9 Water Resources

Chapter 9 evaluates potential impacts of the San Mateo County Mosquito and Vector Control District's (SMCMVCD) IMVMP Plan on water resources. Results of the evaluation are provided at the programmatic level. Section 9.1, Environmental Setting, presents an overview of the physical properties and environmental settings; and contains federal regulations, state regulations, and local ordinances and regulations that are applicable to the Program. Section 9.2, Environmental Impacts and Mitigation Measures, presents the following:

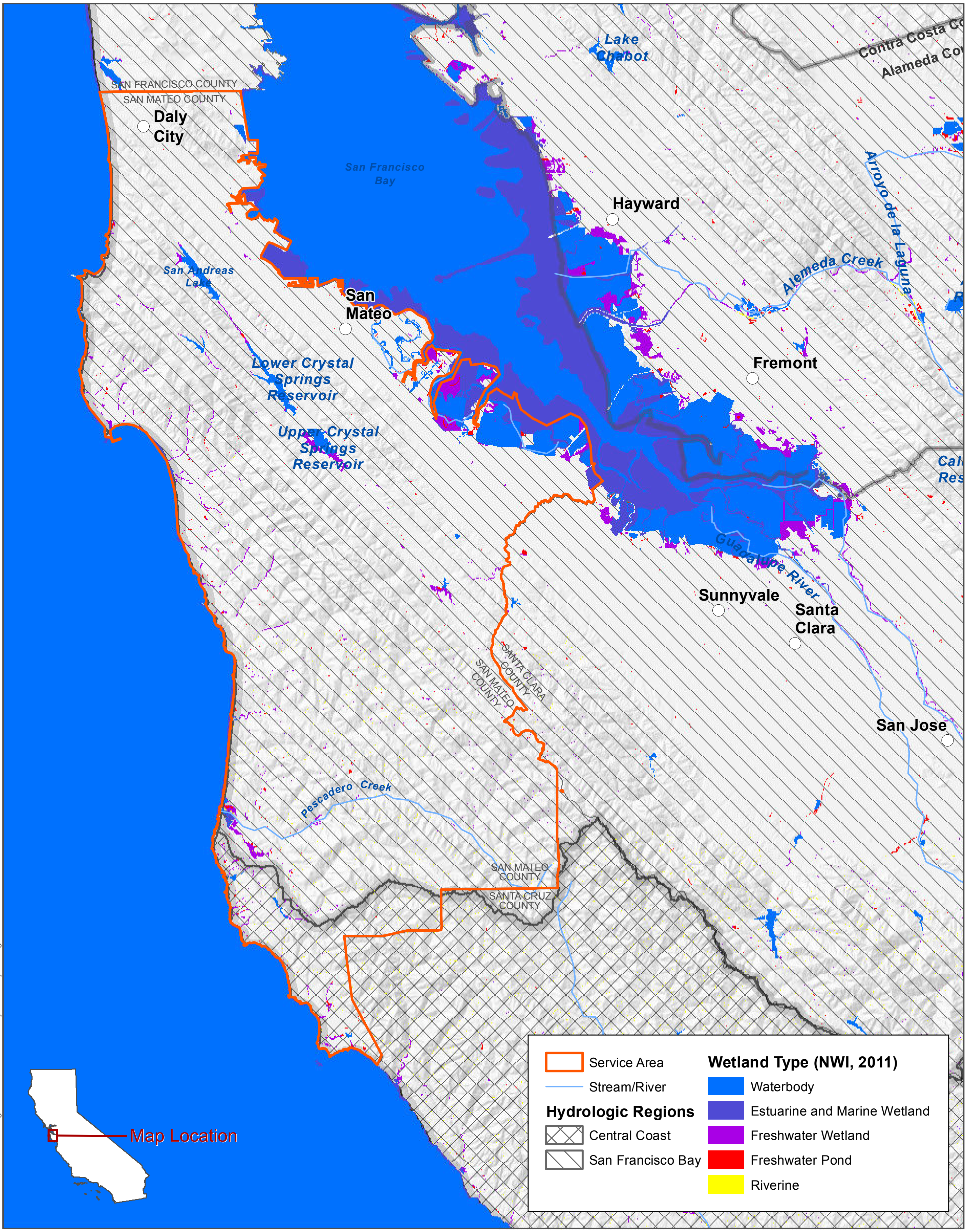
- Environmental concerns and evaluation criteria: A determination of whether the Program components would cause any potentially significant impacts to regional hydrologic resources
- Discussion of methods and assumptions, including findings from the Ecological and Human Health Assessment Report, which is included as Appendix B
- Discussion of the impacts from the existing and future Program activities within the Program components, and recommendations for mitigation, if required, for those impacts
- A summary of estimated environmental impacts to hydrologic resources
- Mitigation (if needed and feasible) and monitoring of chemical applications

9.1 Environmental Setting

9.1.1 California's Hydrologic and Geomorphic Regions

The hydrologic resources of California can be divided into regions based on several hydrologic characteristics. The California Water Plan divides California into 10 hydrologic regions. These regions are delineated based upon the state's major drainage basins. Each region has distinct precipitation characteristics and waterbodies.

Hydrologic regions in the Program Area include portions of the Central Coast and San Francisco Bay regions. The District's Service Area and lands in adjacent counties (San Francisco, Santa Clara, and Santa Cruz counties) comprise the District's Program Area, and the hydrologic regions with important water features for the District are shown on Figure 9-1. Description of surface water and groundwater characteristics for the differing hydrologic regions relied on *California Water Plan, Update 2009* and *California Water Plan, Update 2013, Advisory Committee Review Draft* (CDWR 2009a-c, 2013a-d).



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Source: Cardno ENTRIX, 2013

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Scale in Miles

INTEGRATED MOSQUITO & VECTOR MANAGEMENT PROGRAM PEIR

San Mateo County Mosquito and Vector Control District

Figure 9-1 - Program Area and California Hydrologic Regions with Major Water Bodies

9.1.1.1 San Francisco Bay Hydrologic Region

The San Francisco Bay Hydrologic Region (Bay Region) occupies approximately 4,500 square miles, from Tomales Bay in Marin County to southern Santa Clara County, and inland to the confluence of the Sacramento and San Joaquin Rivers near Collinsville. The eastern boundary follows the crest of the Coast Range where the highest peaks are more than 4,000 feet above mean sea level (CDWR 2013b). This region includes portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda counties.

Principle watersheds in the Bay Region include Tomales Bay, Corte Madera Creek, Novato Creek, Petaluma River, Sonoma Creek, Napa River, Wildcat Creek, San Pablo Creek, Green Valley Creek, Suisun Creek, Walnut Creek, San Mateo Creek, San Francisquito Creek, Guadalupe River, Coyote Creek, Alameda Creek, San Lorenzo Creek, and San Leandro Creek watersheds. These watersheds drain into Suisun, San Pablo, North San Francisco, and South San Francisco bays, or directly into the Pacific Ocean. For example, the Guadalupe River and Coyote and Alameda creeks drain from the Coast Range and flow northwest into San Francisco Bay. The Napa River originates in the Mayacamas Mountains at the northern end of Napa Valley and flows south into San Pablo Bay. Sonoma Creek begins in mountains within Sugarloaf State Park and flows south through Sonoma Valley into San Pablo Bay.

A large proportion of the nine counties that surround the San Francisco Bay is urbanized. As a result, many creeks have been confined to underground culverts beneath the developed regions. While many larger creeks remain open, they often have been heavily modified to run in concrete channels to optimize flood conveyance and provide flood protection. Ownership of Bay Area streams is a patchwork of public title, public easements, and private ownership that complicates policies and jurisdiction over, or maintenance responsibility for, urban streams. Many Bay Area stream reaches have, in fact, no established public jurisdiction or maintenance responsibility (RMC 2006).

Tidal marshes occur throughout much of the fringe of the San Francisco Bay, from the lowest extent of vascular vegetation to the top of the intertidal zone (at the maximum height of the tides). Tidal marsh also exists in the tidal reaches of local rivers and streams. Tidal marshland was once more extensive and was estimated to be 190,000 acres; however, development in the region has decreased the amount of tidal marshland to approximately 40,000 acres. A large effort has recently been undertaken to restore these ecosystems as high-quality wetlands have been shown to moderate the effect of floods, improve water quality, help maintain shipping channels, and provide habitat to numerous species (USEPA 1999).

Like most of Northern California, the climate in the Bay Region largely is governed by weather patterns originating in the Pacific Ocean. About 90 percent of the annual precipitation falls between November and April. The North Bay receives about 20 to 25 inches of precipitation annually. In the South Bay, east of the Santa Cruz Mountains, annual precipitation is only about 15 to 20 inches because of the rain shadow effect. Temperatures in the Bay Region generally are cool, and fog often resides along the coast. The inland valleys receive warmer, Mediterranean-like weather (average summer high temperatures are about 80 degrees Fahrenheit). The gap in the rolling hills at Carquinez Strait allows cool air to flow from the Pacific Ocean into the Sacramento Valley. Most of the interior North Bay and the northern parts of the South Bay are influenced by this marine effect. By contrast, the southern interior portions of the South Bay experience very little marine air movement (CDWR 2013b).

Land use in the Bay Region is diverse. Residents live in urban, suburban, and rural areas. Some of these areas are on natural floodplains, which historically were used for agriculture. Agriculture accounts for 21 percent of the Bay Region's land area, most of which is in the North and Northeast Bay in Napa, Marin, Sonoma, and Solano counties. Santa Clara and Alameda counties also have significant agricultural acreage at the edge of urban development (CDWR 2013b).

The region has many significant water management challenges: sustaining water supply, water quality, and the ecosystems in and around San Francisco Bay; reducing flood damages and adapting to impacts from climate change. Numerous government agencies and water districts deliver, treat, and regulate water in the Bay Region. Many planning organizations identify present and future challenges in the region such as land use, housing, environmental quality, economic development, wetlands, water quality, water reliability, stormwater management, flood protection, watershed management, groundwater management, fisheries, and ecosystem restoration (CDWR 2013b).

Groundwater basins underlie approximately 1,400 square miles or 30 percent of the Bay Region and account for about 15 percent of the region's average annual water supply. The Bay Region has 25 identified groundwater basins, as shown on Figure SFB-3 (CDWR 2013b) The Santa Clara Valley, Livermore Valley, Westside, Niles Cone, Napa-Sonoma Valley, and Petaluma Valley are heavily used groundwater basins (CDWR 2013b).

Ongoing surface water quality issues exist in the Bay Region. Pollutants from urban and rural runoff include pathogens, nutrients, sediments, and toxic residues. Some toxic residues are from past human activities such as mining; industrial production; and the manufacture, distribution, and use of agricultural pesticides. These residues include mercury, PCBs, selenium, and chlorinated pesticides. Emerging pollutants in the region include flame retardants and pharmaceuticals.

San Francisco Bay and a number of the streams, lakes, and reservoirs in the Bay Region have elevated mercury levels, as indicated by elevated mercury levels in fish tissue. The major source of the mercury is historic mercury mining and mining activities in the Sierra Nevada and coastal mountains. Large amounts of contaminated sediments were discharged into the Bay from Central Valley streams and local mines in the Bay Area. Significant impaired waterbodies include the Bay, the Guadalupe River in Santa Clara County (from New Almaden Mine discharges), and Walker Creek in Marin County (from Gambonini Mine discharges). The San Francisco Bay RWQCB has adopted total maximum daily loads (TMDLs) for mercury in the Bay, Guadalupe River, and Walker Creek (CDWR 2013b).

Water agencies in the region have relied on importing water from the Sierra Nevada for nearly a century to supply their customers. Water from the Mokelumne and Tuolumne rivers accounts for about 38 percent of the region's average annual water supply. Water from the Delta via the federal Central Valley Project and the State Water Project accounts for another 28 percent. Approximately 31 percent of the average annual water supply is from local groundwater and surface water, and 3 percent is from miscellaneous sources. Population growth and concerns over diminishing water quality have led to the development of local surface water supplies, recharge of groundwater basins, and incorporation of conservation guidelines (CDWR 2013b).

Drinking water in the Bay Region ranges from high-quality Mokelumne and Tuolumne river water to variable-quality Delta water, which constitutes about one-third of the domestic water supply. Purveyors that depend on the Delta for all or part of their domestic water supply can meet drinking water standards, but still need to be concerned about microbial contamination, salinity, and organic carbon.

The Bay Region generally receives very little snow, so floodwaters originate primarily from intense rainstorms. The northern portion of the region receives more precipitation and floods more often than the southern portion. Flooding occurs more frequently in winter and spring and can be intense with a short duration in small watersheds with steep terrain. Local flooding tends to occur when large, widespread storms fall on previously saturated watersheds that drain into local valleys. The greatest flood damages occur in the lower reaches of streams when floodwaters spill onto the floodplain and spread through urban neighborhoods (CDWR 2013b).

Drought, overdraft, and pollution have impaired portions of 28 groundwater basins in the Bay Region. The basins face a perpetual threat of contamination from spills, leaks, and discharges of solvents, fuels, and other pollutants. Contamination affects the supply of potable water and water for other beneficial uses. Some municipal, domestic, industrial, and agricultural supply wells have been removed from service due to the presence of pollution, mainly in shallow groundwater zones. Overdraft can result in land subsidence and saltwater intrusion, although active groundwater management has stopped or reversed the saltwater intrusion (CDWR 2013b).

A variety of historical and ongoing industrial, urban, and agricultural activities and their associated discharges have degraded groundwater quality, including industrial and agricultural chemical spills, underground and aboveground tank and sump leaks, landfill leachate, septic tank failures, and chemical seepage via shallow drainage wells and abandoned wells. The region has over 800 groundwater cleanup cases, about half of which are related fuel spills from leaking underground tanks. In many cases, the groundwater is treated and discharged to surface waters via storm drains (CDWR 2013b).

9.1.1.2 Central Coast Hydrologic Region

The Central Coast Hydrologic Region (Central Coast region) extends from southern San Mateo County in the north to Santa Barbara County in the south. This region includes Monterey County and portions of San Mateo and Santa Clara counties.

The Central Coast region has a temperate Mediterranean climate characterized by mild, wet winters and warm, dry summers. West of the Coast Range, the climate of the region is dominated by the Pacific Ocean, characterized by small daily and seasonal temperature changes, and high relative humidity. As distance from the ocean increases, the maritime influence decreases, resulting in a more continental type of climate that generates warmer summers, colder winters, greater daily and seasonal temperature ranges, and lower relative humidity. Average annual precipitation can range from 10 inches per year along the southern valley floors to 50 inches per year on northern coastal mountain peaks.

Geographically, the vegetation and topography of the Central Coast is highly variable and includes redwood forests, foggy coastal terraces, chaparral-covered hills, green cultivated valley floors, stands of oak, warm and cool vineyards, and semiarid grasslands. The lower portions of the northern watersheds, close to Monterey Bay, are more urbanized with residential, commercial, and light industrial land use. Upper watershed land use consists predominantly of rural residential, timber production, open space, some mining, and limited agriculture.

For the Central Coast region, surface water quality parameters of special concern include nitrate, water toxicity, pesticides, fecal coliform, sediment, temperature, and dissolved oxygen. Nitrate enters the waters of the region most commonly as runoff from agricultural fields or through percolation to groundwater. Fecal coliform is an indicator for pathogenic bacteria and enters the waters of the region through stormwater runoff, the presence of cattle and other animals in creeks, and from failing septic systems. Toxicity can be caused by metals, fertilizers, pesticides, petroleum products, and other organic compounds. Regionally, erosion and excessive sedimentation in rivers and streams have led to a decline in anadromous fish habitat for migration and spawning. Common causes of erosion and excessive sedimentation include clearing land for development without adequate stormwater controls, farming too close to creek banks or on steep slopes, and increased stormwater runoff from impervious surfaces (CDWR 2013d).

Among all of California's hydrologic regions, the Central Coast is the most reliant on groundwater for its water supply. Groundwater supplies are locally supplemented by stream diversions, timed releases from regional reservoirs, and some imported surface water. Factors that affect water availability in the region include precipitation, groundwater recharge capacity, groundwater quality degradation, groundwater pumping management styles or practices, surface water and reservoir storage capacity, and annually variable State Water Project and Central Valley Project water deliveries (CDWR 2013d). Seawater intrusion in the northern Salinas Valley has been an issue for decades and is likely associated with seasonal groundwater withdrawals for agriculture in Santa Cruz and Monterey counties (CDWR 2013d).

