation, mixing or application of pesticides. Report all pesticide spills and cleanups (excepting cases where dry materials may be returned to the container or application equipment).			√	*	√	

Best Management Practice (BMP)	Surveillance	Physical Control	Veg Mgmt	Bio Control	Chemical Control	Other
2. **Maintain a pesticide spill cleanup kit and proper protective equipment at the District's Service Yard and in each vehicle used for pesticide application or transport.**			√	*	√	
3. **Manage the spill site to prevent entry by unauthorized personnel. Contain and control the spill by stopping it from leaking or spreading to surrounding areas, cover dry spills with polyethylene or plastic tarpaulin, and absorb liquid spills with appropriate absorbent materials.**			√	*	√	
4. **Properly secure the spilled material, label the bags with service container labels identifying the pesticide, and deliver them to a District/Field Supervisor for disposal.**			√	*	√	
5. **A hazardous spill plan will be developed, maintained, made available, and staff trained on implementation and notification for petroleum-based or other chemical-based materials prior to commencement of vector treatment activities.**	√	√	√	√	√	√
6. **Field-based mixing and loading operations will occur in such a manner as to minimize the risk of accidental spill or release of pesticides.**			√		√	
P. **Worker Illness and Injury Prevention and Emergency Response**						
Equip all vehicles used in wildland areas with a shovel and a fire extinguisher at all times.	√	√	√	√	√	√
2. **Train employees on the safe use of pesticides, equipment and machinery, including vehicle operation.**	√	√	√	√	√	√
3. **District will regularly review and update their existing health and safety plan to maintain compliance with all applicable standards. Employees will be required to review these materials annually.**	√	√	√	√	√	√

* Biocontrol agent not available at this time. Should one become available the BMP would be reevaluated at that time.