9.1.1.3 Existing Water Quality

Statewide and regional surface water monitoring has identified pesticides in surface waters and sediments throughout the Program Area and vicinity. A query of water quality data available through the California Environmental Data Exchange Network (CEDEN) water quality database revealed detectable quantities of several chemicals that the District will use or proposes to use and several additional chemicals of the same class (i.e., pyrethroids). See Tables 2-1 through 2-6 for a list of all chemicals the District uses or proposes to use in the future.

The following is a summary of CEDEN data from 1993 to 2012 regarding the concentrations of these chemical constituents when detected and the waterbodies in which they were discovered within the District's Program Area (CEDEN 2013). In addition to the CEDEN data, the list below includes Water Year 2012 Regional Monitoring Coalition pesticide results (BASMAA 2013). The Regional Monitoring Coalition was formed to implement the monitoring program required by the Municipal Regional Stormwater NPDES Permit (Order R2-2009-0074) issued by the San Francisco Bay RWQCB. In consideration of their more frequent usage and potentially greater toxicity compared with other commonly applied pesticides used in this geographic region, monitoring of the class of pesticides known as pyrethroids was conducted by the Regional Monitoring Coalition to explore potential causes of toxicity to Hyalella azteca in sediments. Based on monitoring results, BASMAA (2013) concluded that it is likely that pyrethroids caused toxicity in water year 2012.

> Allethrin was detected in sediments of various bays in the region including Central Bay, Grizzly Bay, San Pablo Bay (Pinole Point), San Francisco Bay (Yerba Buena Island), and Suisun Bay. Concentrations ranged from 0.238 to 5.61 micrograms per kilogram (µg/kg) in these bay sediments. Allethrin concentrations within Sacramento River and San Joaquin River sediments ranged from 0.33 to 2.13 µg/kg.

> Bifenthrin was detected in Central Bay, Grizzly Bay, Lower South Bay, San Pablo Bay (Pinole Point), San Francisco Bay (Yerba Buena Island), South Bay, and Suisun Bay sediments in concentrations ranging from 0.35 to 1.96 µg/kg. Alameda Creek, Agua Hedionda Creek, Coyote Creek, Guadalupe Creek, Kirker Creek, Pajaro River, Redwood Creek, Salinas River, San Leandro Creek, San Mateo Creek, Tembladero Slough, and Walker Creek Ranch sediments contained bifenthrin in concentrations ranging from 0.204 to 38.2 µg/kg. The Hayward Industrial Storm Drain, Sunnyvale East Channel, Guadalupe River, Lower Marsh Creek, and San Leandro Creek water columns contained detectable bifenthrin concentrations ranging from 0.18 to 272 nanograms per liter (ng/L).

> Lambda-cyhalothrin was detected in Central Bay, Lower South Bay, San Pablo Bay, and South Bay sediments in concentrations ranging from 0.065 to 0.395 µg/kg. Guadalupe Creek, Kirker Creek, Laguna de Santa Rosa, Lagunitas Creek, and Tembladero Slough sediments contained lambda-cyhalothrin concentrations ranging from 1.14 to 6.03 µg/kg. Lambda-cyhalothrin concentrations in the water column of the Hayward Industrial Storm Drain ranged from 3.53 to 6.07 ng/L.

> Esfenvalerate/fenvalerate were detected in Central Bay, Grizzly Bay, and Lower South Bay sediments in concentrations ranging from 0.163 to 0.577 µg/kg. Tembladero Slough sediments also contained esfenvalerate/fenvalerate concentrations of up to 60.8 µg/kg.

> The concentration of all permethrin isomers detected in the water column of the Hayward Industrial Storm Drain ranged from 1.57 to 285 ng/L. Sunnyvale East Channel, Guadalupe River, and Lower Marsh Creek sediments contained concentrations ranging from 3.81 to 20.9 µg/kg. Cis- and trans-permethrin isomers were detected in Central Bay, Grizzly Bay, Lower South Bay, San Pablo Bay (Pinole Point), South Bay, and Suisun Bay sediments in concentrations ranging from 0.10 to 1.32 µg/kg. Cis- and trans-isomers were also detected in Coyote Creek, Redwood Creek, San Leandro Creek, and Tembladero Slough sediments in concentrations 0.12 to 25.6 µg/kg. Only the cis- isomer of permethrin was detected in Guadalupe Creek, Laurel Creek, Salinas River, and San Mateo Creek sediments in concentrations ranging from 3.22 to 11.1 µg/kg. Trans-permethrin was the only isomer detected in Lagunitas Creek and the Pajaro River sediments in concentrations ranging from 4.06 to 4.52 µg/kg.

> Phenothrin was detected in Central Bay and San Francisco Bay (Yerba Buena Island) sediments in concentrations ranging from 0.988 to 4.81 µg/kg.

Additional queries were made to the USEPA's ECOTOX database to compare regional water quality data to available ecological toxicity data (Table 9-1). The toxicology data is expressed in LC50.[1] The LC50 value is used as a standard measure of toxicity for evaluation and comparison of chemicals. Chemicals with lower LC50 values are more toxic. The LC50 values in Table 9-1 are populated from the lowest available constituent concentrations in which a 50 percent die-off for the test species is observed (USEPA 2013b). LC50 values are not available for sediment. Freshwater and saltwater values are provided where available.

A 2010 study performed by the CDPR analyzed the presence of pyrethroid insecticides in California's surface waters from urban areas. The most frequently detected pyrethroids were bifenthrin followed by permethrin and cyfluthrin. These pyrethroids are found in many common household insecticides. Bifenthrin and cyfluthrin, which the District does not use or propose to use, were detected with the highest concentrations in both water and sediment. Over 8 percent water samples of bifenthrin and cyfluthrin exceeded the acute toxicity benchmarks for fish, and over 12 percent water samples of cyfluthrin and permethrin exceeded those for aquatic invertebrates (CDPR 2010b). Public health pesticides only account for an estimated 0.9 percent of all reportable pesticides and approximately 0.3 percent of total estimated pesticide use statewide (Howard et al. 2010)

9.1.2 Regulatory Setting

The Program includes components under the jurisdiction of federal, state, and local agencies. Applicable regulations are summarized below and include aspects related to both surface water and groundwater. The primary focus of this regulatory summary is the water quality aspects related to the Program components. Because the Program will not cause changes to natural precipitation patterns, runoff, or groundwater infiltration, changes to water quantity are not anticipated.

9.1.2.1 Federal

Federal Clean Water Act (33 United States Code Section 1251 et seq.)

The USEPA is the federal agency responsible for water quality management and administers the federal Water Pollution Control Act Amendments of 1972 and 1987, collectively known as the Clean Water Act (CWA). The CWA establishes the principal federal statutes for water quality protection. It was established with the intent "to restore and maintain the chemical, physical, and biological integrity of the nation's water, to achieve a level of water quality which provides for recreation in and on the water, and for the propagation of fish and wildlife." Several key CWA sections guide the regulation of water pollution in the US:

> Section 208, Water Quality Control Plans. This section requires the preparation of local water quality control plans throughout the nation. Each water quality control plan covers a defined drainage area. The primary goal of each water quality control plan is to attain water quality standards established by the CWA and the state governments within the defined area of coverage. Minimum content requirements, preparation procedures, time constraints, and federal grant funding criteria pertaining to the water quality control plans are established in Section 208. The USEPA has delegated preparation of the water quality control plans to the individual states. More information is provided below in the state regulatory setting section.

[1] LC50 refers to the lethal concentration of a chemical (amount of chemical in a volume of food, water, or air) that that would kill 50 percent of a group of test animals exposed to the chemical for a defined exposure time.

Table 9-1 Pesticide Concentrations in Surface Water and Sediment throughout the Program Area and Vicinity (1993 to 2012)

Pesticide	Sediment		Water			
	Concentration (µg/kg)	LC50 (µg/kg)	Concentration (ng/L)	LC50 (ng/L)	Standard Test Species	Exposure Time
Allethrin	0.238 - 5.61	*	NA	1,800	Coho Salmon (*Oncorhynchus kisutch*)	96-hour exposure in Freshwater Medium
Cinerin (Pyrethrin)	NA	*	3.76 - 79.9	920	Scud (*Gammarus fasciatus*)	96-hour exposure to Pyrethrin in Freshwater Medium
				84	Opossum Shrimp (*Americamysis bahia*)	96-hour exposure to Pyrethrin in Saltwater Medium
Lambda-cyhalothrin	0.065 - 6.03	*	3.53 - 6.07	30	Zebra Danio (*Danio rerio*)	72-hour exposure in Freshwater Medium
				3	Opossum Shrimp (*Americamysis bahia*)	96-hour exposure in Saltwater Medium
Esfenvalerate / Fenvalerate	0.163 - 60.8	*	*	11	Water Flea (*Ceriodaphnia dubia)*	96-hour exposure to Esfenvalerate in Freshwater Medium
Permethrin	3.81 - 20.9	*	1.57 - 285	0.007 (µmol/L)	Channel Catfish (*Ictalurus punctatus*)	96-hour exposure in Freshwater Medium
				4	Amphipod (*Eohaustorius estuarius*)	48-hour exposure in Saltwater Medium
Cis- and Trans-Permethrin Isomers	0.10 - 25.6	*	*	465	Water Flea (*Ceriodaphnia dubia)*	96-hour exposure to Cis-Permethrin in Freshwater Medium
Phenothrin	0.988 - 4.81	*	*	140	Rainbow Trout (*Oncorhynchus mykiss*)	96-hour exposure in Freshwater Medium
				21	Opossum Shrimp (*Americamysis bahia)*	96-hour exposure in Saltwater Medium

*No data available

> Section 303(d) Water Quality Limited Surface Waters. This section requires each state to provide a list of impaired waters that do not meet or are expected not to meet state water quality standards as defined by that section. It also requires the state to develop TMDLs from the pollution sources for such impaired waterbodies. Table 9-2 lists only one pesticide-impaired surface waterbody and TMDL status in the District's Program Area. Pyrethroids have been implicated in sediment toxicity in other areas, but the source for lower San Mateo Creek is unknown. San Mateo Creek flows through an area that is predominantly developed with residential uses including large lot residences with extensive landscaping. .See the state regulatory setting section (Section 9.1.2.2) for description of the Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL.

Table 9-2 Section 303(d) Pesticide and Sediment Toxicity Limited Surface Waters in San Mateo County

Waterbody	Pollutants	Primary Stressors	TMDL Completion Dates
San Mateo Creek, Lower	Sediment Toxicity	Unknown Source	2021

Source: SWRCB 2011b

> Section 401, Water Quality Certifications. This CWA section requires that, prior to the issuance of a federal license or permit for an activity or activities that may result in a discharge of pollutants into waters of the US (see Section 404 discussion, below), the permit applicant must obtain a certification from the state in which the discharge would originate. A state certification indicates that the proposed activity or activities would not result in a violation of applicable water quality standards established by federal or state law, or that no water quality standards apply to the proposed activity. The SWRCB and/or the nine RWQCBs administer the certification program in California.

> Section 402, NPDES. The NPDES requires permits for pollution discharges (except dredge or fill material) into waters of the US, such that the permitted discharge does not cause a violation of federal and state water quality standards. Biological and residual pesticides discharged into surface waters constitute pollutants within the meaning of the CWA and require coverage under an NPDES permit. NPDES permits define quantitative and/or qualitative pollution limitations for the permitted source and control measures that must be implemented to achieve the pollution limitations. Pollution control measures are often referred to as BMPs. In California, NPDES permits are issued by the SWRCB or the RWQCBs.

> Section 404, Discharge of Dredge and Fill Material. Section 404 assigns the USACE with permitting authority for proposed discharges of dredged and fill material into waters of the US, defined as "…waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide; territorial seas and tributaries to such waters." The USACE typically considers all natural drainages with defined beds and banks to be waters of the US. Section 404 establishes procedures by which the permitting agency is to review, condition, approve, and deny permit requests. Per the regulations, permitting agencies are responsible to conduct public noticing and provide the opportunity for public hearings during the review of each permit request. This responsibility includes informing the USFWS and/or NMFS of each permit request. Consultation with the USFWS and/or NMFS is required for proposed discharges that could affect species protected by the federal Endangered Species Act. Measures that are required by the USFWS and/or NMFS to minimize impacts to federally protected species must be included as conditions of the permit. The USACE also authorizes, with limited application requirements and associated delay, certain activities with minimal adverse effects on the environment, under nationwide permits. Currently, 50 nationwide permits exist, of which about half require preconstruction notification, which USACE reviews to verify the activity qualifies for the nationwide permit.

9.1.2.1.1 Federal Insecticide, Fungicide, and Rodenticide Act

The FIFRA was first passed in 1947 to establish labeling provisions and procedures for registering pesticides with the USDA. It was rewritten in 1972 and has since been amended several times. In its current form, FIFRA mandates that USEPA regulate the use and sale of pesticides to protect human health and preserve the environment. Registration with the USEPA assures that pesticides will be properly labeled and that, if used in accordance with specifications, they will not cause unreasonable harm to the environment. Pesticide use in California is also regulated by the CDPR and local County Agricultural Commissioners.

9.1.2.1.2 California Toxics Rule

The USEPA has developed water quality criteria for priority toxic pollutants and other provisions for water quality standards to be applied to inland surface waters, enclosed bays, and estuaries in California. This rule was developed to address a gap in California's water quality standards that was created when the state's water quality control plans containing water quality criteria for priority toxic pollutants were overturned in 1994. The established numerical standards were deemed necessary to protect human health and the environment. The rule includes ambient aquatic life criteria for 23 priority toxic pollutants, ambient human health criteria for 57 priority toxics, and a compliance schedule.

9.1.2.1.3 Safe Drinking Water Act of 1974

With the passage of the federal Safe Drinking Water Act of 1974, the USEPA established and enforced mandatory nationwide minimum standards. California adopted its own Safe Drinking Water Act in 1976 that gave California Department of Health Services (now CDPH) responsibility for the administration of the federal Safe Drinking Water Act in California. Under this program, the USEPA has delegated primary responsibility for setting and enforcing drinking water standards to the CDPH. CDPH has two approaches to standards for drinking water quality. The first approach is to safeguard public welfare by limiting the level of specific contaminants that can impact public health. These limits are identified as Primary MCLs and are specific concentrations that cannot be exceeded for a given constituent in surface water or groundwater.

9.1.2.1.4 Rivers and Harbors Act

The Rivers and Harbors Act (RHA) of 1899 prohibits the unauthorized alteration or obstruction of any navigable waters of the US. As defined by the RHA, navigable waters include all waters that are:

> Historically, presently, or potentially used for interstate or foreign commerce

> Subject to the ebb and flow of tides

Regulations implementing RHA Section 10 are coordinated with regulations implementing CWA Section 404. The RHA specifically regulates:

> Construction of structures in, under, or over navigable waters

> Deposition or excavation of material in navigable waters

> All work affecting the location, condition, course, or capacity of navigable waters

The USACE administers the RHA. If a proposed activity falls under the authority of RHA Section 10 and CWA Section 404, the USACE processes and issues a single permit. For activities regulated only under RHA Section 10, such as installation of a structure not requiring fill, permit conditions may be added to protect water quality during construction.

Program activities are not anticipated to affect any facilities that would be regulated under the RHA.

9.1.2.2 State

9.1.2.2.1 Porter-Cologne Act

The Porter-Cologne Act (California Water Code Section 13000) is the principal law governing water quality regulation in California. It establishes a comprehensive program to protect water quality and the beneficial uses of water. The Porter-Cologne Act applies to surface waters, wetlands, and groundwater, and to both point and nonpoint sources of pollution. Pursuant to the Porter-Cologne Act, it is the policy of the State of California that:

- The quality of all the waters of the state shall be protected.
- All activities and factors affecting the quality of water shall be regulated to attain the highest water quality within reason.
- The state must be prepared to exercise its full power and jurisdiction to protect the quality of water in the state from degradation.

Pursuant to the Porter-Cologne Act, the responsibility for protection of water quality in California rests with the SWRCB. The SWRCB administers federal and state water quality regulations for California's ocean waters and also oversees and funds the state's nine RWQCBs. The RWQCBs prepare water quality control plans, establish water quality objectives, and carry out federal and state water quality regulations and permitting duties for inland waterbodies, enclosed bays, and estuaries within their respective regions. The Porter-Cologne Act gives the SWRCB and RWQCBs broad powers to protect water quality by regulating waste discharge to water and land and by requiring cleanup of hazardous wastes. See Section 9.1.2.2.10 for the Statewide NPDES Vector Control Permit administered by the SWRQB.

9.1.2.2.2 State Antidegradation Policy

The SWRCB adopted the Statement of Policy with Respect to Maintaining High Quality Water in California (Resolution No. 68-16) on October 28, 1968. This policy is generally referred to as the "Antidegradation Policy" and it protects surface water and groundwater where existing water quality is higher than the standards set by the Water Quality Control Plan (or Basin Plan) to protect beneficial use of the waters. Under the Antidegradation Policy, any action that can adversely affect water quality in surface water or groundwater:

- Must be consistent with the maximum benefit to the people of the state.
- Must not unreasonably affect present and anticipated beneficial use of such water.
- Must not result in water quality less than that prescribed in water quality plans and policies.

9.1.2.2.3 Safe Drinking Water Act 1976

California adopted its own Safe Drinking Water Act in 1976 that gave California Department of Health Services the responsibility for the administration of the federal Safe Drinking Water Act in California. This responsibility was then moved to the CDPH. The first approach is to safeguard public welfare by limiting the level of specific contaminants that can impact public health. These limits are identified as Primary MCLs and are specific concentrations that cannot be exceeded for a given constituent. The second approach is a treatment technique that is based on distribution system sampling in comparison to an action level. If the action level is exceeded in more than 10 percent of the samples, then additional treatment is required of the water supplier. Currently, treatment technique limits apply only to copper and lead. CDPH also has established Secondary MCLs that regulate constituents that affect water quality aesthetics (such as taste, odor, or color). Generally, CDPH uses the Secondary MCLs as guidelines.

Another component of the California Safe Drinking Water Act is the requirement of Cal-EPA's Office of Environmental Health Hazard Assessment to develop PHGs for contaminants in California's publicly supplied drinking water. PHGs are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods. This office establishes PHGs pursuant to Health & Safety Code Section 116365© for contaminants with MCLs and for those for which CDPH will be adopting MDLs. Public water systems use PHGs to provide information about drinking water contaminants in their annual Consumer Confidence Reports. Certain public water systems must provide a report to their customers about health risks from a contaminant that exceeds its PHG and about the cost of treatment to meet the PHG, and hold a public hearing on the report.

9.1.2.2.4 Section 401 Water Quality Certification

CWA Section 401 certification is required for any permit or license issued by a federal agency for any activity that may result in a discharge into waters of the state to ensure that a proposed project will not violate state water quality standards. This water quality certification is part of the 1974 CWA, which allows each state to have input into projects that may affect its waters (USEPA 2013c).

9.1.2.2.5 Water Quality Control Plan

The Water Quality Control Plans (or Basin Plans) of all nine of the RWQCBs and the California Ocean Plan (prepared and implemented by the SWRCB) collectively constitute the State Water Quality Control Plan. These plans are the RWQCB's master water quality control planning documents. They designate beneficial uses and water quality objectives for waters of the state, including surface waters and groundwater and also include programs of implementation to achieve water quality objectives. According to the requirements of the CWA and the California Porter-Cologne Act, each Basin Plan has been designed to support the intentions of the CWA and the Porter-Cologne Act by: (1) characterizing the water resources within a region, (2) identifying beneficial uses that exist or have the potential to exist in each waterbody, (3) establishing water quality objectives for each waterbody to protect beneficial uses or allow their restoration, and (4) providing an implementation program that achieves water quality objectives. Implementation program measures include monitoring, permitting, and enforcement activities. The Basin Plans include numeric site-specific water quality objectives and narrative objectives for toxicity, chemical constituents, and tastes and odors. The narrative toxicity objective states: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life*."

9.1.2.2.6 Diazinon and Pesticide-Related Toxicity in Urban Creeks TMDL

Resolution R2-2005-0063 amended the Basin Plan for the San Francisco Bay region to establish a Water Quality Attainment Strategy and TMDL for Diazinon and pesticide-related toxicity in the Bay Area region creeks. As Diazinon use was phased out in 2004, components began to pose water quality concerns and pyrethroids in particular were identified as the likely cause of sediment toxicity in some Bay Area urban creeks. To account for pesticide use changes over time, the Basin Plan amendment includes generic pesticide-related toxicity targets to comply with the narrative toxicity objective. When pesticide-related toxicity occurs in urban creek water, creeks do not meet the narrative toxicity objective as stated above in *Water Quality Control Plan*. When pesticide-related toxicity occurs in sediment, the creeks also do not meet the narrative sediment objective, which states: "Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life." Management actions designed to reduce the impacts of pesticide-related toxicity are outlined within the TMDL and Water Quality Attainment Strategy and are currently underway via Provision C.9 of the Municipal Regional NPDES Permit (BASMAA 2013).

9.1.2.2.7 California Health and Safety Code

The SMCMVCD operates under the California Health and Safety Code and the California Government Code (reference Division 1, Administration of Public Health, Chapter 2, Powers and Duties; also Part 2, Local Administration, Chapter 8, State Aid for Local Health Administration; Division 3, Pest Abatement, Chapter 5, Mosquito Abatement Districts or Vector Control Districts, Sections 2200 - 2910).

9.1.2.2.8 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 are application requirements and include instructions informing users how to make sure the product is applied only to target pests including precautions the applicator should take to protect human health and the environment. For example, product labels may contain such measures as restrictions in applications to certain land uses and weather (i.e., wind speed) parameters.

In addition to the label instructions, pesticide risks to endangered species within California are evaluated by an interagency network that includes CDPR, the CDFG Pesticide Investigation Unit, CDFA, the Pesticide Registration and Evaluation Committee, and the County Agricultural Commissioners, as well as the USEPA and USFWS. Statewide protection strategies and local plans that resolve pesticide use conflicts, as well as communication tools for implementation, are described in more detail in Section 4.1.3.2.12.

9.1.2.2.9 Cooperative Agreement between the California Department of Public Health and Local Vector Control Agencies

Due to their public health mission, CDPR's Pesticide Regulatory Program provides special procedures for vector control agencies that operate under a Cooperative Agreement with CDPH. The application of pesticides by vector control agencies is regulated by a special and unique arrangement among the CDPH, CDPR, and County Agricultural Commissioners. CDPR does not directly regulate vector control agencies. CDPH provides regulatory oversight for vector control agencies that are signatory to the Cooperative Agreement (SMCMVCD 2017). Signatories to the agreement use only pesticides listed by CDPH, maintain pesticide use reports, and ensure that pesticide use does not result in harmful residues on agricultural products.

9.1.2.2.10 Pesticide Permits

In response to a Sixth Circuit Court decision in 2009 that the application of pesticides at, near, or over waters of the US that results in discharges of pollutants requires coverage under a NPDES permit, the SWRCB adopted four Pesticide Permits. Only the following NPDES Vector Control Permit is applicable to the District's Program.

> <u>Statewide NPDES Vector Control Permit</u>. Users of specific mosquito larvicide and adulticide registered products are required to obtain coverage under the Statewide General NPDES Vector Control Permit [SWRCB 2011a, 2012, 2016]). Permitted larvicide active ingredients in current use by the District include monomolecular films, methoprene, Bti, Bs, petroleum distillates, and spinosad. Permitted adulticide active ingredients used by the District include etofenprox, resmethrin, pyrethrin, sumithrin, and the synergist PBO. Permitted products that are not currently used by the District but may be used in the future include naled, permethrin, and prallethrin. The synergist N-octyl bicycloheptene dicarboximide (MGK-264) and adulticide malathion are also permitted, but they are not included as either current or future use active ingredients in the District's Proposed Program. The permit contains a receiving water limitation for malathion and receiving water monitoring triggers for the other active ingredients. Receiving water monitoring triggers are conservatively based on one-tenth of the LC50 from USEPA's Ecotoxicity Database (LC50 is defined in Section 9.1.1.4). To obtain coverage under the permit, each discharger (typically a vector control district) must submit a Notice of Intent,

application fee, and Pesticide Application Plan (PAP), which is subject to approval by the SWRCB following a 30-day public comment period.

The PAP serves as a comprehensive plan developed by the discharger that describes the project, the need for the project, what will be done to reduce water quality impacts, and how those impacts will be monitored. The PAP must include a description of application and target areas, evaluation of available BMPs, and description of BMPs to be implemented. The PAP must include a discussion of the factors influencing the decision to select pesticide applications for vector control, what pesticide products or types expected to be used, and any known degradation byproducts. The PAP also includes the methodology used to determine how much pesticide is needed and how this amount was determined, the methods in which pesticides are to be applied, and any adjuvants or surfactants that will be used.

Permittees must comply with the Vector Control Permit Monitoring and Reporting Program (MRP), which encourages formation of monitoring coalitions. Monitoring requirements in the original permit included background, event, and post-event sampling for visual, physical, and chemical constituents for each type of aquatic pesticide used. Visual observations were required at 10 percent of all application sites, and physical measurements and chemical samples were required at six sites in each environmental setting (urban, agricultural/rural, and wetland). The District is a member of the Mosquito Vector Control Association of California (MVCAC) NPDES Permit Coalition, which is responsible for coordinating all physical measurements and conducting all chemical monitoring required under the Vector Control Permit MRP. In the original permit, chemical monitoring results that exceeded the receiving water limitation for malathion or the receiving water monitoring trigger for other active ingredients had to be reported to the SWRCB and RWQCB within 24 hours of identification and again after 5 days. A description of actions to be taken to prevent recurrence of adverse incidents is included in those reports. Annual reports are required by the MVCAC NPDES Permit Coalition and each member district. Member district annual reports are typically limited to submittal of Pesticide Application Logs, which contain specific application details and review of their PAP.

The MVCAC NPDES Permit Coalition annual report now includes all physical monitoring data and makes recommendations for modifications to the MRP, if appropriate. Based on the results of monitoring performed in 2011-2012 by the MVCAC Permit Coalition, the monitoring and reporting program for the Vector Control Permit was amended in March 2014 to limit the required monitoring to visual observations, monitoring and reporting of pesticide application rates, and reporting of noncompliant applications. This decision was based on the physical and chemical monitoring results contained in the 2012 Annual Report (MVCAC 2013) indicating that the pesticide active ingredients were rarely present in the waterway and/or the presence of the material in the waterway was of extremely short duration after pesticide application. Ongoing monitoring is done by each vector control agency including the District, and any adverse impacts if observed are reported to the SWRCB.

9.1.2.3 Local

9.1.2.3.1 County General Plan

Local policies (implemented by ordinances and regulations) for San Mateo County can be found in the San Mateo County General Plan (1986). Chapter 11 Wastewater provides policies for management of septic systems. Chapter 16 Man-Made Hazards, addresses spill prevention and incident responses and hazardous waste treatment and disposal. Chapter 11 references the Conservation and Open Space Element (1973): “Additional policies are directed at maintaining the quality of receiving waters” (p. 11.23).

9.1.2.3.2 County Agricultural Commissioners

In addition to federal and state oversight, County Agricultural Commissioners in California also regulate the sale and use of pesticides and issue Use Permits for applications of pesticides that are deemed as restricted materials by CDPR. The San Mateo County Agricultural Commissioner collects pesticide use reports from the District and other users of pesticides, and may investigate incidents and illnesses and conduct annual inspections of pesticide users.

9.2 Environmental Impacts and Mitigation Measures

The water resource impacts evaluation is provided below. The evaluation qualitatively and quantitatively compares the Program's potential water resource impacts to the significance criteria presented in Section 9.2.1, Evaluation Concerns and Criteria. Significant impacts are summarized for each component where one or more potential impacts were identified. Mitigation measures are identified for potentially significant but mitigable impacts following the statement of impact. Additional information on the mitigation measures is provided in Section 9.2.1.1.

9.2.1 Evaluation Concerns and Criteria

Impacts are considered significant if the Program actions cause concentrations of Program compounds in receiving waterbodies (surface water or groundwater) to exceed established water quality objectives or other applicable water quality standards or promulgated regulations on the local, state, or federal level. Increased concentrations of potential pollutants associated with Program activities within the Program Area would be related to the application of Program materials or implementation of Program activities in the Program Area.

As discussed previously in this PEIR, the Program Area is distributed across the District (and adjacent counties) rather than being in a single particular location (i.e., site-specific). The effects on water resources are largely attributable to the post-application movement of those compounds identified for use under the Program components to surface water and/or groundwater. Some Program activities that do not involve applications of compounds could also affect water resources.

Concerns related to water resources issues that were raised during public scoping included the following:

- Consideration of CDPH review and approval of mosquito abatement materials and practices proposed for use on watershed lands.
- Integration of "Source Reduction" strategies with Stream Maintenance Program approaches in Water Agency-owned flood control channels.
- Need for description and quantification of dredge or fill activities and evaluation of their impacts.
- Impacts of drift from aerial spray and ground applications on waterbodies, watersheds, and drinking water supplies.

While the first two issues are related to Program implementation and coordination with other agencies (who will receive this PEIR), the last two are related to the Physical Control, Vegetation Management, and Chemical Control Components and are addressed in the environmental impact analyses.

This water resource analysis addresses potential impacts to the quality of surface water and groundwater at a programmatic level and does not quantify dredge and fill activities (which could be addressed in the new USACE permit described in Section 2.8.1.3). Because no large-scale consumptive use of water supply is associated with implementation of the Program components, the potential for an impact to water supply would be related to a physical impact to water quality. Additional discussion of the potential for the pesticides to result in exceedance of federal or state agency surface water quality standards or objectives is contained in Section 6.2, Ecological Health Environmental Impacts. However, the analyses for this PEIR are qualitative rather than quantitative.

9.2.1.1 Thresholds of Significance

Applicable regulatory and planning standards discussed above can be used to determine appropriate thresholds of significance for this water resource analysis.

The Program activities are evaluated in accordance with the Hydrology and Water Quality Section IX of the CEQA Environmental Checklist Form, Appendix G. Several of the topic areas represented by the questions from the checklist are not affected by the Program activities, as follows:

> Would the Program substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off site?

- No, Program activities would not substantially change or alter drainage amount, timing, or patterns.

> Would the Program substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner, which would result in flooding on- or off site?

- No, Program activities would not substantially change or alter drainage amount, timing, or patterns.

> Would the Program create or contribute runoff water, which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

- No, Program activities would not create or contribute additional sources of clean or polluted runoff.

> Would the Program place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

- No, Program activities would not construct any housing.

> Would the Program place within a 100-year flood hazard area structures, which would impede or redirect flood flows?

- No, Program activities would not create any structures.

> Would the Program expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?

- No, Program activities would not expose people or structures to flooding.

> Would the Program lead to inundation by seiche, tsunami, or mudflow?

- No, Program activities would not cause inundation by seiche, tsunami, or mudflow.

> Would the Program substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?

- No, Program activities would not impact groundwater supplies or groundwater recharge.

Topic areas that may be impacted by the Proposed Program include the following:

> Would the Program violate any water quality standards or waste discharge requirements?

> Would the Program otherwise substantially degrade water quality?

For the evaluation of these topic areas, impacts from Program activities on the water quality of surface water or groundwater would be considered potentially significant if the Program implementation or activities could cause chemical concentrations to exceed the following criteria:

> Any discharge to the surface water or groundwater that exceeds NPDES permit receiving water limitations

> Any discharge to the surface water or groundwater that exceeds Basin Plan objectives with a focus on the toxicity objective

> Any discharge to the surface water or groundwater that exceeds the MCLs

> Any discharge to surface water or groundwater that exceeds the California Toxics Rule Criteria Maximum Concentrations for human health or for aquatic life

> Any discharge to surface water or groundwater that degrades the water quality by either affecting beneficial uses or by exceeding any prescribed concentration limits in state water quality plans and policies.

9.2.2 Evaluation Methods and Assumptions

The methodology and assumptions of this water resources impact evaluation for the Program components are provided below.

9.2.2.1 Methodology

The methodology used to prepare this programmatic impact analysis section is as follows:

> Obtain source-specific data for Program-specific chemical constituents.

> Evaluate Ecological and Human Health Assessment Report (Appendix B) sections related to the Program chemicals.

> Compare water quality conditions associated with Program components against threshold criteria.

> Identify water resource impacts and mitigation measures for Program activities that exceed water quality thresholds.

The Ecological and Human Health Assessment Report (Appendix B) reviews and evaluates 42 pesticide (insecticides and herbicides) active ingredients and four adjuvants currently used or proposed for use by nine Districts in MVCAC's coastal region including SMCMVCD. Application information, including the target organisms, number of treatments, total amount applied, and specific habitat types was obtained from the District. A comprehensive literature review was conducted to evaluate environmental fate and general toxicity characteristics for the active ingredients. The results of the assessment were used to rank the potential for adverse effects to human health and the environment. Chemical and application characteristics such as the likelihood for nontarget species and habitats, the potential for drift, and the possible transport and fate of the chemical in various media (i.e., air, surface water/groundwater, soil) were considered in the assessment. Selected for further analysis in Appendix B are those active ingredients that appear to exhibit a higher level of risk than others or that are in prevalent use in the current Program or needed in the future (even though they had lower toxicity) include the following products:

> Methoprene for mosquito control (toxicity to aquatic organisms and insects)

> Etofenprox for mosquito control (toxicity to aquatic organisms)

> Bti for mosquito control (prevalent use; public concerns)

> Pyrethrins for mosquito control (prevalent use; includes PBO synergist)

> Resmethrin for mosquito control (prevalent use; includes PBO synergist)
> Vegetable oil (coconut oil)/mix for mosquito control (contains low percentage petroleum distillate)
> Permethrin for mosquito and wasp control (toxicity to aquatic organisms; potential endocrine disruptor)
> Lambda-cyhalothrin for yellow jacket wasp control (high toxicity to aquatic organisms; potential to bioaccumulate in fish; possible endocrine disruptor)
> Bromadiolone for rodent control (high toxicity to nontarget organisms)
> Difethialone for rodent control (high toxicity to nontarget organisms including mammals, birds, and aquatic organisms)
> APEs for weed control (high toxicity to aquatic organisms; moderately bioaccumulative)
> Glyphosate for general weed control (prevalent use; possible endocrine disruptor);
> Benfluralin for weed control (high toxicity to aquatic organisms; potential for bioaccumulation and endocrine disruption)

The District's IMVMP Plan includes the following BMPs as environmentally protective project features that pertain to water resources (Table 9-3 below; a subset of practices in Table 2-8 in Chapter 2).

Table 9-3 SMCMVCD BMPs to Avoid/Minimize Environmental Impacts to Water Resources

Best Management Practice (BMP)
A. General
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.
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.
10. Properly train all staff, contractors, and volunteer help to prevent spreading weeds and invasive animal species (e.g., New Zealand mud snails) or pathogens (e.g., the fungus that causes chytridiomycosis in amphibians) 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. Decontamination methods to clean equipment and personnel clothes, such as boots, of invasive species and pathogens will be included in worker training and be implemented when working in wetlands in different watersheds.
B. Tidal Marsh-Specific
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.
3. District will minimize travel along tidal channels and sloughs to reduce impacts to vegetation used as habitat (e.g., RIRA nesting and escape habitat).
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.

Best Management Practice (BMP)
F. 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 3 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 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 3 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. 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. 9. If suitable habitat 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, as appropriate, 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. 10. 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.
G. Maintenance / Construction and Repair of Channels, Tide Gates, and Water Structures in Waters of the US and State 1. District staff will consult with appropriate resource agencies (USACE, USFWS, CDFW, NMFS, BCDC, RWQCB) and obtain all required permits prior to the commencement of ditch maintenance or construction within tidal marshes. 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 or State of California, 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. 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.

Best Management Practice (BMP)
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 circulation. 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 feasible (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.
H. Applications of Pesticides, Surfactants, and/or Herbicides 1. 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. Applicators will complete training in an annual basis. 2. District will avoid use of surfactants when feasible in sites with aquatic 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 if necessary. 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. Truck, hand larviciding, and fogging equipment will be calibrated and inspected semiannually. 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 feasible (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 2015, and the results 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

Best Management Practice (BMP)
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 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. 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 adulticides in spray/fog forms over large areas (more than 0.25 acres) during the day when honeybees and other pollinators are present and 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 bees and other pollinators are present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent. Liquid larvicides are applied only to waterbodies. 13. The District will provide notification to the public (24 – 48 hours in advance if possible) and/or appropriate agency(ies) and the San Mateo County Beekeepers Guild when applying pesticides or herbicides for large-scale treatments that will occur in close proximity to homes, heavily populated, high traffic, and sensitive areas (including bee hives). The District applies or participates in the application of herbicides in areas when a joint effort is most effective and/or efficient. 14. Provide for buffer zones between herbicide application sites and surface and usable groundwater supplies. 15. For rodenticides in sewer systems, deploy bait blocks by suspension to reduce potential dietary exposure to nontarget animals. Apply bait block attachments to the underside of manhole covers so that rodents are more likely to perish while still in the sewer and away from predators to reduce secondary exposure. 16. For rodenticides in aboveground sites, use tamper-proof bait stations firmly attached to embedded stakes or duckbill anchors so that bait cannot be accessed or be dragged away by nontarget animals.
I. Hazardous Materials and Spill Management 1. 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). Monitor application equipment on a daily basis. 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.

9.2.2.2 Assumptions

The following assumptions were used in the assessment of potential water resource impacts from the Program components:

> Site-specific evaluation of water quality impacts are not within the scope of this programmatic evaluation.

> The programmatic evaluation is based on District's current Program and its future Program when the activities and materials can be identified at present. Section 1.8 discusses procedures for evaluation of changes to the Program that could be proposed at a future date.

> Existing baseline ambient water quality data related to Program chemicals are limited for most areas.

Assumptions related to the analysis of hazards, toxicity, and exposure for chemical treatment methods are explained below, including the definition of key terms.

9.2.2.2.1 Hazardous Material

A "hazardous material" is defined in California Health and Safety Code Section 25501 (p): as "any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. "Hazardous materials" include, but are not limited to, "hazardous substances, hazardous waste, and any material that a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment." Any liquid, solid, gas, sludge, synthetic product, or commodity that exhibits characteristics of toxicity, ignitability, corrosiveness, or reactivity has the potential to be considered a "hazardous material."

9.2.2.3 Toxicity and Exposure

Toxicology is the study of a compound's potential to elicit an adverse effect in an organism. The toxicity of a compound is dependent upon exposure, including the specific amount of the compound that reaches an organism's tissues (i.e., the dose), the duration of time over which a dose is received, the potency of the chemical for eliciting a toxic effect (i.e., the response), and the sensitivity of the organism receiving the dose of the chemical. Toxicity effects are measured in controlled laboratory tests on a dose/response scale, whereby the probability of a toxic response increases as dose increases. Exposure to a compound is necessary for potential toxic effects to occur. However, exposure does not, in itself, imply that toxicity will occur. Thus, toxic hazards can be mitigated by limiting potential exposure to ensure that doses are less than the amount that may result in adverse health effects.

The toxicity data included in the numerous tables and charts in this document are generally derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure. In these studies, the species of interest is exposed to 100 percent chemical at several doses to determine useful information such as the lowest concentration resulting in a predetermined adverse effect (LOAEL) on numerous selected physiological and behavioral systems. The second component of these tests is to determine the highest concentration of chemical that results in no measurable adverse effect (NOAEL).

However, these, and other, coordinated and focused laboratory tests are designed to document the effects of the chemical when a continuous, controlled, exposure exists and do not realistically reflect the likely exposures or toxicity in the District field application scenarios. As such, the toxicity information is intended as an overview of potential issues and guidance for understanding the completely "safe" maximum exposure levels of applications that would not adversely impact humans or nontarget plant and animal species.

Although the regulatory community uses this basic information to provide a relative comparison of the potential for a chemical to result in unwanted adverse effects and this information is reflected in the approved usage labels and MSDSs/SDSs, in actual practice, the amounts applied in the District's Program Area are substantially less than the amounts used in the toxicity studies. Because of the large safety factors used to develop recommended product label application rates, the amount of chemical resulting in demonstrated toxicity in the laboratory is much higher than the low exposure levels associated with an actual application. The application concentrations consistent with the labels or MSDSs are designed to be protective of the health of humans and other nontarget species (i.e., low enough to not kill them, weaken them, or cause them to fail to reproduce). In reality, these low-dose exposures need to be sustained over longer periods than are relevant to typical application scenarios for vector control in order to exhibit toxicity.

9.2.3 Surveillance Component

Surveillance activities involve monitoring the abundance of adult and larval mosquitoes, field inspection of mosquito habitat, testing for the presence of encephalitis virus-specific antibodies in sentinel chickens or wild birds, collection and testing of ticks, small rodent trapping, and/or response to public service requests regarding nuisance animals or insects. Mosquito populations are monitored through the use of traps, inspections, and sampling in mosquito habitats. Known and suspected habitats are anywhere that water can collect, be stored, or remain standing for more than a few days, including, but not limited to, catch basins, stormwater detention systems, residential communities, parks, ornamental ponds, unmaintained swimming pools, seeps, seasonal wetlands, tidal and diked marshes, wastewater ponds, sewer plants, winery waste/agricultural ponds, managed waterfowl ponds, canals, creeks, treeholes, and flooded basements. If preexisting roads and trails are not available, low ground pressure ATVs may be used to access sites. Offroad access is minimized and used only when roads and trails are not available. Ticks are collected along trails and sampled for disease. Rodents (roof rats and Norway rats) may be collected during disease surveys and during inspections to respond to public service requests.

These activities do not involve chemical applications to water or soil and require very little interaction with waterbodies to collect samples. Some adult mosquito traps (light traps) use a Vapona strip infused with dichlorvos in the bottom of the collection jar; this chemical would be contained in the collection device and would not contact nor interact with the environment. Bait stations for rodents are located above the water line in storm drains. Small animals may be trapped using traps baited with food in terrestrial settings only. Therefore, no impact would occur to surface water or groundwater.

> **Impact WR-1:** The Surveillance Component collection devices would not contact nor interact with the environment. **No impact** would occur to surface water or groundwater.

9.2.4 Physical Control Component

Physical control for mosquitoes consists of the management of mosquito-producing habitat (including freshwater marshes and lakes, saltwater marshes, temporary standing water, and wastewater treatment facilities) especially through water control and maintenance or improvement of channels, tide gates, levees, and other water control facilities, etc. Physical controls reduce or eliminate mosquito development sites by improving the habitat value for mosquito predators (i.e., providing deepwater sanctuary for larvivorous fish) or by reducing the habitat value for mosquitoes. Because mosquitoes breed in stagnant standing water, the District attempts to reduce these habitats through vegetation management, increased circulation, steepening banks, changes in water quality, or by reducing the duration that standing water is allowed to persist. The specific method employed is based on site- and project-specific considerations, including whether the activity is conducted to prevent mosquito-producing habitat from forming or in response to existing conditions. Characteristics of the site and waterbody are also considered in planning physical control activities. Vegetation management is based on an IPM approach and is discussed in Section 9.2.5. The District conducts physical control activities, requests/requires landowners and stewards to implement maintenance activities, and advises landowners on source reduction for mosquito habitat. The District may perform additional ditching control activities in saline and brackish habitats in the future (see Section 2.3.2.1.5).

Three types of physical control practices are implemented:

1. Maintenance activities include removal of sediments from existing water circulation ditches; repair of existing water control structures, removal of debris in natural channels, clearance of brush for access to streams tributary to wetland areas, and filling of existing, nonfunctional water circulation ditches to achieve required water circulation dynamics and restore ditched wetlands.
2. New construction typically involves the creation of new ditches to enhance tidal flow preventing stagnant water.
3. Cultural practices include vegetation and water management (i.e., irrigation practices), placement of culverts or other engineering works, and making other physical changes to the lands.

The District performs these physical control activities in accordance with all appropriate environmental regulations and in a manner that generally maintains or improves habitat values for desirable species. Physical control activities can be relatively minor, are unpredictable with ongoing habitat restoration projects, and are often covered by the District's 5-year USACE and BCDC regional wetlands permits (Section 2.3.2.1). Filling or periodically draining artificially ponded areas such as ornamental ponds and irrigation ponds can be cost-effective and environmentally acceptable; however, these methods are not appropriate strategies in natural areas, large permanent waterbodies, or in areas set aside for stormwater or wastewater retention. Consequently, the District does not usually undertake physical control projects in fresh waterbodies including marshes and ponds. In saline and brackish marsh habitat, physical control measures are typically designed to reduce salt-marsh mosquito production through enhancement of the frequency and duration of tidal inundation or through other water management strategies.

Physical control activities for other vectors such as rates, mice, raccoon, skunk, and opossum are based on the District's site inspections. They may include education of property owners on sanitation, exclusion, and rodent proofing. The District may also remove the vector, typically by trapping methods.

Construction of water control facilities and changes in water management strategies could affect existing drainage patterns and water quality locally. However, physical control activities would be designed to increase water circulation, which can increase dissolved oxygen and reduce water temperatures, improving these water quality conditions locally. Changing water circulation patterns can also increase localized areas of scour due to increased water velocities, particularly near structures. Water control facilities (e.g., tide gates, levees) are designed to minimize scour near the structure for long-term stability. Potential increases in turbidity in the waterbody would be limited to during and immediately after the action and would not extend beyond the vicinity of the area being improved. Changes to groundwater conditions such as water quality or recharge would not occur.

Removal of sediments from existing water circulation ditches has the potential to temporarily approach or exceed turbidity water quality objectives in nearby downstream receiving waters. However, the physical control activities are short in duration (typically less than 1 day), are localized to site-specific areas, and are transitory in location. Therefore, this temporary and transitory potential impact to surface water or groundwater is less than significant.

> **Impact WR-2**: The Physical Control Component's activities to modify water circulation, remove sediment, and maintain water control facilities to reduce habitat conditions for mosquito production would have a **less-than-significant** impact on water resources and no mitigation is required.

9.2.5 Vegetation Management Component

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. The District uses hand tools, other mechanical means, or herbicide applications to thin or remove vegetation. These activities primarily occur in aquatic habitats to assist with the control of mosquitoes but are also implemented in terrestrial habitats to help with the control of other vectors. The District may also perform vegetation management to assist other agencies (such as the Coastal Conservancy) and landowners with the management of invasive/nonnative weeds. These actions are typically performed under the direction of the concerned agency, which also maintains any required permits.

Herbicides the District uses now or potentially in the future are listed in Table 2-1 along with information regarding the timing/season of application, method of application, and types of sites where they are applied. Section 4.6 of the Ecological and Human Health Assessment Report (Appendix B) includes descriptions of each herbicide and information on their environmental fate and toxicity. All herbicides are applied in strict conformance with label requirements, which have been approved by CDPR for use in California. Pesticide labels are legal requirements and include instructions telling users how to apply the product and precautions the applicator should take to protect human health and the environment.

The District also incorporates hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface water and groundwater resources (Table 9-3, BMPs I1 through I6). These measures require the implementation of a hazardous spill plan and procedures used to minimize the risk of an accidental spill or release. District control measures also require that mixing and transferring of materials would occur within a contained area (Table 9-3, BMP H5) and materials would be disposed of at an approved site (Table 9-3, BMP H9).

District staff would monitor sites post-treatment to determine if the target weeds were effectively controlled with minimum effect to the environment and nontarget organisms. This information would be used to help design future treatment methods in the same season or future years to respond to changes in site conditions (Table 9-3, BMP H11). Implementation of these BMPs would reduce exposure of applied chemicals to surface and groundwater resources during and following application of the material.

In some instances, the water quality objective that establishes a minimum concentration for dissolved oxygen may not be met, such as when aquatic weeds killed by herbicides decompose rapidly and consume dissolved oxygen in the process.

Some herbicide applications also have the potential to approach or exceed the narrative toxicity water quality objective or the numeric water quality objective or receiving water monitoring trigger for the specific active ingredient. Herbicides that are not labeled for aquatic use and are subject to spray drift or surface water runoff may cause acute or chronic toxicity. Only one pesticide-impaired surface waterbody, Lower San Mateo Creek, was identified in the District's boundaries (for permethrin sediment toxicity; see Table 9-2). Herbicides and adjuvants the District uses are grouped below based on toxicity to fish and aquatic invertebrates. They are discussed in more detail in Appendix B, Ecological and Human Health Assessment Report.

9.2.5.1 Mechanical Removal of Vegetation

Mechanical and hand removal of vegetation from aquatic habitats has the potential to temporarily approach or exceed turbidity water quality objectives in downstream receiving waters. However, the vegetation control activities are short in duration (typically less than 1 day), are localized to site-specific areas, and are transitory in location. Therefore, this temporary and transitory potential impact to surface water is less than significant. No impact to groundwater is associated with these activities.

> **Impact WR-3:** Mechanical removal of vegetation from aquatic habitats would have a **less-than-significant** impact to surface water and **no impact** to groundwater resources.

9.2.5.2 Registered Herbicides or Adjuvants with Relatively Low Toxicity to Fish and Aquatic Invertebrates

Imazapyr is a systemic, nonselective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds, including terrestrial annual and perennial grasses, broadleaf herbs, woody species, and riparian and emergent aquatic species. Imazapyr is water-soluble, can run off to surface waterbodies, and degrades in clear, open water. However, it is persistent in soil and leaches to groundwater. The Health-Based Screening Level determined by the USGS as a benchmark concentration of a contaminant in water that may be of potential concern to human health is 17,500 µg/L (USGS 2014). The USEPA performed Tier 1 Screening Concentration in Ground Water exposure modeling to predict concentrations of imazapyr in groundwater when applied at the highest noncrop application rate (1.5 lbs. a.i./acre), and found that the concentration in groundwater was not expected to exceed 36 µg/L, which is far below the 17,500 µg/L that would trigger a health concern (USEPA 2006c). The District’s use of imazapyr to date has been limited to controlling invasive spartina in conjunction with the Coastal Conservancy in mudflats and tidal marshes. A persistence study in Washington state found that imazapyr rapidly dissipated from both water and sediment in this type of environment, and after being applied at the maximum application rate used in the Invasive Spartina Project (1.5 lb a.i./acre) was undetectable in water after 40 hours, and in sediment in 400 hours, with half-lives of <0.5 and 1.6 days, respectively (Patten, pers. comm., as cited in Grasetti and Leson 2005). It has low toxicity to fish and aquatic invertebrates. Based upon imazapyr’s toxicity and environmental fate, and using BMP application techniques, these products should not result in adverse effects.

Glyphosate is a nonselective, post-emergent, and systemic herbicide registered for use in agricultural and nonagricultural areas. It is used to control emergent foliage, but it is not effective on submerged or mostly submerged foliage. Glyphosate is highly water-soluble, but it binds tightly to soil and sediments. It has a low tendency to run off when applied to land because of strong adsorption to soil particles and it has a low potential to move to groundwater. Glyphosate degrades in soil in about a month. It has low toxicity to fish and aquatic invertebrates. Using BMP approaches, which ensures an adequate buffer to water sources is maintained (for the terrestrial use formulations), applications of glyphosate can be used safely.

Sulfometuron methyl is a broad-spectrum herbicide used for pre-emergence and post-emergence control of annual, biennial, and perennial grasses and broadleaf weeds. It effectively retards or stops root and shoot development. Sulfometuron methyl has a low tendency to sorb to sediments and has the potential to leach to groundwater and/or reach surface water during runoff events. It typically degrades in a few weeks and has low toxicity to fish and invertebrates. Based upon sulfometuron methyl’s toxicity and environmental fate, these products should not result in adverse effects when using BMP application techniques.

DCPA is a pre-emergent herbicide used to control annual grasses and broadleaf weeds by causing abnormal cell division. Use practice limitations prohibit applying DCPA directly to water or wetlands (swamps, bogs, marshes, and potholes) or through any type of irrigation system. DCPA is not mobile in soil and has low persistence; however, the metabolite tetrachloroterephthalic acid (TPA) is unusually mobile and persistent and will leach to groundwater. DCPA is of low acute toxicity to most receptors, but was classified as a possible endocrine disruptor. The results of subsequent USEPA reviews have reported no evidence of potential interaction of DCPA with the estrogen or androgen pathway, but they did recommend further studies be conducted to generate specific data on any potential thyroid effects that may be used for human health risk assessment (USEPA 2015c). It should be noted that all herbicides are used in the field at USEPA-mandated label rates, which result in much lower levels of exposure than are used in laboratory experiments. The present toxicity database for TPA is lacking; however, available data suggest that TPA is no more toxic than its parent compound (USEPA 2008d). DCPA applications, when using BMPs and label application practices, are not expected to result in adverse effects, given its low persistence and low toxicity.

Modified vegetable oils (or plant oils including those containing coconut oil) can increase the penetration of oil-soluble herbicides into plants. Little is known of the environmental fate of these adjuvants. Modified vegetable oils are essentially nontoxic to most organisms, including plants. Although some information is lacking regarding the toxicity and environmental fate of these oils, the USEPA has determined that they present such a low potential hazard that they are exempt from the requirement of a tolerance when applied to growing crops (USEPA 1996). These products are not expected to result in adverse effects when using BMP application techniques, given the low toxicity of modified vegetable oils to most organisms.

Lecithins are naturally occurring phospholipids in biological cell membranes. Lecithins are used extensively in the cosmetics industry in skin-care products and in the food industry (Fiume 2001). In food applications, lecithins are generally recognized as safe (GRAS) by the US Food and Drug Administration (2017. Although toxicity and environmental fate information for lecithins in herbicide adjuvant products is scarce, no evidence indicates that use of lecithins would result in adverse effects when used in accordance with recommended BMP application techniques.

The District would apply all herbicide formulations in strict conformance with its PAP (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects. If downstream waterbodies are not already impacted by these chemical active ingredients (i.e., imazapyr, glyphosate, sulfometuron methyl, and DCPA), application of these herbicides would have a less-than-significant impact to surface water or groundwater resources when applied in accordance with label instructions. If downstream waterbodies are impaired by these ingredients, different herbicides would be used. Only one waterbody within the District’s Service Area (San Mateo County) is designated impaired but impairment is not from herbicide use, and that is lower San Mateo Creek (sediment toxicity due to permethrin). Therefore, at present, none of the downstream waterbodies in San Mateo County are impaired by any of these herbicides.

> **Impact WR-4:** Application of the herbicides imazapyr, glyphosate, sulfometuron methyl, DCPA, modified vegetable oils, and lecithins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.3 Registered Herbicides or Adjuvants with Moderate Toxicity to Fish or Aquatic Invertebrates

Triclopyr is used for the control of woody plants and annual and perennial broadleaf weeds. It is absorbed by leaves and roots and is moved throughout the plant into the foliage. Triclopyr is highly soluble, is moderately persistent in soil (with sorption to soil increasing with time), but degrades rapidly in clear, open water. The USEPA has separately evaluated the environmental fate and ecological risk of three forms of Triclopyr as herbicide active ingredients: triclopyr acid, triclopyr triethylamine salt (TEA) and triclopyr butoxyethyl ester (BEE) (USEPA 1998b). The acid and TEA forms of triclopyr are slightly toxic or practically nontoxic to birds, fish, and invertebrates. Triclopyr BEE has similarly low toxicity to birds, but is moderately to highly toxic to fish and invertebrates (Appendix B, Table 4-1). The District does not currently use triclopyr, but the two proposed future use products, Renovate 3 and Alligare Triclopyr 3, contain only the acid and TEA formulations of this active ingredient, not BEE (Chapter 2, Table 2-1).

Based upon triclopyr's toxicity and environmental fate, and using BMP application techniques, these products (acid and TEA formulations) should not result in adverse effects.

Oryzalin is a selective, pre-emergent surface-applied herbicide used for control of annual grasses and small-seeded broadleaf weeds that controls weeds by disrupting the growth process during seed germination. Oryzalin is not mobile under field conditions, and most of the applied oryzalin either binds to soil or is fully mineralized. It does not leach to groundwater. Oryzalin is moderately toxic to fish and freshwater invertebrates. The District does not currently use oryzalin, but its proposed future use does not include any products labeled for aquatic plants. Any future applications of the products containing oryzalin listed in Chapter 2, Table 2-1 will not be applied directly to water, areas where surface water is present, or intertidal areas below the mean high water mark, per legally-binding label restrictions. Based upon oryzalin's toxicity and environmental fate, and using BMP application techniques, these products for terrestrial use should not result in adverse effects.

The District would apply all herbicide formulations in strict conformance with its PAP (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects. If downstream waterbodies are not already impacted by these chemical active ingredients (i.e., triclopyr and oryzalin), application of these herbicides would have a less-than-significant impact to surface water and groundwater resources when applied in accordance with label instructions. If downstream waterbodies are impaired by these ingredients, different herbicides would be used. Only one waterbody in San Mateo County is designated impaired; but impairment is not from herbicide use, and that body is lower San Mateo Creek (sediment toxicity due to permethrin). Therefore, at present, none of the waterbodies in San Mateo County are impaired by any of these herbicides.

> **Impact WR-5:** Application of the herbicides triclopyr and oryzalin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.4 Registered Herbicides or Adjuvants with High Toxicity to Fish or Aquatic Invertebrates

Alkylphenol ethoxylates (APEs) and benfluralin are nonaquatic herbicides that were identified in Appendix B, Ecological and Human Health Assessment Report as having high toxicity to fish or other aquatic organisms.

APEs were identified in Appendix B (Section 4.7.1) as having high toxicity to fish or other aquatic organisms. APEs include a broad range of chemicals that act as adjuvants. APEs bind strongly to aquatic particles in river and coastal environments and are persistent in sediments. Nonylphenol and short-chain nonylphenol ethoxylates are moderately bioaccumulative and extremely toxic to aquatic organisms. The USEPA has recently recommended that nonylphenol and short-chain ethoxylates be evaluated further due to their widespread use (past and present), persistence, and possible estrogen-mimicking behavior. Potential contamination of surface water runoff and groundwater is particularly high for highly soluble or highly mobile chemicals.

Benfluralin (Benefin) is a pre-emergent herbicide used to control grasses by inhibiting growth. Benfluralin has low mobility and variable persistence in soils, but degrades rapidly in water. When benfluralin is applied to waterbodies, it generally binds to sediments. Benfluralin does not generally leach into groundwater from soil applications due to its low mobility in soil. It is highly toxic to fish and aquatic invertebrates and is bioaccumulative. Additionally, benfluralin was included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. Subsequent evaluation by the USEPA using a weight of evidence approach found some potential endocrine effects in mammals. Most of these effects occurred only at levels causing overt toxicity, or in the presence of concurrent increases in liver weight. This implies that the effects observed may result from liver enzyme induction and increased hormone clearance. However, no convincing evidence was found of an interaction between benfluralin and estrogen, androgen or thyroid pathways in wildlife. No convincing evidence was found for a potential interaction with the estrogen or androgen pathways in fish, or thyroid pathways in amphibians, and no additional testing was recommended (USEPA 2015d). Benfluralin is not currently used by the District, and the only product containing this active ingredient included in the Proposed Program (Table 2-1) is intended only for terrestrial application. If used in the future as part of the District's Proposed Program, according to label guidelines and BMP application techniques, benfluralin is not expected to result in adverse effects to aquatic systems or aquatic organisms.

The District would apply all herbicide formulations and adjuvants in strict conformance with the PAP (if applicable) and label requirements, which have been approved by CDPR for use in California. Standard BMP application techniques, maintaining adequate buffer zones, and using care during herbicide applications would minimize adverse effects and substantially avoid degradation of water quality. For the herbicides benfluralin and APEs, if downstream waterbodies are not already impacted by these chemical active ingredients, application of these herbicides would have a less-than-significant impact to surface water and groundwater resources when applied as proposed. If downstream waterbodies are already impacted, then other herbicides would be used Only one waterbody in San Mateo County is designated impaired but impairment is not from herbicide use, and that is lower San Mateo Creek (sediment toxicity due to permethrin). Therefore, at present, none of the waterbodies in San Mateo County are impaired by any of these herbicides.

> **Impact WR-6:** For benfluralin and APEs, application of these herbicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.5.5 Registered Herbicides or Adjuvants with Unknown Toxicity to Fish or Aquatic Invertebrates

Dithiopyr is a pre-emergent and post-emergent herbicide used for control of annual grasses and broadleaf weeds. Dithiopyr degrades slowly in water and is relatively immobile in soil. Very little ecological toxicity information is available for this compound; however, it has low acute toxicity to mammals and no known mutagenic or carcinogenic effects, and there is a lack of reported, documented adverse ecological effects from field applications of dithiopyr. The two dithiopyr herbicide products proposed for future use by the District (Table 2-1) are both intended only for terrestrial applications, and their label restrictions prohibit application directly to water or areas where surface water is present. Exposure of this herbicide to water resources would be unlikely when applied as described in the District's IMVMP Plan, including BMPs that minimize drift and runoff (BMPs H1, H3, H5, H6, H7, and others). When applied as part of the District's described program, any future applications of dithiopyr using BMP application techniques are not expected to result in adverse effects.

The District would apply all herbicide formulations in strict conformance with applicable BMPs, as well as label requirements, which have been approved by CDPR for use in California. If downstream waterbodies are not already impacted by these chemical active ingredients, application of these chemicals would have a less-than-significant impact to surface water and groundwater resources when applied following label instructions. If waterbodies are impacted by these active ingredients in the future (designated impaired), then other herbicides would be used. Only one waterbody in San Mateo County is designated impaired (but impairment is not from herbicide use), and that is lower San Mateo Creek (sediment toxicity due to permethrin). Therefore, at present, none of the waterbodies in San Mateo County are impaired by dithiopyr.

> **Impact WR-7:** Application of dithiopyr would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.6 Biological Control Component

Biological control of mosquitoes involves the intentional use of vector pathogens, parasites, and predators to reduce the mosquito population. It is one of the principal components of the IPM approach followed by MVCAC member agencies, in which the emphasis is on source reduction and control of mosquitoes in their immature stages. Mosquito pathogens include an assortment of viruses and bacteria. Mosquito parasites are not generally available commercially for mosquito control at present. Mosquito predators are represented by insects, fish, birds, and bats that consume larval or adult mosquitoes as prey. Although the District supports the presence of a variety of species, only mosquitofish (*Gambusia affinis*) are commercially available to use at present.

On average, the District produces and releases about 21 pounds of mosquitofish annually. Mosquitofish are reared at the District's small-scale hatchery where wastewater discharge has the potential to convey nutrients, sediments, and other potential pollutants to storm drains, downstream receiving waters, and groundwater. The wastewater is discharged to land as irrigation water on District landscaping, and natural degradation would provide some treatment via chemical, biological, and physical processes that occur as the wastewater flows over and percolates through the soil. Because the volume and frequency of discharges on District property are relatively diffuse and minor, up to 25 gallons per week during the warmer months, the impact of this component to surface water and groundwater is less than significant.

> **Impact WR-8:** The Biological Control Component's production of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.

Due to concerns that mosquitofish may potentially impact red-legged frog and tiger salamander populations, use of mosquitofish is limited to man-made water features such as ornamental fish ponds, water troughs, water gardens, fountains, unused swimming pools, and other types of isolated man-made ponds (not providing habitat for amphibians) where their migration into habitats used by special-status species is limited.

Currently, no commercial biological control agents or products are available for wasp and yellow jacket control, and the District does not employ predators for rodent control.

Because the potential environmental impacts of mosquito pathogens the District applies are generally similar to those of chemical pesticide applications, these chemicals are evaluated under the Chemical Control Component (Section 9.2.7).

High populations of mosquitofish in a waterbody could increase nutrient concentrations, causing algal blooms and a subsequent drop in dissolved oxygen. However, because mosquitofish use is limited to man-made water features that are hydrologically isolated from receiving waters, their impact to surface water is less than significant. Because the connection between these man-made waterbodies and natural surface waters or groundwater is limited or nonexistent, the impact of this component is less than significant.

> **Impact WR-9:** The Biological Control Component's use of mosquitofish in man-made water features that are hydrologically isolated from receiving waters would have a **less-than-significant** impact on surface-water and groundwater resources. No mitigation is required.

9.2.7 Chemical Control Component

Chemical control consists of the application of chemicals to directly reduce populations of vectors that pose a risk to public health (herbicides are discussed in Section 9.2.5, Vegetation Management Component.). The majority of chemical control tools are used for mosquito abatement. As part of their IPM program, the District prioritizes the least toxic materials available for control of the larval stages, focusing on bacterial larvicides, growth regulators, and surface films rather than OPs or pyrethroids. Control of adult mosquitoes may become necessary under some circumstances, such as in the event of a disease outbreak (documented presence of infectious virus in active host-seeking adult mosquitoes), or lack of access to larval sources and habitats leading to the emergence of large numbers of biting adult mosquitoes. An OP insecticide naled is under consideration as part of the Proposed Program and would be used in rotation with pyrethrins or pyrethroids to avoid the development of resistance. The active ingredients currently used for control of adult mosquitoes have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in accordance with label guidelines for ULV mosquito control. The pesticide tables in Chapter 2 indicate whether these materials are in use at present or under consideration for future use.

The District also uses insecticides to control populations of ground-nesting yellow jackets and ticks. This yellow jacket activity is generally triggered by public requests, whereas tick control is the result of a special project or surveillance activities yielding an abnormally high level of ticks infected with Lyme disease. The District does not treat yellow jacket nests that are located inside a structure; instead, the resident is encouraged to contact a private pest control company. Likewise, residents complaining of honeybee swarms or hives may be visited by a technician to confirm they are honeybees, after which they would be referred to the San Mateo County Beekeepers Guild if the confirmation was made. If a District technician deems it appropriate to treat stinging insects, they will apply the insecticide directly within the nest to avoid drift or harm to other organisms. Alternatively, they will place tamper-resistant traps or bait stations, selective for the target insect in the immediate environment. Chemicals used in the traps are contained and do not interact with the environment.

The District's rodent population control program includes limited use of rodenticides in response to resident requests. Rodent baits containing first and second generation anticoagulants are typically placed in secure bait stations or at underground sites such as sewers, and may be placed in storm drains, or catch basins above the water line in the future. In sewer baiting, bait blocks containing bromadiolone are often suspended by wire above the water line. For rodent burrows, fumigants or anticoagulant dust may be blown into the burrows. Baiting may also occur at aboveground public storm control waterways, primarily in residential and commercial areas (including urban creeks) and within 50 feet of a structure. Rodenticides may be used at the edges of public areas but not near areas where children play. A neurotoxin type of rodenticide may also be used where rapid breakdown of the active ingredient is desired to minimize the potential for secondary poisoning of nontarget animals. The description of the District's rodent abatement program is provided in Section 2.3.5.3.

Potential effects from chemical applications of pesticides include increased aquatic toxicity for nontarget species and contributions to instream exceedances of water quality criteria. For example, some chemical applications have the potential to approach or exceed the narrative toxicity water quality objectives, numeric water quality objectives, or receiving water monitoring triggers for the specific active ingredient, particularly if applied in previously impacted waterbodies. However, the District applies all chemicals in strict conformance with label requirements, which have been approved by CDPR for use in California (BMP H1). Pesticide labels are application requirements and include instructions informing users how to apply the product and precautions the applicator should employ to protect human health and the environment. Pesticide applications would comply with label restrictions on application rates and methods, storage, transportation, mixing, and container disposal as well as District BMPs H1, H3, H5, H6, and H9. In addition, chemicals are applied in conformance with the PAP as required by the NPDES

Vector Control Permit. All BMPs included in the PAP and product labels are followed and include such measures as restrictions in applications to certain land uses and weather (i.e., wind speed) parameters.

The District will implement label requirements, District BMPs, and any other applicable legal or regulatory requirements to reduce adverse effects to surface and groundwater resources from the applied chemicals during and following pesticide applications. To minimize the amount of pesticides, pesticide applications will be informed by surveillance and monitoring of vector populations (BMP H4). Materials will be applied at the lowest effective concentration for the environmental conditions (BMP H3). For non-ULV applications, spray nozzles will be adjusted to produce larger droplet size rather than smaller droplet size, low nozzle pressures will be used where possible, and spray nozzles will be maintained within a predetermined maximum distance from target areas. For ULV applications, sprays will be calibrated for the proper droplet size (BMP H8). Applicators will be aware of wind conditions to minimize unwanted drift to waterbodies and adjacent areas, and aware of potential rain when rain is a determining factor on material application (BMP H6 and H7). Pesticides that could affect insect pollinators will not be applied in liquid or spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees are present and active or when other pollinators are active (BMP H12). If special-status aquatic wildlife species are potentially present, only pesticides and adjuvants approved for aquatic areas will be applied within a predetermined distance from aquatic features (BMP H10) to minimize the potential for interaction with terrestrial wildlife.

The District will also implement hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface and groundwater resources (BMPs I1 through I6 and procedures included in the IMVMP Plan). These measures are included in the District's 2015 hazardous spill plan and procedures used to minimize the risk of an accidental spill or release (SMCMVCD 2015b). District control measures also require that mixing and transferring of materials will occur within a contained area (BMP H5) and materials will be disposed at an approved site (BMP H9).

District staff will monitor sites post-treatment to determine if the target vectors 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 (BMP H11). Implementation of these BMPs will reduce exposure of applied chemicals to surface and groundwater resources during and following application of the material. Ongoing monitoring efforts by the District continue to show effective control of target species with no observed effects to nontarget species, demonstrating the effectiveness of the District's BMPs.

In addition, monitoring efforts by the District and other vector control agencies in 2011 to 2012 found almost no differences in visual observations or physical measurements between background, event, and post-event observations that could not be explained by diurnal factors or subjective observations by different field personnel (Mosquito and Vector Control Association of California [MVCAC] NPDES Permit Coalition 2013). The MVCAC monitoring coalition conducted chemical monitoring for adulticides at 61 locations during 19 application events in 2011 to 2012, and coordinated physical monitoring for 136 larvicide application events in 2012. Samples were collected from agricultural, urban, and wetland environmental settings in both northern and southern California. The single exception in more than a hundred visual observations and physical monitoring samples was an observation of "light" water surface oils following application of monomolecular films in an agricultural setting – effects to nontarget species were not observed. The results of the chemical monitoring of the active ingredients applied by the District were similar. A few samples exceeded monitoring triggers, but an associated ecotoxicology study by researchers from University of California Davis found no water toxicity during those application events (Phillips et al. 2013). As discussed in the Vegetation Management and Chemical Control Components, implementation of District BMPs will effectively minimize or avoid adverse effects and substantially avoid degradation of water quality.

All chemical active ingredients and adjuvants the District currently uses and proposes to are reviewed and evaluated in the Ecological and Human Health Assessment Report (Appendix B). The following sections evaluate groups of chemicals based on their target vector/organism or its life stage.

9.2.7.1 Mosquito Larvicides

Larvicides are used to manage immature life stages of mosquitoes including larvae and pupae in aquatic habitats. Temporary aquatic habitats are usually targeted because permanent waterbodies generally support natural mosquito predators such as fish. The larvicides are applied using ground application equipment and rotary aircraft. Applications may be repeated at any site at recurrence intervals ranging from annually to weekly.

Under some circumstances, and at the request for service from District clients, the District performs mosquito surveillance near septic systems (onsite wastewater treatment systems) by inspecting or removing the lid(s) on the system to determine the presence of larval and/or adult mosquitoes. Or, if mosquito populations are detected via adult mosquito surveillance (e.g., adult mosquito traps) in an area associated with a septic system, the District staff may choose to treat soil and/or surface water in the vicinity of a septic tank that appears to have failed or malfunctioned. In this situation, the District may provide selected mosquito larvicide treatment to the tank and/or the septic leach/drain field and system environs. This treatment is intended to efficiently and effectively break the cycle of mosquito production in order to address the potential for transmission of disease in humans, livestock, domestic animals, and wildlife. The larvicides currently used include materials not known to adversely impact septic system bacteria: *Bacillus sphaericus* as an active ingredient (e.g., VectoLex), methoprene, (e.g., Altosid briquets), larvicide oils (e.g., BVA 2 and CoCoBear™), and monomolecular films (e.g., Agnique MMF). A larvicide oil or monomolecular film must be used if mosquito larvae are in the pupal phase. These products are selected for these special physical conditions as they are not known to impact the subsurface resident bacterial mats that are associated with septic system leach fields.

As part of its IMVMP, the District will choose site-appropriate materials for mosquito larvae control and, when possible, work with property owners to use nonchemical methods to resolve the problems with their private systems, i.e., keeping the tanks impervious to mosquito entry and the leach field operating properly without water rising to the ground surface to stagnate. The fate and transport of these larvicides in septic tanks is generally similar to the characteristics of fate and transport to soils and water under the other approved applications (see Sections 9.2.7.1.1 and 9.2.7.1.2).

9.2.7.1.1 Biological Agents

Bs is a bacterial larvicide that is applied to irrigation ditches, floodwater, standing ponds, woodland pools, pastures, tidal water, fresh- or saltwater marshes, and stormwater retention areas. It damages and paralyzes the gut of mosquito larvae that ingest the spores. Although dormant Bs spores may persist in the environment for several weeks to months and the endotoxins generally persist for 2 to 4 weeks following application, the δ-endotoxins degrade rapidly in sunlight and are degraded by soil microorganisms. Bs does not percolate through the soil and readily binds to sediments. It is highly selective for mosquitoes and is not toxic to nontarget species, including birds, mammals, fish, and invertebrates in amounts that effectively control mosquito larvae. For these reasons, Bs should not result in adverse effects to surface water or groundwater.

Bti is applied in a similar manner and often in combination with Bs. Bti toxins may persist in soil for several months, yet a half-life for typical Bti products on foliage is approximately 1 to 4 days due to rapid degradation in sunlight. Toxicity is minimal to nonexistent to nontarget avian, freshwater fish, freshwater aquatic invertebrates, estuarine and marine animals, arthropod predators/parasites, honeybees, annelids, and mammalian wildlife at the label use rates of registered Bti active ingredients. For these reasons, Bti should not result in adverse effects to surface water or groundwater.

Spinosad is a biologically derived insecticide produced from the fermentation of *Saccharopolyspora spinosa*, a naturally occurring soil organism. It activates the central nervous system of insects through interaction with neuroreceptors and causes mortality through continuous stimulation of the insect nervous system. Spinosad degrades quickly in sunlight in both aqueous and soil environments. It adsorbs strongly to soil particles where it is quickly metabolized by soil microorganisms under aerobic conditions and is therefore unlikely to leach into groundwater. In water, spinosad is degraded primarily through photolysis, which has a half-life of less than 1 day. It is slightly to moderately toxic to fish, amphibians, and most aquatic invertebrates. It may have slight impacts on some aquatic invertebrates with chronic exposure, but application for mosquitoes tends to be episodic, and given the rapid breakdown of spinosad in the environment, chronic exposure is unlikely. The District employs techniques to ensure applications do not generally occur that close together. Measures include following label instructions, education of state-certified field personnel, use of real-time application recording equipment, and the use of color-coded data management tools that alert personnel of estimated active ingredient remaining at application sites.

Proper application methods and practices using BMPs are not expected to result in adverse effects and use of these larvicides would have a less-than-significant impact to surface water and groundwater resources.

> **Impact WR-10:** Application of the biological agents Bs, Bti, and spinosad would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.1.2 Hydrocarbon Esters

Methoprene is an insect growth regulator and selective larvicide that is applied at very low concentrations for mosquito control in the form of briquettes, pellets, sand granules, and liquid. It consists of two enantiomers: S-methoprene and R-methoprene, with S-methoprene being the biologically active enantiomer. Fate and transport characteristics of the s-enantiomer and the mixture are similar, but toxicity differs. Methoprene readily binds to suspended solids in the water column and soils. It rapidly degrades by photolysis and is metabolized in soil under both aerobic and anaerobic conditions.

Methoprene is considered one of the least toxic of all mosquito larvicides. Although it may exhibit toxicity to fish at extremely high doses, studies to date have shown that methoprene applications at levels up to 100x that expected for mosquito control were safe for fishes (Lawler 2017). While some toxicity was shown to marine crustacean larvae in laboratory testing, most effects were found only at levels above that typically used in mosquito control (Lawler 2017). Additionally, studies have shown that vast dilution from ocean water rendered any methoprene runoff from coastal applications well below the lowest ecologic endpoint of stress reported for crustaceans in the marine environment (Miller et al. 2005; Zulkosky et al. 2005). The few studies that have been conducted on molluscs have not indicated any detectable effects of methoprene on either freshwater or marine species when exposed to levels used in mosquito applications (Lawler 2017). Although methoprene is toxic to a variety of insects, only certain types of aquatic insects are affected by the low levels applied in mosquito control. The District applies methoprene at a maximum concentration of 0.5 µg/L. At this application rate, some effects may occur to some nontarget midges (*Chironomidae*) and blackflies (*Simuliidae*), but these populations recover quickly after treatment (Appendix B; Maffei, pers. comm., 2013). No other invertebrates have shown signs of toxicity at these concentrations. Experimental methoprene treatments for mosquito control conducted on a freshwater pond by Davis and Peterson (2008) did not find any depletion of nontarget aquatic or terrestrial insects after applications.

Methoprene has been evaluated as a possible cause of limb deformities observed in wild amphibians, but a review of relevant research has found this suggestion to be unsubstantiated (Lawler 2017). Limb deformities are often caused by trematode parasites and other pathogens, and even the type of deformities induced in lab experiments using unrealistically high doses of methoprene did not match limb deformities observed in the field (Ankley et al. 2004). Methoprene has very low toxicity to amphibians, and numerous lab studies have demonstrated negative effects only at extremely high doses (Lawler 2017). A study on African clawed frogs found that even when exposed to 2 mg/kg, or 200x amount of methoprene exposure expected from mosquito applications, there were no toxic or developmental effects observed (Degitz et al. 2003). When applied in the manner recommended on product labels and as proposed in the District's IMVMP, the concentrations used by the District are well below the harmful levels established in laboratory tests.

These products would have a less-than-significant impact to surface-water or groundwater resources when applied in accordance with the recommended BMP application techniques described in their PAP and product label requirements.

Impact WR-11: Application of methoprene would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.1.3 Surfactants

Surfactants used as mosquito larvicides by the District include alcohol ethoxylated surfactants (monomolecular film), and aliphatic solvents (mineral oil and aliphatic petroleum hydrocarbons). The monomolecular film used in California for the control of mosquito larvae is alpha-isooctadecyl-omega-hydroxypoly (oxyethylene). Monomolecular film spreads a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae, and emerging adults to attach to the water's surface, causing them to drown. It also disrupts larval respiration. Reported half-lives of monomolecular films in water range from 5 to 22 days. They may temporarily impact nontarget surface-breathing insects but has no observable effects to amphibians, fish, or other aquatic organisms. These products should not result in adverse water quality conditions in surface water or groundwater when used in accordance with approved BMP application requirements and techniques.

Specially derived aliphatic solvents (e.g., mineral oils and aliphatic petroleum hydrocarbons) are used to form a coating on top of water to drown larvae, pupae, and emerging adult mosquitoes. Petroleum distillates can be more effective than monomolecular films but break down much more rapidly (2 to 3 days). They have low water solubility and high sorption to organic matter. They are practically nontoxic to most nontarget organisms. Using BMP application techniques, these products should not result in adverse effects to water quality conditions in surface water or groundwater.

The District applies surfactants in accordance with BMP H2, avoiding the use of surfactants, when feasible in sites with aquatic nontarget species or natural enemies of mosquitoes present such as nymphal damselflies and dragonflies, dytiscids, hydrophilids, corixids, notonectids, and ephydrids. Although surfactants can be used with pupae, microbial larvicides (e.g., Bti, Bs) or insect growth regulators (e.g., methoprene) are often used with other earlier life stages (see Table 9-3, BMP H2) to prevent development of pupae and minimize use of surfactants.

The District would apply all surfactant larvicides in strict conformance with their PAP and the label requirements, which have been approved by CDPR for use in California. Proper application using BMPs is not expected to result in adverse effects, and use of these chemicals would have a less-than-significant impact to surface water or groundwater resources.

Impact WR-12: Application of the surfactant larvicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.2 Mosquito Adulticides

The use of adulticides to control mosquitoes is a method of control and only one element in the District's IPM Program. Adulticides are only applied when other tools are not available and when specific criteria by the District are met, including species composition, population density, proximity to human populations, and/or human disease risk. The active ingredients currently in use have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in strict conformance to label instructions for ULV mosquito control. Adulticides are applied using existing ground application equipment or fixed-wing aircraft and following strict conformance with label requirements and BMPs described in the District's future PAP.

In the special circumstance of septic tanks/onsite wastewater treatment systems, and at the request for service from District clients, the District inspects for the presence of larval and/or adult mosquitoes. Mosquito populations may also be detected via adult mosquito surveillance in a given area (e.g., adult mosquito traps). The District staff may observe surface water in the vicinity of a failed septic tank. In these situations, the District may provide selected mosquito adulticide treatment to the environs of the tank and/or the septic leach system. The adulticides currently used for malfunctioning or improperly sealed septic systems currently include Zenivex E4 (etofenprox) (National Pesticide Information Center 2014). Adulticides are often applied in a focused process to selected areas contiguous to the septic tank/system. Adult mosquito control performed in relation to mosquito production from septic systems is typically site specific, and the adulticide is applied with handheld equipment (e.g., handheld ULV fogger, ULV backpack fogger). However, if the potential for transmission of disease by mosquitoes associated with septic systems appears to be problematic, the District may, in that instance, prudently use more aggressive approaches such as truck-mounted applications. In these situations, the District would use proven BMP techniques aligned with these applications to reduce or minimize any nontarget impacts.

As chemical treatment of adult mosquitoes is considered a tertiary line of defense, the District will rely as much as possible on the other methods of control and work with property owners to resolve the mosquito problems with their private systems. Typical applications to standing water above the leach field would not likely result in transport or leaching to the biological bacterial mat in the leach lines because they adsorb strongly to soil surfaces, and are generally considered immobile in soils and, therefore, are unlikely to leach to groundwater (USEPA 2006c). Although special conditions are associated with the septic applications, the fate and transport of these adulticides when used in areas associated with septic systems are generally similar to those of other application scenarios (see Section 9.2.7.2.1).

9.2.7.2.1 Pyrethrins and Pyrethroids

The District uses pyrethrins and pyrethroids to control adult mosquitoes and yellow jacket wasps. Pyrethrins are naturally occurring products distilled from the flowers of Chrysanthemum species. Pyrethroids are synthetic compounds that are chemically similar to the pyrethrins but have been modified to increase their stability and activity against insects, while minimizing their effect on nontarget organisms. First generation or "Type I" photosensitive pyrethroids include d-allethrin, phenothrin (sumithrin), prallethrin, resmethrin, and tetramethrin. Typically, these pyrethroids are used indoors and around residential areas. The newer second-generation pyrethroids are mostly "Type II" pyrethroids. The active ingredients that fall into this group include deltamethrin, esfenvalerate, lambda-cyhalothrin, and permethrin. Type II pyrethroids are more toxic than Type I pyrethroids because they are less photosensitive and persist longer in the environment. Etofenprox is a synthetic pyrethroid-like chemical, differing in structure from pyrethroids in that it lacks a carbonyl group and has an ether moiety, whereas pyrethroids contain ester moieties. Pyrethrins and pyrethroids act by causing a persistent activation of the sodium channels on insect neurons.

Pyrethrins and pyrethroids quickly adsorb to suspended solids in the water column and partition into the sediment. They adsorb strongly to soil surfaces, and are generally considered immobile in soils and, therefore, are unlikely to leach to groundwater (USEPA 2006d). These materials are relatively nontoxic to mammals and birds but are highly toxic to fish and invertebrates. The major route of degradation is through photolysis in both water and soil. Pyrethrins and pyrethroids may be persistent in environments free of light, and pyrethroids as a class have been implicated in 303(d) listings of sediment toxicity in urban creeks (BASMAA 2013). However, the ULV applications common to mosquito control and the limited use at ground-dwelling yellow jacket and aerial wasp nests (that pose an imminent threat to people or to pets) encourage dissipation rather than persistence in the environment.

Insecticides containing pyrethrins and pyrethroids usually also contain PBO as a synergist, which allows lower initial doses and prolongs the effectiveness (persistence) of the pesticides. PBO interferes with the insect's ability to detoxify pyrethrins and pyrethroids, thus enhancing the product's effectiveness. PBO has low toxicity to mammals but has been identified as a possible endocrine disruptor and was included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. Subsequently, the USEPA published the results of Tier 1 screening assays which found no convincing evidence of potential interaction with the estrogen, androgen, or thyroid pathways of PBO in mammals or wildlife (USEPA 2015b). Although it is moderately to highly toxic to fish and is highly toxic to aquatic invertebrates in controlled experiments, laboratory and field studies of PBO applied with various pyrethrins using the ULV method did not result in increased invertebrate mortality (Weston et al. 2006, Lawler et al. 2008). PBO is moderately mobile in soil and water but degrades rapidly in the environment by photolysis and through metabolism by soil microbes. Although it degrades rapidly, there is some concern that release of PBO to the environment may "activate" persistent pyrethroids that are already present in the sediment. However, PBO would have a less-than-significant impact on surface water or groundwater when applied following District BMPs and using ULV techniques, and when used in strict conformance with label requirements and the District's PAP. However, a series of field experiments conducted using pyrethrins and PBO at rates used for mosquito control did not find detectable effects on indicator species in the sediment or water column after 11 biweekly spray events (Lawler et al. 2008). Other studies confirm that ULV-applied mosquito adulticides do not accumulate in water or sediment during repeated applications (Appendix B, Section 4.1).

Impact WR-13: Application of the synergist PBO would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

The District applies pyrethrins in terrestrial and aquatic environments for adult mosquito control using ULV techniques. They are also used locally to treat ground-dwelling yellow jacket wasp nests. Pyrethrins quickly adsorb to suspended solids in the water column and adsorb strongly to soil surfaces making them immobile in soils and unlikely to leach into groundwater. They degrade via photolysis and are likely to persist under anaerobic conditions. Pyrethrins have low to moderate acute toxicity to mammals but are practically nontoxic to birds. They are very highly toxic to freshwater fish and invertebrates. Several studies have shown that pyrethrins applied using ULV techniques do not accumulate in water or sediment following repeated applications. These studies also determined that no toxicity is associated when exposure is limited to the amounts used when following ULV protocols for mosquito control (Lawler et al. 2008; Amweg et al. 2006). Pyrethrins would have a less-than-significant impact on surface water or groundwater, including their limited use near septic systems, when applied following District BMPs and using ULV techniques, and when used in accordance with label requirements and the District's PAP.

Impact WR-14: Application of pyrethrins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

D-trans allethrin is a Type I synthetic pyrethroid that is usually combined with a synergist such as PBO. It is typically released into the air through the use of mosquito coils and mats, although these are not application methods employed by the District. Once in the air, allethrins are degraded by photolysis in less than 8 hours. The toxicity of allethrins varies depending on which of the four isomers are present. D-trans allethrin is used in the District's described program only for the control of yellow jackets, where it is applied directly to the yellow jacket nest, which occur only in terrestrial environments. Although allethrins are highly toxic to fish and invertebrates the method of use by the District as a spot-treatment inside yellow jacket nests would preclude nearly all contact with waterbodies or nontarget insects. The small amount that could possibly enter an aquatic environment through drift (not from stormwater runoff) would degrade too quickly to result in adverse effects to surface water or groundwater when used according to label and PAP requirements. The District only uses this active ingredient intermittently; in 2011, a total of three-and-a-half aerosol spray cans of d-trans allethrin products were used by the District

(Appendix B, Table A41). Use of d-trans allethrin would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-15:** Application of d-*trans* allethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Permethrin is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes using ULV techniques and for yellow jacket wasp control. It is hydrophobic and tends to partition to soil and sediment. Its primary degradation pathways include photolysis and aerobic metabolism and it may be persistent in environments free of light. Permethrin is slightly toxic to humans and was included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. Subsequently, in its 2015 weight of evidence conclusions on the Tier 1 Screening Assay for permethrin, the USEPA did not recommend additional testing for mammals or wildlife, as there was no convincing evidence of potential interaction with the estrogen or thyroid pathways in mammals, and potential interaction with the androgen pathway in mammals was only manifested at levels of exposure far above the USEPA's existing regulatory point of departures and endpoints for human health risk assessments (USEPA 2015g). It has low toxicity to mammals and is practically nontoxic to birds but is very highly toxic to fish and aquatic invertebrates.

Permethrin formulations are applied following District BMPs and used in strict conformance with label requirements such as aquatic habitat buffer zones. Permethrin has a strong repellent effect in the environment, which reduces toxic effects to bees under field conditions (Appendix B). Pesticides that could affect insect pollinators will not be applied in liquid or spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees and other pollinators are present and active (BMP H12). When applied in accordance with ULV label instructions, studies have shown rapid dissipation, low persistence, and no observed aquatic fish and invertebrate toxicity following aerial ULV applications (Appendix B, Section 4.1). Although one study found higher levels of permethrin on the surface microlayer of the waterbody, corresponding water samples did not contain detected residues, and higher surface microlayer concentrations were not correlated with toxic effects in the waterbody.

The District currently uses permethrin only to directly treat inside yellow jacket nests using hand-held canisters in very small, localized areas, minimizing its potential for contact with water. If the District were to use this active ingredient for adult mosquito control in the future, it would be applied through ULV application with a backpack mister or handcan/duster that facilitates its rapid breakdown, and the District would not apply it during high winds (BMPs H6 and H7). When District BMPs are implemented and when materials are applied according to the District's PAP using ULV techniques, the use of permethrin would have a less-than-significant impact on surface water or groundwater, including locations where receiving waters are 303(d) listed for pyrethroids or sediment toxicity (i.e., lower San Mateo Creek) because of the study results reported above (from Appendix B, Section 4.1).

> **Impact WR-16:** Application of permethrin would have a **less-than-significant** impact to surface and groundwater resources and no mitigation is required.

Phenothrin (or sumithrin) is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes and yellow jacket wasps. Phenothrin has low solubility and a relatively high affinity for binding to soil. It degrades through photolysis in water and aerobic metabolism in soil but is moderately persistent under aerobic conditions and persistent under anaerobic conditions. Phenothrin is not toxic to mammals or birds but is highly toxic to fish and freshwater invertebrates. When applied locally (for yellow jacket wasp control) or in ULV applications (for mosquito control) according to the District's PAP, phenothrin would not result in adverse effects to surface water or groundwater. Use of phenothrin would have a less-than-significant impact on surface water or groundwater. The District only uses this active ingredient infrequently; in 2011, a total of three-and-a-half aerosol spray cans of phenothrin products for wasps were used by the District (Appendix B, Table A41). At total of 1.3 gallons of phenothrin products have been applied by the District for mosquito control since the year 2000, with the most recent application taking place in 2014 (Chapter 13, Table 13-2). There are no plans by the District to expand the frequency of this active ingredient use in the future beyond its current level of intermittent use.

Impact WR-17: Application of phenothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Prallethrin is a Type I synthetic pyrethroid. The only prallethrin-containing product registered for mosquito control in California is Duet, which also contains phenothrin and PBO. The District does not currently use Duet but may consider its use in the future in the case of a disease outbreak or as part of pesticide resistance management efforts. However, no current plans exist to expand its use. Prallethrin is also intermittently used to target yellow jacket wasp nests. The formulation used by the District, Spectracide 3, is applied using aerosol cans directly into yellow jacket nests. These occur only in terrestrial environments and this application method does not produce any runoff. Prallethrin readily sorbs to soils and sediments and degrades quickly via photolysis in both water and soil. It is not toxic to mammals or birds but is highly toxic to fish and nontarget aquatic invertebrates. As this active ingredient is not used in or around water, and BMPs to minimize drift are observed during applications (BMP H6 and H7), little to no exposure to aquatic organisms is expected. When applied locally (for yellow jacket wasp control) or in ULV applications (for mosquito control) according to the District's PAP, prallethrin would not result in adverse effects to surface water or groundwater. Use of prallethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-18: Application of prallethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Resmethrin is a Type I synthetic pyrethroid that is usually combined with synergists such as PBO to control adult mosquitoes in tree holes and using ULV techniques. Resmethrin has a high affinity to bind to soils, sediments, and organic carbon and it degrades rapidly when exposed to light. When not subject to photolysis, it may be environmentally persistent. Resmethrin has low toxicity to mammals but has been included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. Although this evaluation has not yet been completed, the USEPA noted in its 2006 reregistration documents that "In the available toxicity studies on resmethrin submitted for registration purposes, there was no estrogen, androgen, and/or thyroid mediated toxicity" (USEPA 2006e). It is moderately toxic to birds and highly toxic to fish and aquatic invertebrates.

Although the District has only used resmethrin infrequently in the past, it may be used in the future if needed to manage pesticide resistance or in critical circumstances such as outbreak of infectious disease. Despite its relatively high toxicity and potential for persistence, studies have shown rapid dissipation, low persistence, and no observed aquatic fish and invertebrate toxicity following aerial ULV application (Appendix B). When District BMPs are implemented and materials are applied according to the District's PAP using ULV techniques, the application of resmethrin would have a less-than-significant impact on surface water or groundwater.

Impact WR-19: Application of resmethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Tetramethrin is a Type I synthetic pyrethroid that the District uses in very localized applications for the control of yellow jacket wasps. It is slightly mobile in soil but decomposes rapidly by photolysis and hydrolysis and is not considered persistent in the environment. Tetramethrin is practically nontoxic to birds and terrestrial mammals but meets the criteria for classification as a possible human carcinogen. It is highly toxic to fish and aquatic invertebrates. Current and future use tetramethrin products included in the District's Program are applied using aerosol cans directly into yellow jacket nests. These occur only in terrestrial environments, and this application method does not produce any runoff to waterbodies. As this active ingredient is not used in or around water, and BMPs to minimize drift are observed during applications (BMPs H6 and H7), very little to no exposure to aquatic organisms is expected. When used according to label requirements and BMP application techniques that limit its release to aquatic systems, tetramethrin would not result in adverse effects to surface water or groundwater. Use of tetramethrin would have a less–than-significant impact on surface water or groundwater.

> **Impact WR-20:** Application of tetramethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Deltamethrin is a longer lasting Type II synthetic pyrethroid that kills adult mosquitoes, yellow jacket wasps, and ticks on contact and through ingestion. Deltamethrin is low to moderately toxic to humans and may cause prenatal damage. It is practically nontoxic to birds but is very highly toxic to fish and nontarget aquatic invertebrates. For this reason, it is not used in or adjacent to aquatic environments, per label restrictions. It binds to soils and sediments and may be persistent in the environment. The multitarget deltamethrin product Suspend has been used infrequently by the District to control adult mosquitoes in special cases requiring a residual product, such as around an outdoor classroom. Additionally, the District has applied Suspend for ticks as part of controlled experiments on two occasions in 2006. Most deltamethrin treatments for yellow jackets made by the District are applied in a dust formulation directly into the entrance of ground nests. As these nests are located in terrestrial environments and the dust formulation is applied only in dry conditions, per label restrictions, there is little to no risk of runoff of this product into aquatic systems. When applied locally to target vectors in compliance with the District's PAP and label instructions, deltamethrin would not result in adverse effects to surface water or groundwater. Use of deltamethrin would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-21:** Application of deltamethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Esfenvalerate is a relatively new Type II synthetic pyrethroid that is deployed above ground in bait stations for yellow jacket wasp control. It is practically insoluble in water and has a strong tendency to bind to sediments and soil. It degrades via photolysis and aerobic metabolism and does not appear to persist in the environment. Esfenvalerate is considered moderately toxic to mammals and birds, highly toxic to fish and aquatic invertebrates, and is bioaccumulative in fish. Additionally, esfenvalerate was included in the final list of chemicals for screening under USEPA's Endocrine Disruptor Screening Program. The conclusion of the weight of evidence evaluation is that esfenvalerate demonstrates no convincing evidence of potential interaction with the estrogen or androgen pathway in mammalian and wildlife species. Additionally, the available information indicates no convincing evidence of potential interaction with the thyroid pathway for mammals, but a conclusion for this pathway could not be determined for nonmammalian species (USEPA 2015h). Esfenvalerate is not currently used by the District. However, if it were to be used in the future, it would generally be deployed in bait stations, which are readily isolated from aquatic environments and exclude mammals and birds from accessing the material. No issues with runoff or drift are associated with this type of bait product. When used according to label guidelines and BMP application techniques that limit its release to the soil surface and aquatic systems, esfenvalerate should not result in adverse effects to surface water or groundwater. Use of esfenvalerate would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-22:** Application of esfenvalerate would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Lambda-cyhalothrin is a Type II synthetic pyrethroid that the District uses for ground-nesting yellow jacket wasp control in very localized settings. It is extremely hydrophobic and rapidly adsorbs to soils and sediments. Its primary degradation pathways include photolysis and aerobic metabolism and it may be persistent in the absence of light. Lambda-cyhalothrin is moderately toxic to mammals, has low toxicity to birds, and is highly toxic to fish and aquatic invertebrates. It also has the potential to bioaccumulate in fish. The formulation used by the District, Spectracide 3, is applied using aerosol cans directly into yellow jacket nests. These occur only in terrestrial environments and this application method does not produce any runoff. As this active ingredient is not used in or around water, and BMPs to minimize drift are observed during applications (BMPs H6 and H7), very little to no exposure to water resources is expected. When used according to label requirements and BMP application techniques that limit its release to the soil surface and aquatic systems, lambda-cyhalothrin would not result in adverse effects to surface water or groundwater. Use of lambda-cyhalothrin would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-23:** Application of lambda-cyhalothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

Etofenprox is a pyrethroid-like insecticide that is used as a mosquito and yellow jacket wasp adulticide and is available in formulations that do not contain PBO. It is virtually insoluble in water and stable to hydrolysis but is rapidly degraded by photolysis. Residues of etofenprox are not likely to persist in the environment. It has low toxicity to mammals but is highly toxic to fish and aquatic invertebrates. The District currently uses the etofenprox product Zenivex to control adult mosquitoes using either handheld or truck-mounted ULV techniques in terrestrial environments. Etofenprox applied for adult mosquito control would only be expected to enter aquatic systems through runoff, which is minimal when using the ULV method. Etofenprox is also included in the District’s Program as a future use active ingredient for yellow jacket control. The proposed product formulation, Wasp-X, is applied as a foam directly inside terrestrial yellow jacket nests and would, therefore, not come into contact with surface water. Etofenprox degrades rapidly and binds readily to soil, making groundwater exposure unlikely. Based on toxicity and environmental fate, etofenprox would not result in adverse effects to surface water or groundwater when applied following label requirements and BMPs described in the District’s PAP. Use of etofenprox would have a less-than-significant impact on surface water or groundwater.

> **Impact WR-24:** Application of etofenprox would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.2.2 Organophosphates

Naled is an OP insecticide and is used in rotation with pyrethrins or pyrethroids to avoid the development of resistance in adult mosquitoes. Naled is the most commonly used material for this purpose. The District does not use it at present but may need to use it in the future if resistance to the other products occurs.

Naled has low water solubility but is mobile in soils with low organic matter content. It is moderately toxic to mammals, fish, and aquatic invertebrates but degrades readily in water, under sunlight, in soil under aerobic and anaerobic conditions, in air, and on plants. Dichlorvos, a breakdown product of naled, and itself a registered pesticide, may be present in toxic concentrations after naled is no longer detectable (see Section 13.7). Dichlorvos is very highly toxic to birds and freshwater fish and insects, including honeybees. It has high water solubility and degrades primarily through volatilization and aerobic soil metabolism. With a half-life of about 0.9 day, the degradation of dichlorvos is rapid but slower than that of its parent naled (USEPA 2006g). It does not persist in surface water and, because of breakdown by soil micro-organisms, is unlikely to leach to groundwater. More detailed information on the toxicity profile and environmental fate of naled is presented in Section 4.2 of Appendix B. Naled and other OPs are important chemicals that help control resistance of alternative products such as pyrethrins and pyrethroids. Due to the toxicity of its breakdown product dichlorvos, but its importance in the District’s IMVMP Plan, use of naled is significant and unavoidable relative to the possibility it could impact a pesticide-impaired surface waterbody such as lower San Mateo Creek for a brief period. No feasible mitigation exists.

> **Impact WR-25:** Due to the toxicity of its breakdown product but its importance in the District’s IMVMP Plan, the application of naled is considered a **significant and unavoidable** impact to surface water resources.

9.2.7.3 Yellow Jacket Abatement

Pyrethrins and pyrethroids are applied direct to yellow jack wasp nest openings. The active ingredients the District uses are described under Mosquito Adulticides (Section 9.2.7.2).

9.2.7.3.1 Potassium Salts

Potassium salts of fatty acids are commonly referred to as "soap salts." They penetrate the insect's body covering and disrupt cell membranes causing the insect to die of dehydration. Potassium salts are not applied directly to water and degrade very quickly in soil. They are practically nontoxic to birds, slightly toxic to fish, and highly toxic to aquatic invertebrates. Currently, the District does not use the product M-Pede containing potassium salts, but it would be available for future use by the District only if necessary for the control of Africanized honeybees. Under a CDPR Section 24(c) special local need registration, a formulation of this active ingredient under the trade name M-Pede may be applied directly to bee swarms and exposed colonies by trained personnel in the state of California (CDPR 1994). The District would not apply potassium salts directly to water and, therefore, it poses very little risk to aquatic environments (USEPA 1992). These products would have a less-than-significant impact on surface water or groundwater resources when applied using label requirements and BMPs described in the District's PAP.

> **Impact WR-26:** Application of potassium salts (i.e., "soap salts") would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.4 Tick Abatement

Currently, deltamethrin and PBO are the only active ingredients employed for tick control. They are evaluated under Mosquito Adulticides (Section 9.2.7.2) and the impact analyses are not repeated here.

9.2.7.5 Rodenticides

The District's limited use of rodenticides is as a result of surveillance and/or in response to District resident requests.

9.2.7.5.1 Anticoagulants, Bromethalin, and Cholecalciferol

The District may use two different groups of anticoagulant rodenticides, known as first generation and second generation rodenticides. First generation rodenticides (e.g., chlorophacinone, diphacinone) require consecutive multiple doses or feedings over a number of days to be effective. Second generation rodenticides (e.g., brodifacoum, bromadiolone, difethialone) are lethal after one dose and are effective against rodents that have become resistant to first generation anticoagulant rodenticides. Secure, tamper-proof bait stations or other accepted methods of rodent baiting are conducted in areas with severe rodent infestations. They would not be used near any areas where children play. Other poisons that act through ingestion include bromethalin and cholecalciferol.

Chlorophacinone is formulated as tracking powder, as loose-grain bait, paraffinized pellets, rat and mouse bait ready-to-use place packs, and paraffin blocks. It has low water solubility and is moderately persistent and immobile in soil. Chlorophacinone is highly toxic to wildlife, freshwater fish, and aquatic invertebrates, but application methods such as solid bait blocks minimize exposure pathways for nontarget species. For this reason, chlorophacinone products should not result in adverse effects when using BMP application techniques.

Diphacinone and diphacinone salt products are formulated as food baits, water baits, and a tracking powder. Diphacinone technical material has low water solubility and is generally applied as food bait blocks; however, diphacinone salt is highly soluble and is used to prepare water baits for indoor control of rodents. Diphacinone is highly toxic to mammals but only slightly to moderately toxic to fish and aquatic invertebrates. The District uses diphacinone in tree holes, burrows, and/or urban creek corridors; and since it is generally applied as solid bait blocks, exposure to surface water and groundwater would be minimal.

Brodifacoum is formulated as meal bait, paraffinized pellets, ready-to-use place packs, and paraffin blocks. Brodifacoum has low solubility and is immobile and persistent in soil. Contamination of surface water and groundwater is expected to be minimal because of its use pattern and immobility in soil. Brodifacoum is highly toxic to mammals and highly toxic to freshwater fish and invertebrates, but due to its extremely low solubility, the USEPA does not believe the chemical poses a hazard to nontarget aquatic organisms.

Bromadiolone formulations include meal bait, pellets, ready-to-use place packs, and paraffinized blocks. It is moderately persistent in soils. Bromadiolone is moderately toxic to fish and moderately to highly toxic to freshwater invertebrates. The District uses bromadiolone in and around man-made and natural standing and moving water. When deployed in sewers, bromadiolone blocks are often attached to a string and hung below manhole covers and the bromadiolone is usually wax-encased in block form, which has exceptionally low water solubility and low leaching potential. This method of bait deployment reduces the probability of exposure to surface water and groundwater. Outside of sewers, bromadiolone is typically contained in tamper-proof bait stations, which are most frequently deployed at residential and commercial locations per homeowners' requests, at the edges of public areas, and not near aquatic systems. When used properly, potential for impacting aquatic systems is very limited.

Difethialone is formulated as meal, pellets, blocks, packs or pouches, paste, paraffin blocks, and bait stations. Difethialone adsorbs to suspended solids and sediment and is immobile in soil. Difethialone is highly toxic to mammals, birds, and aquatic organisms including fish. The District does not currently use difethialone, but it is under consideration for use around landscaping and fence lines and in urban creek corridors.

Bromethalin is an ingestion poison, which causes loss of osmotic control in cells, often used to exterminate rodents resistant to first generation anticoagulant rodenticides. Bromethalin is formulated as pelleted food bait. Bromethalin is very highly toxic to freshwater fish and aquatic invertebrates. However, some bromethalin products meet the USEPA's new, more protective risk reduction standards when applied in tamper-resistant and weather-resistant bait stations. Aquatic exposure is expected to be minor based on use patterns.

Cholecalciferol is a sterol and its ingestion by mice and rats results in hypercalcemia. Cholecalciferol is formulated as pellets and blocks. It is expected to be essentially insoluble in water and immobile in soil. Although it is highly toxic to target rodents, cholecalciferol is considered of low hazard to nontargets such as birds, dogs, and fish. Though it is not currently used by the District, cholecalciferol is under consideration for use along urban creek corridors and waterfronts.

Although many of these chemicals have high toxicity to aquatic organisms (i.e., chlorophacinone, brodifacoum, bromadiolone, difethialone, bromethalin), these rodenticides generally have minimal exposure to surface water and groundwater due to paraffinization of these materials and the method of bait deployment. Furthermore, these materials often have low solubility. Therefore, application of these chemicals would have a less-than-significant impact to surface water or groundwater resources when applied in accordance with label instructions and District BMPs (see BMPs H15 and H16).

> **Impact WR-27:** Application of chlorophacinone, diphacinone, brodifacoum, bromadiolone, difethialone, bromethalin, and cholecalciferol would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.7.5.2 Fumigants

Sulfur and sodium nitrate are two of the active ingredients in fumigant (gas-producing) cartridge products, which are used for rodent control. Carbon, sodium and potassium nitrates, sawdust, and sulfur are used in the fumigant gas-producing cartridge products. After the cartridges are ignited, these active ingredients produce toxic gases that cause asphyxiation of pests. The gases displace the oxygen in the burrows, creating an unbreathable atmosphere, causing asphyxiation of the target organisms (rats and mice). Sulfur fumigants are of low toxicity prior to activation of sulfur-containing cartridges. Elemental sulfur will become incorporated back into the natural sulfur cycle after deployment. Elemental sulfur is practically nontoxic to aquatic organisms. Sodium nitrates are naturally occurring substances and exposure to the aquatic environment is limited and localized when the products are used as fumigants in burrows.

Because of the low toxicity to aquatic organisms and because exposure is limited to areas within burrows, effects on surface water and groundwater would be less than significant from the active ingredients of fumigant cartridge products used as rodenticides.

> **Impact WR-28:** Application of sulfur and sodium nitrate active ingredients in fumigant rodenticides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.

9.2.8 Other Nonchemical Control/Trapping Component

This component includes the trapping of rodents and/or yellow jackets that pose a threat to public health and welfare. For both species, tamper-resistant or baited traps are used which limits the exposure of chemical-containing baits to the environment. Traps may also be used to remove nuisance wildlife such as raccoon, skunk, and opossum. Trapping is currently done using a licensed PCO. In the future, The District may set live traps for raccoon and skunks. This component would have no impact to surface water or groundwater.

> **Impact WR-29:** The Nonchemical Control/Trapping Component collection techniques use tamper-resistant or baited traps, which limit the exposure of chemical-containing baits to the environment **no impact** would occur to surface water or groundwater.

9.2.9 Public Education

The District's ongoing public education activities would have no effect on water quality. District staff advise the public on keeping chemical traps and spay applications away from storm drains when they respond to requests for service. Public education has no impact on surface and groundwater resources.

9.2.10 Environmental Impacts Summary

Table 9-4 provides a summary of the identified impacts for each subgroup of technical practices and chemicals for each component included in the overall Program, including existing activities combined with future chemical use activities. All of the components will be combined with public education into the Proposed Program as described in Chapter 2 herein and in the IMVMP Plan.

One instance of a potentially significant impact exists. Under the Chemical Control Component, the direct impact of the adulticide naled to water resources is **significant and unavoidable** due to the toxicity of its breakdown product but its importance as an option for future use in the District's IMVMP Plan. Dichlorvos, a breakdown product of naled, and itself a registered pesticide, may be present in toxic concentrations after naled is no longer detectable. No mitigation exists for its potential direct impact to water resources. However, dichlorvos degrades rapidly and does not persist in aquatic and soil environments. This rapid breakdown of both naled and its breakdown product, its planned infrequent use, and application using ULV method and District BMPs result in less-than-significant indirect effects to other nontarget organisms and resources (also see Section 13.4).

Naled is under consideration for future use, so the Existing Program would not include this significant and unavoidable impact. The other chemicals under consideration for future use, along with the additional equipment needed for both future physical control and chemical control activities, result in less-than-significant impacts to water resources. All of the impacts associated with the Existing Program activities are either none or less than significant.

Table 9-4 Summary of Water Resources Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Effects on Water Resources						
Impact WR-1: The Surveillance Component collection devices would not contact nor interact with the environment. **No impact** would occur to surface water or groundwater.	N	na	na	na	na	na
Impact WR-2: The Physical Control Component's activities to modify water circulation, remove sediment, and maintain water control facilities to reduce habitat conditions for mosquito production would have a **less-than-significant** impact on water resources and no mitigation is required.	na	LS	na	na	na	na
Impact WR-3: Mechanical removal of vegetation from aquatic habitats would have a **less-than-significant** impact to surface water and **no impact** to groundwater resources.	na	na	LS, N	na	na	na
Impact WR-4: Application of the herbicides imazapyr, glyphosate, sulfometuron methyl, DCPA, modified vegetable oils, and lecithins would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na	na
Impact WR-5: Application of the herbicides triclopyr and oryzalin would have a **less-than-significant** impact **to** surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na	na
Impact WR-6: For benfluralin and APEs, application of these herbicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na	na
Impact WR-7: Application of dithiopyr would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	LS	na	na	na
Impact WR-8: The Biological Control Component's production of mosquitofish would have a **less-than-significant** impact on surface water and groundwater resources and no mitigation is required.	na	na	na	LS	na	na

Table 9-4 Summary of Water Resources Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact WR-9: The Biological Control Component's use of mosquitofish in man-made water features that are hydrologically isolated from receiving waters would have a **less-than-significant** impact on surface-water and groundwater resources. No mitigation is required.	na	na	na	LS	na	na
Impact WR-10: Application of the biological agents Bs, Bti, and spinosad would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-11: Application of methoprene would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-12: Application of the surfactant larvicides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-13: Application of the synergist PBO would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-14: Application of pyrethrins would have a **less-than-significant** impact **to** surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-15: Application of d-trans allethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-16: Application of permethrin would have a **less-than-significant** impact to surface and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-17: Application of phenothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-18: Application of prallethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na

Table 9-4 Summary of Water Resources Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact WR-19: Application of resmethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-20: Application of tetramethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-21: Application of deltamethrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-22: Application of esfenvalerate would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-23: Application of lambda-cyhalothrin would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-24: Application of etofenprox would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-25: Due to the toxicity of its breakdown product but its importance in the District's IMVMP Plan, the application of naled is considered a **significant and unavoidable** impact to surface water resources.	na	na	na	na	SU	na
Impact WR-26: Application of potassium salts (i.e., "soap salts") would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-27: Application of chlorophacinone, diphacinone, brodifacoum, bromadiolone, difethialone, bromethalin, and cholecalciferol would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na

Table 9-4 Summary of Water Resources Impacts by Technical Component

Impact Statement	Surveillance	Physical Control	Vegetation Management	Biological Control	Chemical Control	Other Nonchemical/ Trapping
Impact WR-28: Application of sulfur and sodium nitrate active ingredients in fumigant rodenticides would have a **less-than-significant** impact to surface water and groundwater resources and no mitigation is required.	na	na	na	na	LS	na
Impact WR-29: The Nonchemical Control/Trapping Component collection techniques use tamper-resistant or baited traps, which limit the exposure of chemical-containing baits to the environment **no impact** would occur to surface water or groundwater.	na	na	na	na	na	N

LS = Less-than-significant impact

N = No impact

na = Not applicable

SM = Potentially significant but mitigable impact

SU = Significant and unavoidable impact

9.2.11 Mitigation and Monitoring

The District implements chemical control of vectors as part of its IMVMP Plan, which incorporates label requirements and District BMPs that minimize adverse effects to surface-water and groundwater resources from the applied chemicals during and following pesticide applications. The District applies all chemicals in strict conformance with label requirements that have been approved by CDPR for use in California, including restrictions on application rates and methods, storage, transportation, mixing, and container disposal. As applicable, insecticides are applied in conformance with the PAP, as required by the Vector Control Permit, The District also implements hazardous materials and spill management control measures to prevent and reduce potential exposure of spilled chemicals to surface-water and groundwater resources.

As none of the impacts to water resources were potentially significant but mitigable, no mitigation is required. However, the District will continue surveillance and monitoring on a routine basis. Sites are monitored post-treatment to determine if the target vector were effectively controlled with minimum effect to the environment and nontarget organisms. This information is used to help design future treatment methods in the same season or future years to respond to changes in site conditions (BMP H11).

Due to the toxicity of its breakdown product but its importance in the District's IMVMP, the potential application of naled poses the potential for a significant and unavoidable impact. It is impossible to predict precisely where disease risks from pesticide-resistant mosquitoes will occur in the future, and hence the District is unable to mitigate adverse effects to a less than significant level by avoiding naled exposure to water resources if its use were necessary to protect public health. As a result, the potential application of naled would be considered a significant and unavoidable impact to surface and groundwater resources.